

Dossier CMP Arles : 783

Page/Sheet 0.1

Client / Customer : AIR LIQUIDE AGS

Engineered System N° :

# 1 x 1800MT LOX + 1 x 1000MT LIN STORAGE TANKS

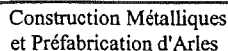
## INSTALLATION and MAINTENANCE INSTRUCTIONS for ACCESSORIES

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783-MA1 CHAPTER II

# PROCÉDURE GÉNÉRALE

## MAINTENANCE INSTRUCTIONS ABOUT THE CRYOGENIC STORAGE TANKS *INSTRUCTIONS DE MAINTENANCE SUR LES RESERVOIRS DE STOCKAGE CRYOGENIQUE*

0	19/11/02	D. LEBOUCO <i>DL</i>	G. HULIN <i>GH</i>	S. MARTIN <i>SM</i>	First issue / 1 <sup>ère</sup> édition
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**1 – PURPOSE / BUT DU DOCUMENT**

These instructions are given to the customer for him to keep the cryogenic storage tank in the best conditions since the initial cooling-down. They particularly remind the user of some elementary precautions enabling to avoid the destruction of the inner vessel or part of it.

*Ces instructions sont données au client pour lui permettre de conserver les réservoirs de stockage cryogénique dans les meilleures conditions après la mise en froid. Elles rappellent particulièrement à l'utilisateur les précautions élémentaires lui permettant d'éviter la destruction en tout ou partie du récipient intérieur.*

**2 – SCOPE / DOMAINE D'APPLICATION**

These instructions have to be followed by the CUSTOMER/USER as soon as the perliting is performed and the report of the tank cross-examination agreed and signed by the two parties: CUSTOMER AND TANK CONSTRUCTOR.

The signature of this document is the starting point of the maintenance responsibility by the CUSTOMER/USER irrespective of whether the inner vessel has been completely filled with liquefied gas or not.

*Ces instructions doivent être suivies par le client/utilisateur dès la fin du perlitage et dès que le rapport de l'examen du réservoir est accepté et signé par les deux parties : Client et constructeur du réservoir.*

*La signature de ce document est le point de départ de la responsabilité de maintenance par le client/utilisateur que le récipient intérieur ait été ou pas complètement rempli avec du gaz liquéfié.*

**3 – CLAUSE OF THE MECHANICAL GUARANTEE CANCELLATION  
CLAUSE D'ANNULATION DE LA GARANTIE MECANIQUE**

To follow the hereunder instructions is one of the customer obligation towards the contract. In case of non-observance of these rules, the terms of the contract regarding the mechanical guarantee shall no longer be applicable.

Therefore, the tank CONSTRUCTOR responsibility will not be in any case admitted if a tank destruction or crash happens due to the non-observance of these instructions by the user.

*Suivre les instructions ci-dessous est une des obligations du client vis à vis du contrat. Au cas d'un non-respect de ces règles, les termes du contrat concernant la garantie mécanique ne seront plus applicables.*

*En conséquence, la responsabilité du constructeur du réservoir ne sera en aucun cas engagée si une destruction du réservoir ou un accident arrive dû au non-respect des instructions par l'utilisateur.*

**4 – BASIC RULES / REGLES BASIQUES**

4.1 In normal operation Positive and/or vacuum (s) inside the inner vessel and/or the interspace have to be always under the design values. The overload could result in the partial or complete destruction of the tank. When the maintenance of the safety devices is correctly done, this destruction by overload cannot happen due to the setting of the valves, except for the special case stated under paragraph 4.2.

*En service normal les pression (s) et/ou dépression(s) du récipient intérieur et/ou de l'interparoi doivent toujours être en dessous des valeurs de calcul. Le dépassement peut résulter en une destruction partielle ou complète du réservoir. Quand la maintenance des dispositifs de sécurité est correctement faite, la destruction par dépassement des pressions ne peut pas arriver du fait du tarage des soupapes, excepté pour le cas spécial énoncé sous le paragraphe 4.2.*

- 4.2 When the inner vessel is not pressurized and does not contain liquefied gas, it is very important not to let the positive pressure inside the interspace raised up to the setting pressure of the safety devices which protect the outer casing from over-pressurization. If that happens, the setting pressure of the outer casing safety devices, usually set to + 8 mbar/10 mbar, will be too high and will result in a lift of the inner vessel bottom with all the consequences which may follow from this lifting (welds cracks, pipes destruction, and so on ....).

*Quand le récipient intérieur n'est pas pressurisé et ne contient pas de gaz liquéfié, il est très important de ne pas laisser la pression de l'interparoi s'élever à la pression de tarage des dispositifs de sécurité qui protège la double-enveloppe de la surpression. Si cela arrive, la pression de tarage des dispositifs de sécurité, habituellement installés de + 8 mbar à 10 mbar sera trop élevée et entraînera un soulèvement du fond du récipient intérieur avec toutes les conséquences qui pourraient arriver (fissuration des soudures, destructions des tubes, etc.)*

As a general rule, the user must always check the interspace pressure and more carefully, when the inner vessel is empty of liquid.

*En règle générale, l'utilisateur doit toujours vérifier la pression de l'interparoi et plus particulièrement, quand le récipient intérieur est vide de liquide*

The principle is the following / *Le principe est le suivant:*

The pressure in the interspace must never exceed the pressure located at the inner vessel bottom by more than the values described in the hereafter table:

*La pression de l'interparoi ne doit jamais dépasser la pression située au fond du récipient intérieur, de plus que les valeurs décrites dans la table ci-dessous :*

Material of inner vessel <i>Matière du récipient intérieur</i> Stainless steel or 9% Ni steel <i>Austénitique / 9% Ni</i>	Thickness of bottom in mm <i>Épaisseur du fond mm</i>	5	6	7
	Pressure in mbar <i>Pression en mbar</i>	4	4.8	5.6
Aluminium alloy <i>Alliage d'aluminium</i>	Thickness of Bottom in mm <i>Épaisseur du fond mm</i>	6	8	10
	Pressure in mbar <i>Pression en mbar</i>	1.6	2.1	2.7

- 4.3 Inner vessel components and nozzles have to be kept dry and free from condensation in order to avoid the metal corrosion. If no liquefied gas is contained, the inner vessel must be nitrogen purged.

*Les composants du récipient intérieur et les tuyauteries doivent être conservés secs et libres de condensation dans le but d'éviter la corrosion du métal. Si aucun gaz liquéfié n'est contenu, le récipient intérieur doit être balayé à l'azote.*

- 4.4 Perlite in the interspace must be permanently protected from moisture entrance. The interspace will be consequently purged with a flowrate of 3 Nm<sup>3</sup>/h. nitrogen gas when the inner vessel is empty or pressurized to 5 mbar, the inner vessel being under normal operation with liquid inside.

The dew point of the nitrogen gas for purging or pressurization shall be at an average of - 70°C. and it will be advisable for the used nitrogen gas that its oxygen contents be less than 10 ppm (1 ppm = 10<sup>-6</sup> in volume). For the above mentioned reasons, it is recommended to check often the interspace nitrogen purge system.

*La perlite dans l'interparoi doit être en permanence protégée contre l'entrée d'humidité. L'interparoi sera par conséquent balayée avec un débit de 3Nm<sup>3</sup>/h d'azote gazeux quand le récipient intérieur est vide ou pressurisé à 5 mbar le récipient intérieur étant en opération normale avec du liquide à l'intérieur.*

*Le point de givre de l'azote gazeux pour le balayage ou la pressurisation doit être environ de -70°C et il est conseillé que l'azote gazeux utilisé contienne moins de 10 ppm d'oxygène (1 ppm = 10<sup>-6</sup> en volume). Pour les raisons mentionnées ci-dessus, il est recommandé de souvent contrôler le système de balayage azote de l'interparoi.*

## **5 - SOME IMPORTANT PHASES OF THE TANK EXPLOITATION** **QUELQUES PHASES IMPORTANTES DE L'EXPLOITATION DU RESERVOIR**

### **5.1 Nitrogen purging of the inner vessel / Balayage azote du récipient intérieur:**

This nitrogen purge is applied to dry the inner vessel before any liquid entrance. This condition would immediately exist after the tank perliting.

While the inner vessel purging is carried out, the interspace will be directly connected to the atmosphere and also purged with dry air or dry nitrogen. The safety devices of the inner vessel and of the outer casing will be consequently "open" (use a chock or remove the pallet). The above paragraph 4.2 conditions will so fulfil in case of inner vessel nitrogen purge failure.

As a general rule, it is recommended at the beginning to dry the inner vessel by purging and not by pressurizing it, with a regular flow of nitrogen. This latter process will only be used at final stage to dry all the pipes including instrument lines (pressurize and blow pipe per pipe).

Le balayage à l'azote est effectué pour sécher le récipient intérieur avant l'introduction du liquide. Cette condition doit immédiatement être satisfaite après perlitage du réservoir. Pendant que le balayage du récipient intérieur est effectué, l'interparoi sera directement connecté à l'atmosphère et également balayé avec de l'air sec ou de l'azote sec. Les dispositifs de sécurité du récipient intérieur et de l'enveloppe extérieure seront en conséquence « mise en position ouvert » (utiliser une cale ou enlever le clapet). Les conditions du paragraphe 4.2 ci-dessus seront remplies dans le cas d'un arrêt de la purge azote du récipient intérieur. En règle générale, il est recommandé au début de sécher le récipient intérieur en le balayant et non en le pressurant, avec un débit régulier d'azote. La pressurisation sera seulement utilisée dans le dernier stade pour sécher toutes les tuyauteries y compris les lignes d'instrumentation (pressuriser et souffler tube par tube).

### 5.2 Initial cooling-down / mise en froid

The inner vessel will be pressurized at a minimum of 20 mbar from the starting of this operation in order to answer always the above paragraph 4.2 requirements. The interspace will be then pressurized when it does not exist a risk due to the level of the pressure inside the inner vessel. The setting of the interspace pressurization at 5 mbar will be done when the temperature of the metal and the insulants will enable the pressure stabilization.

Le récipient intérieur sera pressurisé à un minimum de 20 mbar à partir du début de cette opération dans le but de toujours répondre aux demandes du paragraphe 4.2 ci-dessus. L'interparoi sera ensuite pressurisée quand il n'existe pas de risque dû au niveau de la pression à l'intérieur du récipient intérieur. Le réglage de la pressurisation de l'interparoi à 5 mbar sera faite quand la température du métal et des isolants permettra la stabilisation de la pression.

### 5.3 Modification or opening of the cryogenic storage tank

#### Modification ou ouverture du réservoir de stockage cryogénique

This condition may happen for instance, to connect a new pipe with the surrounding equipments or to visit the inner vessel inside for technical reasons.

Cette condition peut arriver par exemple, pour connecter une nouvelle tuyauterie ou pour visiter l'intérieur du récipient intérieur pour des raisons techniques.

5.3.1 If the vessel has already been filled with liquefied gas; it must be first emptied. During the liquid withdrawal and coming to the final step, the pressure at the lowest part of the inner vessel will be carefully checked and as soon as it approximates the interspace pressure, the interspace must be connected to the atmosphere by opening the vent valve. Inner vessel and interspace will be after purged with dry air enabling people entrance, if necessary.

Si le récipient a déjà été rempli avec du gaz liquéfié; il doit d'abord être vidé. Pendant la vidange et en arrivant à la dernière étape, la pression à la partie basse du récipient intérieur devra être contrôlée avec précaution et dès qu'elle approche la pression de l'interparoi, celle-ci sera connectée à l'atmosphère en ouvrant l'évent de secours. Le récipient intérieur et l'interparoi seront ensuite purgés avec de l'air sec permettant l'entrée des personnes, si nécessaire.

5.3.2 If no liquid has been contained in the inner vessel and if this operation must take place before the initial cooling-down, the first work will be to purge the interspace, in case it was pressurized, prior to connect the inner vessel to the atmosphere. So the perlite will be protected from humidity during the modification or the visit.

*Si aucun liquide n'a été contenu dans le récipient intérieur et si l'opération doit prendre place avant la mise en froid, le premier travail sera de balayer l'interparoi, au cas où elle était pressurisée, avant de connecter le récipient intérieur à l'atmosphère. L'isolant sera ainsi protégé de l'humidité pendant la modification ou la visite.*

#### 5.4 Tank under normal operating conditions / Réservoir en service normal

The interspace is set to 5 mbar. The safety valves of the outer casing and of the inner vessel are in their normal operating position. The user will keep above the bottom a minimum height of 200 mm. of liquid to minimize the risk for the inner vessel to be submitted to an external over-pressure.

*L'interparoi est réglée à 5 mbar. Les soupapes de sécurité de la double-enveloppe et du récipient intérieur sont en position de service normal. L'utilisateur conservera au dessus du fond une hauteur minimum de 200 mm de liquide pour minimiser le risque d'une dépression du récipient intérieur.*

### 6 - MAINTENANCE OF EQUIPMENTS / MAINTENANCE DES EQUIPEMENTS

Twice a year the safety valves of the inner vessel and of the outer casing shall be entirely checked and repaired if necessary.

*Deux fois par an, les soupapes de sécurité du récipient intérieur et de la double-enveloppe doivent être entièrement contrôlées et réparées si nécessaire.*

#### 6.1 Inner vessel safety devices / dispositifs de sécurité du récipient intérieur

- The two safety valves and the bursting disc when existing are erected on a three way valve and/or block valves which in normal operation enable the gas to be distributed simultaneously to the safety valves and the bursting disc when existing.

*Les deux soupapes de sécurité et le disque rupture, s'il existe, sont installés sur robinets de jumelage et/ou vannes d'arrêt qui en opération normale permet au gaz d'être distribué simultanément aux soupapes de sécurité et au disque de rupture s'il existe.*

- To allow the dismantling of one of them position the three way valve and/or close the block valve in order that the device is no longer fed with gas. Nevertheless, prior to the safety valve dismantling for inspection, check the second one for proper operation.

*Pour permettre le démontage de l'un d'entre eux, positionner le robinet de jumelage et/ou fermer la vanne d'arrêt afin que le dispositif ne soit plus alimenté en gaz. Néanmoins, avant le démontage d'une soupape pour inspection, contrôler le bon fonctionnement de la deuxième.*



- In case of the safety valves ice-up due to their operation because the pressure regulation valve do not operate properly, the ice formation on these valves has to be removed in checking that no gas escape exits.

*En cas de givrage des soupapes de sécurité dû à leur opération lorsque la vanne de régulation de pression ne fonctionne pas correctement, les soupapes doivent être dégivrées en vérifiant qu'aucun gaz ne s'échappe aux clapets.*

- While painting the tank outer casing, protect the safety valves from paint in covering them such as they should be left for free operation. Do not wrap them in plastic bag which may prevent their breath.

*Pendant la peinture de la double-enveloppe, protéger les soupapes de sécurité de la peinture en les couvrant sans gêner leur libre opération. Ne pas les emballer dans un sac plastique qui peut empêcher leur fonctionnement.*

#### 6.2 Pressure regulation valve / vanne de régulation de pression

It may happen that ice formation builds up around the gas outlet. From time to time remove this icing-up.

*Il peut arriver qu'une formation de glace se fasse autour de la mise à l'air. De temps en temps, casser la glace.*

#### 6.3 Pressure gauges / manomètres

Check by mean of water pressure gauge the accuracy of the pressure gauges indication. Reset them if necessary.

*Contrôler l'exactitude des manomètres au moyen de manomètres à colonnes d'eau. Les régler si nécessaire.*

#### 6.4 Nitrogen purge system / système de balayage azote

Check the system to see if it operates properly and proceed to the adequate maintenance work according to the recommendation of the nitrogen purge system supplier.

*Contrôler le système pour voir s'il fonctionne correctement et procéder à la maintenance adéquate en fonction de la recommandation du fournisseur du système de balayage azote.*

**7 – CARBON STEEL MATERIAL – CONCRETE FOUNDATION**  
**MATERIEL DE CARBONE ACIER – FONDATION BETON**

- The outer casing protection against atmospheric agents must be performed at regular intervals when a lot of rust appears. The painting of the carbon steel parts will necessarily include the carbon steel parts of the staircase and platforms and anchoring when existing.  
*La protection de la double-enveloppe contre les agents atmosphérique doit être réalisée à des intervalles réguliers quand beaucoup de poussières apparaissent. La peinture sur les parties de double-enveloppe inclura nécessairement les parties de double-enveloppe de l'escalier et plateformes et ancrage s'il existe.*
- For outer tank directly sealed in the concrete foundation
  - Clean at regular intervals the junction between the outer casing shell and the concrete sealing. It may be necessary sometimes to remove the concrete which does not insure the required tightness. Repair the concrete or pour a new one, paint or cover the concrete with a recommendable product.
  - Check sometimes the general behaviour of the concrete foundation to see the eventual cracks or fissuration which may have some influences on the interspace gas tightness.

*Pour les réservoirs extérieurs directement scellés à la fondation béton*

- Nettoyer à intervalles réguliers la jonction entre la virole de la double-enveloppe et le béton scellé. Il sera peut être nécessaire des fois d'enlever le béton qui ne doit pas assurer l'étanchéité demandée. Réparer le béton ou en placer un nouveau, peindre ou couvrir le béton avec un produit recommandable.
- Contrôler de temps en temps le comportement général de la fondation béton pour voir les fissures éventuelles or les fissurations qui peuvent influencer l'étanchéité de gaz de l'interparoi.

783 - MA1 CHAPTER III

# PROCÉDURE GÉNÉRALE

INSTRUCTIONS BEFORE THE INITIAL COOLING-DOWN  
OF CRYOGENIC FLAT-BOTTOMED STORAGE TANKS  
*INSTRUCTIONS AVANT LE REFROIDISSEMENT INITIAL  
DES RECIPIENTS DE STOCKAGE A FOND PLAT CRYOGENIQUE*

0	19/11/02	D. LEBOUCO	G. HULIN	S. MARTIN	First issue / 1 <sup>ère</sup> édition
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**1 – PURPOSE / BUT DU DOCUMENT**

- To inform the staff of the customer about the safety instructions to follow absolutely,
- To state the operations prior the liquid filling,
- To give the suggested flowrates for liquefied gas first entrance.
  
- *Informer le personnel du client sur les instructions de sécurité à suivre absolument,*
- *Préciser les opérations avant le remplissage du liquide,*
- *Suggérer le débit pour la première entrée des gaz liquéfiés.*

**2 – SCOPE / DOMAINE D'APPLICATION**

This procedure has to be applied for the initial cooling-down of a flat-bottom cryogenic storage tank with a stainless steel inner vessel.

*Cette procédure doit être appliquée pour la mise en froid des réservoirs de stockage cryogéniques à fond plat avec un récipient intérieur en acier inoxydable.*

**3 – CUSTOMER RESPONSABILITY IN CASE OF CONSTRUCTOR ASSISTANCE  
RESPONSABILITE DU CLIENT EN CAS D'ASSISTANCE DU CONSTRUCTEUR**

The staff of the customer is responsible for all the handling particularly those in relation with the truck and its control board (valves, taps, gauges, and so on ...).

In the event of valves and cocks fitted on inlet/outlet pipes, outside the tank, are supplied by the customer, its staff is in principle responsible for their opening and/or closing.

*Le personnel du client est responsable pour toutes les opérations et en particulier celles en relation avec le camion et son tableau de contrôle (vannes, robinets, manomètres, etc.).*

*Dans le cas où des vannes ou des robinets installés sur les tubes internes/externes, en dehors du réservoir, sont fournies par le client, son personnel est en principe responsable pour leur ouvertures et/ou fermetures.*

**4 – SAFETY INSTRUCTIONS / INSTRUCTIONS DE SECURITE**

Whatever the liquid filling procedure will be, either from road tanker or from the cold box, the following is applicable:

*Quelque soit la procédure de remplissage de liquide, soit par camion ou par la boîte froide, ce qui suit est applicable :*

- 4.1 At no time the positive pressure or the negative pressure in the inner vessel and in the interspace shall exceed the maximum operating values indicated on the drawing (working conditions). Non observation of this instruction may cause the destruction of both inner vessel and/or outer casing.

*A aucun moment la pression ou la dépression du récipient intérieur et de l'interparoi doit excéder les valeurs en service maximum indiquées sur le plan (conditions de fonctionnement). La non observation de cette instruction peut causer la destruction du récipient intérieur et/ou de la double-enveloppe.*

- 4.2 In addition to the above paragraph 4.1, the pressure in the interspace shall never exceed the actual pressure applied at the lowest point of the inner vessel by more than the values which would permit the lifting of the inner vessel flat bottom i.e.: 4 mbar for a stainless steel bottom with a thickness of 5 mm.

*En addition au paragraphe 4.1, la pression de l'interparoi ne doit jamais dépasser la pression actuelle appliquée au point le plus bas du récipient intérieur par plus que les valeurs qui permettraient la montée du récipient intérieur à fond plat, par exemple : 4 mbar pour un fond en acier inoxydable avec une épaisseur de 5 mm.*

- 4.3 Access to the inner vessel must be prohibited, as long as nitrogen atmosphere is contained therein. If for any reason, it would be necessary for staff to enter, nitrogen must first be exhausted from inner vessel by blowing in dry, clean, and oil free air.

*L'accès au récipient intérieur doit être interdit, aussi longtemps que l'atmosphère d'azote est contenue à l'intérieur. Si pour n'importe quelles raisons, il est nécessaire pour le personnel d'entrer, l'azote doit être d'abord vidé du récipient intérieur en soufflant de l'air sec, propre et déshuilé.*

## **5 - INSTRUMENTATION / INSTRUMENTATION**

Water pressure gauges shall be installed as shown on the attached sketch. Such gauges are to be fitted preferably at the base of the storage tank to provide the staff with pressures information and to enable him immediate action in case of accident.

*Les manomètres à colonnes d'eau doivent être installés comme précisé sur le plan ci-joint. Ces manomètres doivent être installés de préférence à la base du récipient intérieur pour donner au personnel les informations de pression et lui permettre immédiatement d'agir en cas d'accident.*

## **6 - ACTIONS PRIOR TO FILLING OF LIQUID** **ACTIONS AVANT LE REMPLISSAGE LIQUIDE**

- 6.1 Check safety valves of inner and outer casing for proper operation (valves location: outer casing roof).

*Contrôler les soupapes de sécurité du récipient intérieur et de la double-enveloppe pour leur bon fonctionnement (positionnement des soupapes: dôme de la double-enveloppe).*

- 6.2 Check for proper nitrogen purge in the interspace. This purging must be put in operation from the end of perliting. In so far as the inner vessel is not pressurized, the emergency vent on the outer casing must intentionally be held in "OPEN POSITION"; the nitrogen flowrate shall be maintained at 3 Nm<sup>3</sup>/h. See after paragraphs "6.4 and 6.5".

*Contrôler le balayage azote dans l'interparoi. Le balayage doit être mis en service à la fin du perlitage. Tant que le récipient intérieur n'est pas pressurisé, l'évent de secours de la double-enveloppe doit intentionnellement être mis en « POSITION OUVERTE » ; le débit d'azote doit être maintenu à 3 Nm<sup>3</sup>/h. Voir paragraphes suivants « 6.4 et 6.5 ».*

- 6.3 Flush out all condensation which may have been accumulated in the pipes. For that, first raise up to 60 mbar the pressure in the inner vessel with nitrogen or dry, clean, degreased air and then, open rapidly each pipe one after each other.

*Supprimer la condensation qui peut avoir été accumulée dans les tuyauteries. Pour cela, augmenter la pression du récipient intérieur à 60 mbar avec de l'azote ou de l'air sec, propre, dégraissé et ensuite, ouvrir rapidement chaque tuyauterie l'une après l'autre.*

- 6.4 For the drying of the inner vessel use gas nitrogen or dry, clean, degreased air (warm air if possible). The purge will be done so that gas outlet is located opposite to the inner vessel gas inlet (gas flow may be continuous or discontinuous).

Check the gas at outlet and measure the dew point. The purge shall be carried out until the dew point value has reached the value of the "Process". As guidance only for the inner vessel a dew point of  $-40^{\circ}\text{C}$  is considered to be acceptable before the initial cooling-down (dew point of  $-40^{\circ}\text{C}$  means 100 g of water in a volume of  $1000\text{ m}^3$ ).

*Pour le séchage du récipient intérieur, utiliser de l'azote gazeux ou de l'air sec, propre, dégraissé (air chaud si possible). Le balayage sera fait de façon à ce que la sortie gaz soit située à l'opposé de l'entrée gaz dans le récipient intérieur (le débit de gaz peut être continu ou discontinu).*

*Contrôler et mesure le point de givre à la sortie gaz. Le séchage doit être exécuté jusqu'à ce que la valeur du point de givre atteigne la valeur "process". Pour information, pour le récipient intérieur, un point de givre de  $-40^{\circ}\text{C}$  est considéré comme acceptable avant la mise en froid (point de givre à  $-40^{\circ}\text{C}$  signifie 100 g d'eau dans un volume de  $1000\text{ m}^3$ ).*

- 6.5 Interspace cooling tends to lower the pressure inside. To avoid air entrance in the interspace during this pressure drop, the nitrogen flowrate suggested in paragraph 6.2 must be increased. When the pressure of the inner vessel is stabilized above 20 mbar, the outer casing emergency vent shall be re-put to the normal service condition and the interspace nitrogen purge system shall be put into service to regulate the pressure at 5 mbar.

*Le refroidissement de l'interparoi tend à diminuer la pression. Pour éviter l'entrée d'air dans l'interparoi pendant la baisse de pression, le débit d'azote suggéré au paragraphe 6.2 doit être augmenté.*

*Quand la pression du récipient intérieur est stabilisée au dessus de 20 mbar, l'évent de secours doit être remis en condition de service normal et le système de balayage azote de l'interparoi doit être mis en service pour réguler la pression à 5 mbar.*

## **7 - LIQUID INLET / ENTREE LIQUIDE**

### **7.1 Inlet nozzle / tuyauterie d'entrée**

The liquid inlet may be done in using a nozzle located either at the upper or at the lower part of the inner vessel. In the event of the liquid inlet is located at the upper part of the inner vessel, the nozzle diameter shall be sized between 25 and 50 mm but no more than 50 mm in order to avoid irregular vaporizations.

*L'entrée liquide peut être faite en utilisant une tuyauterie située soit à la partie haute ou à la partie basse du récipient intérieur. Dans le cas où l'entrée liquide est située à la partie haute du récipient intérieur, le diamètre de la tuyauterie doit être de 25 à 50 mm mais pas plus de 50 mm pour éviter des vaporisations irrégulières.*

### 7.2 Outlet nozzle / tuyauterie sortie gaz

If the liquid inlet is located at the lower part of the inner vessel, the evaporations will be blown out through a nozzle located at the upper part. If the liquid inlet is located at the upper part of the inner vessel, the evaporations may still be released as indicated above, but they also may be released through a discharge opening at the lower part in during the first hours of the cooling-down.

*Si l'entrée liquide est située à la partie basse du récipient intérieur, les évaporations seront mises à l'air par une tuyauterie située à la partie haute. Si l'entrée liquide est située à la partie haute du récipient intérieur, la mise à l'air peut être effectuée comme indiqué ci-dessus, mais peut également être effectuée par une tuyauterie située à la partie basse pendant les premières heures de mise en froid.*

If the pressure regulation valve is not connected to the vent line, the two safety valves will open as soon as the pressure will raise up over their setting pressure. In this case:

- Open another pipe to increase the gas outlet and consequently to reduce the pressure; by means of pipes opening and closing, the inside pressure may be regulated.
- Check the safety valves (for eventual ice forming).
- Try to reduce to a minimum the opening time of safety valves by acting on the optimal inlet flowrate of liquefied gas.

*Si la vanne de régulation de pression n'est pas raccordée à la mise à l'air, les deux soupapes de sécurité s'ouvriront dès que la pression atteindra la pression de tarage. Dans ce cas:*

- *Ouvrir une autre tuyauterie pour augmenter la sortie gaz et par conséquent réduire la pression; par ouverture et fermeture de tuyauteries, la pression intérieure peut être régulée.*
- *Contrôler les soupapes de sécurité (pour la formation éventuelle de glace).*
- *Essayer de réduire au minimum le temps d'ouverture des soupapes de sécurité en optimisant le débit d'entrée de liquide.*

Wherever the location of the gas outlet nozzle is, the staff has to be careful of the automatic or manual valve fitted on the gas discharge pipe which could be put out of service by icing. At regular time interval, check and operate this valve in order to be able to shut it off to regulate as soon as the liquid appears on the bottom of the inner vessel.

*Quelque soit le positionnement de la tuyauterie de sortie gaz, le personnel doit surveiller le fonctionnement de la vanne automatique ou manuelle qui peut être mise hors service par prise en glace. A intervalle régulier, vérifier et faire fonctionner la vanne de façon à pouvoir réguler dès que le liquide apparaît au fond du récipient intérieur.*

### 7.3 Flowrates of the liquefied gas / débit de gaz liquéfié

To reduce the thermal stresses due to temperature decreasing (thermal shock), it is recommended to perfectly control the liquefied gas flowrates especially when liquid inlet is done by a lower nozzle. The flowrates to be followed are:

*Pour réduire les contraintes thermiques dues au refroidissement (choc thermique), il est recommandé de contrôler parfaitement le débit d'entrée de gaz liquéfié spécialement quand l'entrée liquide est faite par une tuyauterie basse.*

Les débits sont les suivants :

	* <u>Hourly rate in litres</u> <u>litres par heure</u>	* <u>Cumulative litres</u> <u>litres cumulés</u>
First hour / 1ère heure	100	100
Second hour / 2 <sup>nd</sup> heure	200	300
Third hour / 3ème heure	300	600
Fourth hour / 4ème heure	400	1000
Fifth to eighth hour / 5ème à 8ème heure	500	3000
Ninth to twelfth hour / 9ème à 12ème heure	1000	7000

After the twelfth hour the flowrate may be increased to 2000 litres/hour. As a general rule, a maximum flowrate may be used when the liquid height in the inner vessel reaches 200 mm.

*Après douze heures le débit peut être augmenté jusqu'à 2000 litres/heure. En règle générale, le débit maximum peut être utilisé quand la hauteur du liquide dans le récipient intérieur atteint 200 mm.*

#### 7.4 Pressure / pression

To comply with the safety requirements state under paragraph 4, the pressure in the inner vessel shall be maintained between 20 mbar and the nominal operating pressure. This may be obtained by properly setting the valve (s) on the gas outlet (s).

*Pour bien suivre les demandes de sécurité indiquées dans le paragraphe 4, la pression dans le récipient intérieur doit être maintenue entre 20 mbar et la pression nominale de service. Ceci peut être obtenu par le réglage de la(des) vanne(s) sur la(les) sortie(s) gaz.*

### 8 - INSTRUMENTS FITTED ON THE TANK / INSTRUMENTS INSTALLES SUR LE RESERVOIR

#### 8.1 The safety devices of the inner vessel have to be checked.

The setting value of the inner vessel safety valves has to be checked during the initial cooling-down procedure. To do so, let the pressure raise up until their complete opening, by shutting of gas outlet pipes and/or in setting the pressure regulation valve to a pressure upper than the opening pressure of safety valves. Re-set the regulation valve after checking to enable evaporations not to blow out any longer through the safety valves.

*Les dispositifs de sécurité du récipient intérieur doivent être vérifiés.*

*La valeur de tarage des soupapes de sécurité du récipient intérieur doit être vérifiée pendant la mise en froid. Pour ceci, laisser la pression augmentée jusqu'à leur complète ouverture, en fermant les tuyauteries de sortie gaz et/ou en réglant la vanne de régulation de pression à une pression plus élevée que la pression d'ouverture des soupapes de sécurité. Re-régler la vanne de régulation après vérification pour ne pas mettre à l'air trop longtemps par les soupapes de sécurité.*



- 8.2 Check the pressure gauges for proper operation in using the indications of the water pressure gauges.

*Contrôler les manomètres pour leur bon fonctionnement en utilisant les indications des manomètres à colonnes d'eau.*

- 8.3 As soon as the liquid appears on the inner vessel bottom, check and/or set the level gauge device for proper operation.

*Dès que le liquide apparaît sur le fond du récipient intérieur, vérifier et/ou régler le jaugeur de niveau pour une bonne opération.*



*Constructions Métalliques  
et Préfabrication d'Arles*

1, Rue Copernic - Z.I. Nord - 13200 ARLES

☎ : 04.90.93.33.30 - Téléfax : 04.90.93.33.31

**783-MA1**

**CHAPTER IV**

## **SHUT OFF VALVE + ACTUATOR**

**ITEMS HV72008 / HV62009 for 1800MT LOX TANK**

**ITEMS HV7101A / HV7102A for 1000MT LIN TANK**

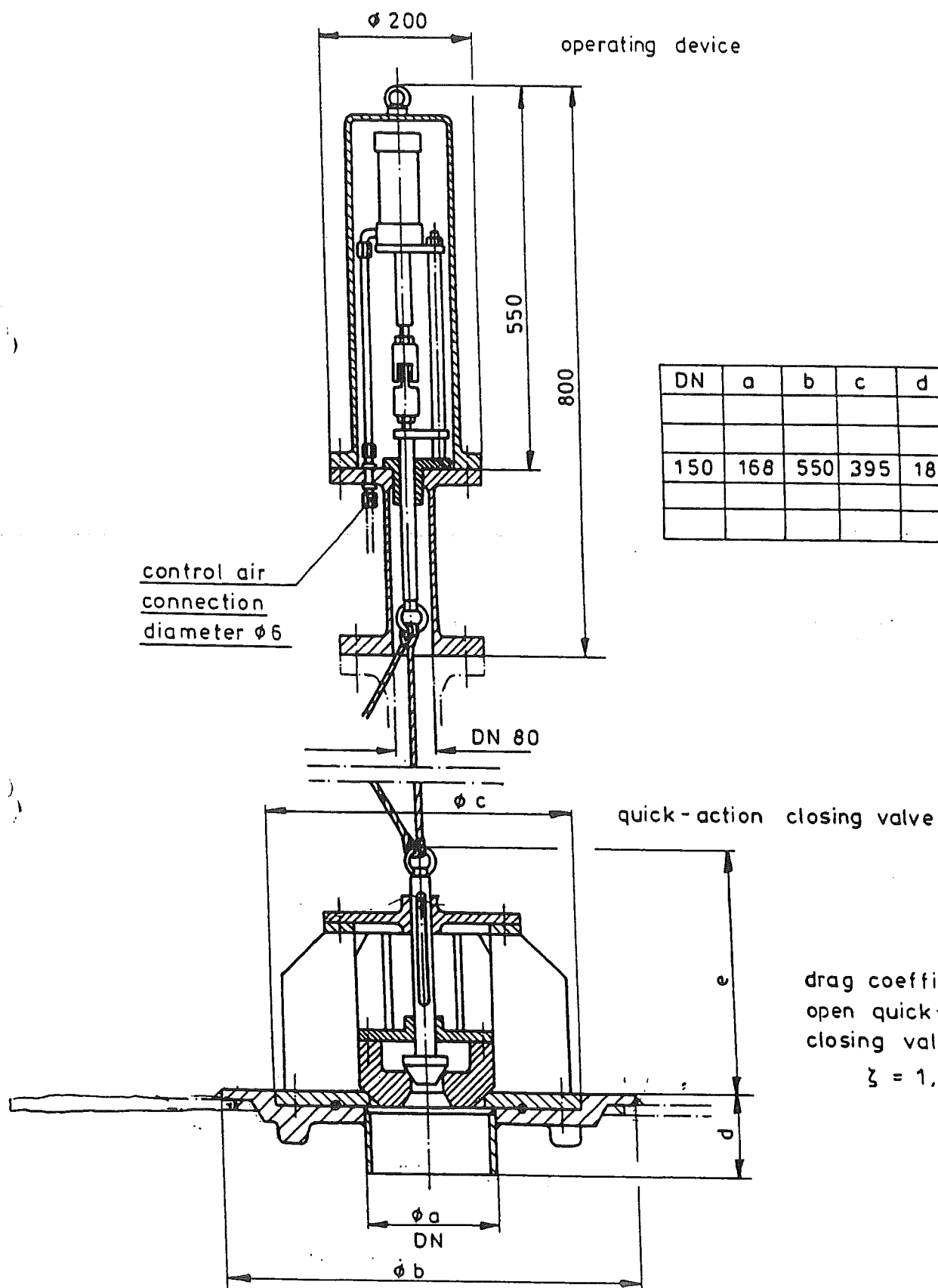
**SUPPLIER :**

Braunschweiger Flammenfilter Gmbh  
Industriestrasse 11  
Postfach 5930  
D-38051 Braunschweig  
Germany  
Mr KLOCKE  
Tel: 00 49 5307 809 177  
Fax: 00 49 5307 78 24

# Pneumatically operated bottom drain valve PROTEGO NB/AP



BRAUNSCHWEIGER FLAMMENFILTER



DN	a	b	c	d	e
150	168	550	395	185	330

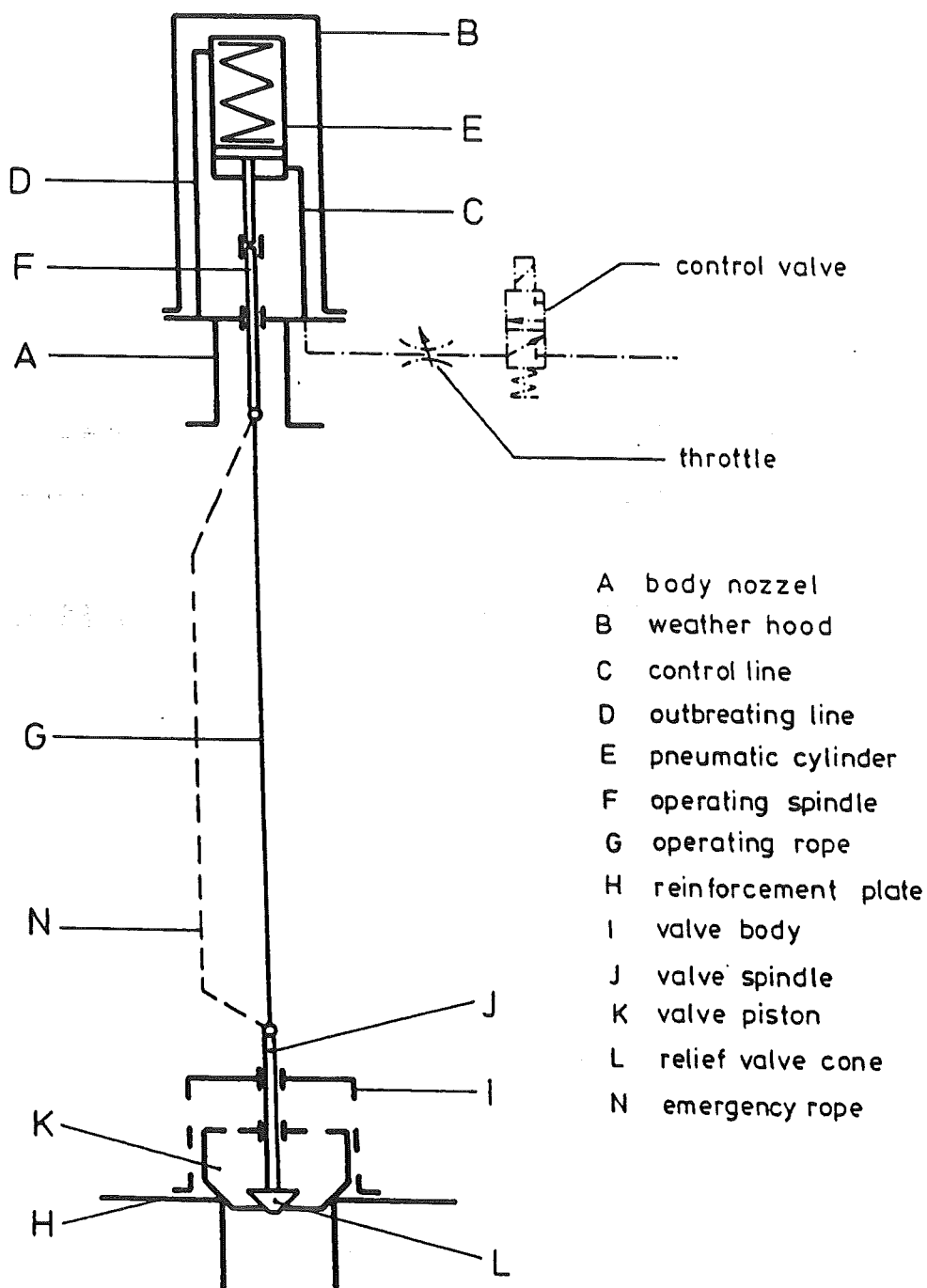
# Pneumatically operated bottom drain valve PROTEGO NB/AP



BRAUNSCHWEIGER FLAMMENFILTER

## operational scheme

operating device

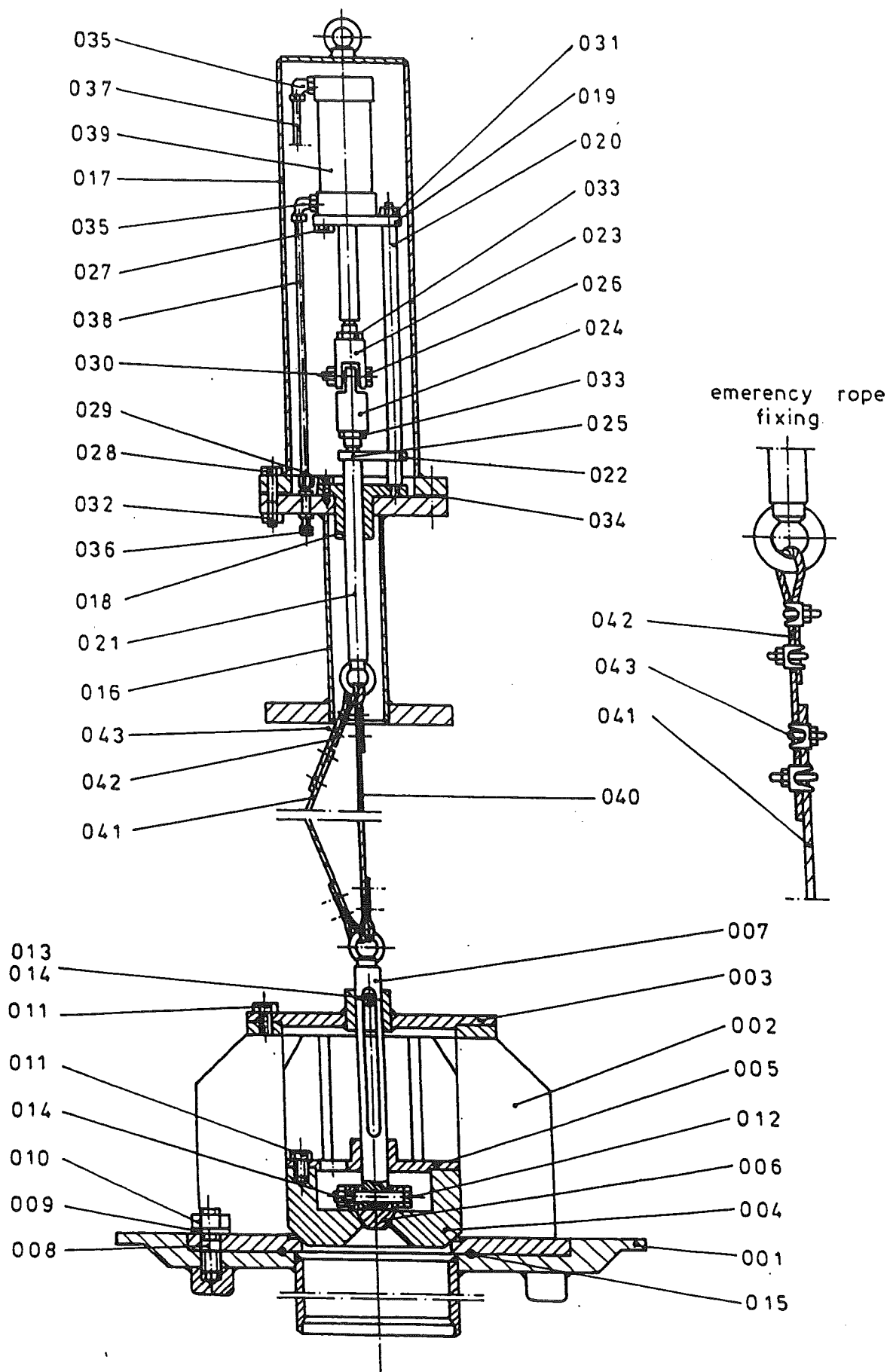


quick-action closing valve

# Pneumatically operated bottom drain valve PROTEGO NB/AP



BRAUNSCHWEIGER FLAMMENFILTER





### Field of Application:

Bottom drain valves PROTEGO type NB/AP are used in order to close tank emptying openings immediately in case of danger (e.g. break of pipeline). Therefore, these devices are also called "emergency bottom drain valves".

Under normal operating conditions these devices are kept open by a pneumatic cylinder. Only in case of emergency they are closed by remote control through control valve which does not belong to scope of supply in general.

In case of power failure the valve closes automatically.

### Design:

All important piece parts of this pneumatically operated bottom drain valve are numbered in accordance with spare parts list and are shown in sheet 0-7913-00.

The device mainly consists of reinforcement plate to be welded into tank bottom with nozzle for welding of emptying line, flanged quick-action closing valve and complete operating device which is to be installed onto tank roof. Quick-action closing valve consists of reinforcement plate and body. Inside the body valve piston is led through ribs. The relief valve cone with valve spindle is located in valve piston. The valve spindle is protected against displacing off-centre inside body cover which serves as lift stop at the same time. There is a metal-to-metal cone sealing of valve cone and relief valve cone.

Sealing between reinforcement plate and quick-action closing valve is done by a ring gasket.

The operating device consists of body nozzle, weather hood and single-acting pneumatic cylinder. Body flange and pneumatic cylinder are connected by a control line. The outbreathing line leads from pneumatic cylinder to body flange.

Cylinder piston rod and operating spindle are connected by coupling. Operating spindle is led to a bushing and is protected against displacing off-centre.

Operating rope connects quick-action closing valve and operating device. Opening of quick-action closing valve in case of damaged operating rope is possible by means of an additional emergency rope.



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**BRAUNSCHWEIGER FLAMMENFILTER**

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Emergency rope is guided by quick-action closing valve to the outer edge of tank roof, from where it is led to operating spindle. Emergency rope is fixed at operating spindle by means of a "rope with a predetermined breaking point".

Therefore, operating of quick-action closing from the edge of tank is also possible in case of possible bursting resp. lifting off of tank roof.

Function:

The description of function refers to the operational scheme 0-7911-00.

The piston in the pneumatic cylinder (E) is operated by control valve and through control line (C), so piston rod with operating spindle (F) is pulled in.

Relief valve cone (L) is opened by operating rope (G). Afterwards valve piston (K) is opened.

The control valve has to be operated in order to close the bottom drain valve, whereby the pneumatic cylinder (E) is relieved for outbreathing. Relief valve cone (L) and valve piston (K) fall down due to their dead weight and close the valve.

We recommend to install a throttle between control valve and control line (C) of pneumatic cylinder, in order to be able to adjust the opening velocity of pneumatic cylinder (E). Control valve and throttle can be supplied on demand.

Assembly and Commissioning:

When installing reinforcement plate (H), i.e. during welding into tank bottom and during welding of emptying line, you have to prevent any foreign matter, e.g. dust, welding beads etc., from getting in touch with resp. from getting inside the quick-action closing valve, in order to guarantee perfect function and tightness of valve. This work should only be done when valve (I) is disassembled.

Welding (tank bottom and emptying line) has to be carried out by a skilled person, so that the reinforcement plate is neither under stress occurs nor distorted.



Assembly has to be carried out according to the following instructions:

1. Weld reinforcement plate (001) into tank bottom.  
Weld emptying line onto pipe nozzle.
2. Sealing ring (015) either belongs to supply or will be placed for disposal at job-site. Place ring gasket in tank bottom and protect nuts (010) against displacement by welding spots.
3. Fix operating rope (040) and emergency rope (041) as well as rope with predetermined breaking point (042) at operating spindle (021). Fix emergency rope (041) by fixing rope with predetermined breaking point (042) at operating spindle (021) at first. Then the proper emergency rope (041) is fixed at rope with predetermined breaking point. Afterwards the complete operating device with operating rope and emergency rope has to be installed onto roof nozzle.
4. Take off weather hood (017) from operating device and press operating spindle (021) down completely.
5. Install control valve and throttle. Connect control line with coupling (036).
6. Press valve spindle (007) down completely inside quick-action closing valve. Fix operating rope (040) with an excessive length of 5 to 20 mm at valve spindle (007).
7. Fix emergency rope (041) with an excessive length of at least 30 mm at valve spindle (007).
8. Carry out valve function control by pulling up valve spindle (007) with valve piston (004) until stop at operating rope (040) and by letting down again. Valve spindle (007), relief valve cone (006) and valve piston (004) have to move up and down without any noticeable resistance.
9. Carry out complete function control by compressed air inbreathing through control valve into pneumatic cylinder (039), afterwards outbreathing.
10. Control, whether relief valve cone (006) and valve piston (004) close tightly. Operating rope (040) and emergency rope (041) may not be tense. If necessary, control ropes at coupling (023) and ropes (024) between piston rod and operating spindle (021) can be readjusted.
11. Repeat complete function control.
12. Reinstall weather hood (017).





Exchange or Renewal of  
Operating Rope and/or Emergency Rope

1. Loosen operating rope and emergency rope (040 and 041) from valve spindle (007) of quick-action closing valve.
2. Remove weather hood (017) from operating device.
3. Loosen control line from control line coupling (036). Remove screws (029) from guide bushing (018).
4. Pull out upwards complete operating element with operating rope and emergency rope (040 and 041).
5. Remove damaged rope and replace it by a new rope. Consider point 3. of assembly instructions.
6. Fix operating element at body nozzle and connect control line with coupling (036).

All further steps have to be carried out in the same way as described in point 6. of assembly instructions.

Maintenance

Quick-action closing valve and operating device require nearly no maintenance works. But function control should be carried out within regular periods of time, but at least once a year. If the quick-action closing valve leaks, the tank has to be emptied, so that it can be walked for purpose of repair.

In order to control or to repair the quick-action closing valve it has to be removed completely, then it has to be checked with regard to contamination resp. damage. If necessary, cone metal-to-metal sealings of relief valve cone and of valve piston have to be reworked and ground-in.

Damaged parts have to be replaced by new parts. Use only genuine PROTEGO spares for this purpose.

Carry out tightness test before reinstallation of quick-action closing valve.

Spare Parts and Working Parts

Generally usual spare parts and working parts are marked by "X" in the enclosed parts list resp. in sheet 0-7913-00.

pneumatically operated bottom drain valve  
PROTEGO NB/AP



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BRAUNSCHWEIGER FLAMMENFILTER

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parts list 0-7913-00

pos.	qty.	name	spare part	material	p.o.no.
------	------	------	------------	----------	---------

001		reinforcement plate			
002		valve body			
003		body cover			
004		valve piston			
005		valve piston cover			
006		relief valve cone			
007		valve spindle			
008		stud			
009		washer			
010		hexagon nut			
011		hexagon screw			
012		hexagon screw			
013		hexagon screw			
014		hexagon nut			
015		sealing ring	x		
016		body nozzle	x		
017		weather hood			
018		adapter sleeve			
019		flange			
020		distance bolt			
021		operating spindle			
022		displacing protection			
023		upper joint part			
024		lower joint part			
025		clamp bushing			
026		hexagon screw			
027		hexagon screw			
028		hexagon screw			
029		hexagon screw			
030		hexagon nut			
031		hexagon nut			
032		hexagon nut			
033		hexagon nut			
034		gasket	x		
035		angular connection coupling			
036		straight connection coupling			
037		outbreathing line			
038		control line			
039		pneumatic cylinder			

pneumatically operated bottom drain valve  
PROTEGO NB/AP



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parts list 0-7913-00

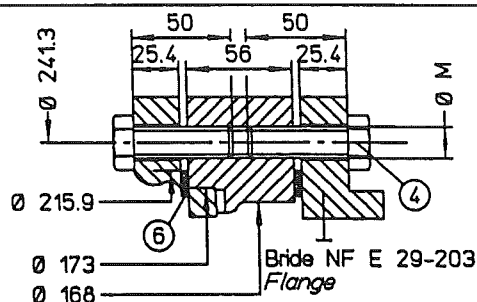
pos.	qty.	name	spare part	material	p.o.no.
040		operating rope	x		
041		emergency rope	x		
042		rope with predetermined breaking point	x		
043		wire rope clamp	x		

**BUTTERFLY VALVE  
AMRI-KSB DN 150 (6")****With locking device****ITEMS GV62036 / GV62037 for 1800MT LOX TANK****ITEMS GV72036 / GV72037 for 1000MT LIN TANK****Without locking device but 2 contacts****ITEM GV62004 for 1800MT LOX TANK****ITEM GV72004 for 1000MT LIN TANK****SUPPLIER :**

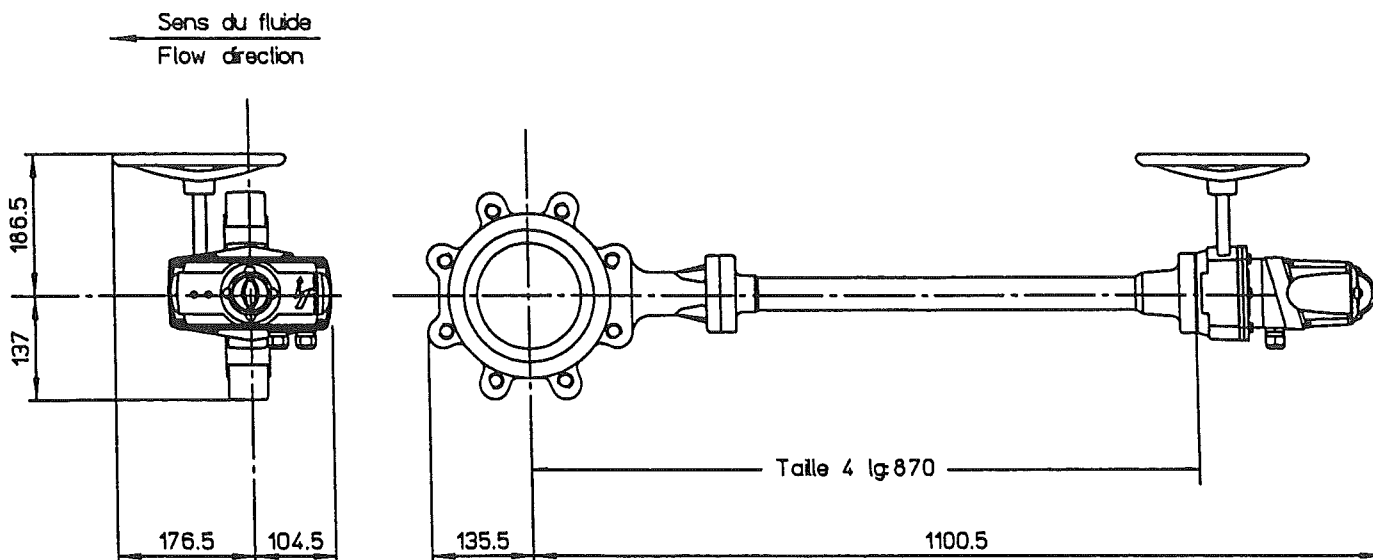
AMRI – KSB Vannes et actionneurs  
Zone Industrielle de Gagnaire Fonseche  
24490 LA ROCHE CHALAIS  
FRANCE  
Mr Bernard FORNELLI  
Tel: 06 11 10 03 77  
Fax: 01 69 52 40 12

ROBINET DANAIS TBT 2 A OREILLES TARAUEES Classe 150 DN 150 (PN 20)  
LUG TYPE DANAIS TBT 2 VALVE Class 150 DN 6" (PN 20)  
ACTIONNEUR MANUEL TYPE MR 25 AVEC VOLANT ET AMTROBOX  
MANUAL ACTUATOR TYPE MR 25 WITH HANDWHEEL AND AMTROBOX  
SIGNALISATION PAR BOITIER AMTROBOX  
SIGNALLING WITH BOX AMTROBOX

Boulonnerie		Bolling	
1	Q	Désignation	Designation
1			
2			
3			
4	16	Vis	Screw
5			
6	2	Joint de bride (3 mm)	Flange gasket



Masse Mass 50,5 Kg Pour information Information only  
Pipe Flange Bridage : 8 Trous Ø 22.2 Sur Ø 241.3  
Drilling : 8 Holes Dia. 22.2 on Dia. 241.3



Tag n°: ~~781-02-GV~~  
783-02-GV / 783-102-GV 72004  
~~812-102-GV~~

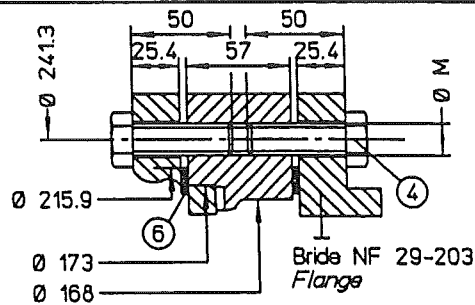
DESSINATEUR  
YD 23.05.05  
VERIFICATEUR  
LB 23.05.05

ROBINET DANAIS TBT2 A OREILLES TARAUEES Classe 150 DN 150 (PN 20)  
LUG TYPE DANAIS TBT2 VALVE Class 150 DN 6" (PN 20)  
ACTIONNEUR MANUEL TYPE MR 25 AVEC VOLANT ET INDEX  
MANUAL ACTUATOR TYPE MR 25 WITH HANDWHEEL & VISUAL INDICATION  
SERRURE SMITH FLOW CONTROL TYPE GL2  
LOCK SMITH FLOW CONTROL TYPE GL2

PRODUCED WITHOUT AUTHORIZATION

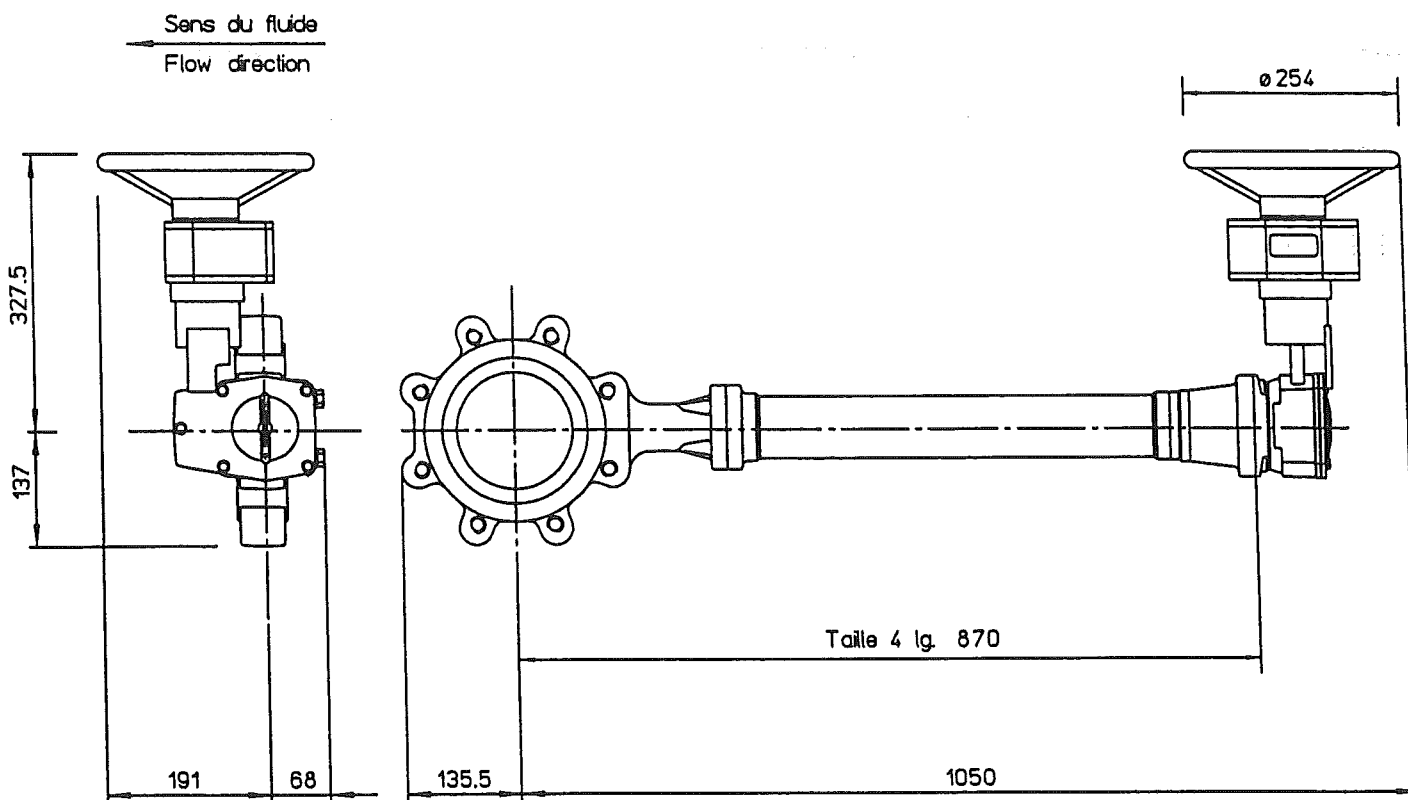
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Boulonnerie		Bolting	
Q	Désignation	Designation	ø M
1			
2			
3			
4	16 Vis	Screw	20
5			
6	2 Joint de bride (3 mm)	Flange gasket	



Masse	Mass	97 Kg	Pour information
			Information only

Bridage : 8 Trous Ø 22.4 Sur Ø 241.3  
Drilling : 8 Holes Dia. 22.4 on Dia. 241.3



Tag n° : ~~752-102-V211~~ / ~~752-102-V215~~  
~~781-02-GV62036~~ / ~~781-02-GV62037~~  
783-02-GV62036 / 783-02-GV62037  
783-102-GV72036 / 783-102-GV72037  
~~812-102-GV72036~~ / ~~812-102-GV72037~~  
~~814-02-V211~~ / ~~814-02-V215~~

DESSINATEUR	
YD	23.05.05
VERIFICATEUR	
LB	23.05.05



AMRI-KSB	DANAIS TBT2 "AL" A OREILLES TARAUBES Cl.150 DN 80 A 200 "AL" TBT2 LUG DANAIS VALVE Cl.150 SIZE 3" TO 8" DANAIS GEWINDEFLANSCHAUGENKLAPPE TBT2"AL" Cl.150 DN 80-200 SIEGE PLASTOMERE - PLASTOMER SEAT - PLASTOMER-SITZRING	Page 1/ 3
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Repère	Qté	Numéro mécano	Désignation	Matière
		FT032766-B	ENSEMBLE GENERAL DRAWING GESAMTZEICHNUNG	
13-21	1		Rallonge Extension Verlängerung	A 351 gr. CF8 M
100	1		Corps Body Gehäuse	A 351 gr. CF8 M
144	1		Siège Seat Sitz	P.F.A
213	1		Arbre monobloc Drive shaft Antriebswelle	A479 gr.316L 316L stainless steel Rostfre. Stahl 316L
310.1	1		Bande DFNG 10 à collerette Self lubricating strip Gleitlager	Acier inox + PTFE Stainless steel +PTFE Rostfreier Stahl-PTFE
310.2	1		Bague autolubrifiante DFN-C Self lubricating strip Gleitlager	Acier inox + PTFE Stainless steel +PTFE Rostfreier Stahl+PTFE
310.3	1		Bague autolubrifiante DFN-C Self lubricating strip Gleitlager	Acier inox + PTFE Stainless steel +PTFE Rostfreier Stahl+PTFE
41-2	1		Joint statique Static joint Statische Dichtung	Nickel + nimonic
412.1	1		Joint torique O'ring O-Ring	Viton
412.2	1		Joint torique O'ring O-Ring	Viton
412.3	1		Joint torique O'ring O-Ring	Viton
412.4	1		Joint torique O'ring O-Ring	Viton
412.5	1		Joint torique O'ring O-Ring	Viton
415.1	1		Joint à lèvres Lip seal ring Lippendichtring	PTFE + Elgiloy
415.2	1		Joint à lèvres Lip seal ring Lippendichtring	PTFE + Elgiloy
50-6	1		Anneau de serrage Tightening ring Spannring	Acier inox Stainless steel Rostfreier Stahl

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Date : A.L. 25/06/03

CW 25/06/03

No Nomenclature : FT032766-B

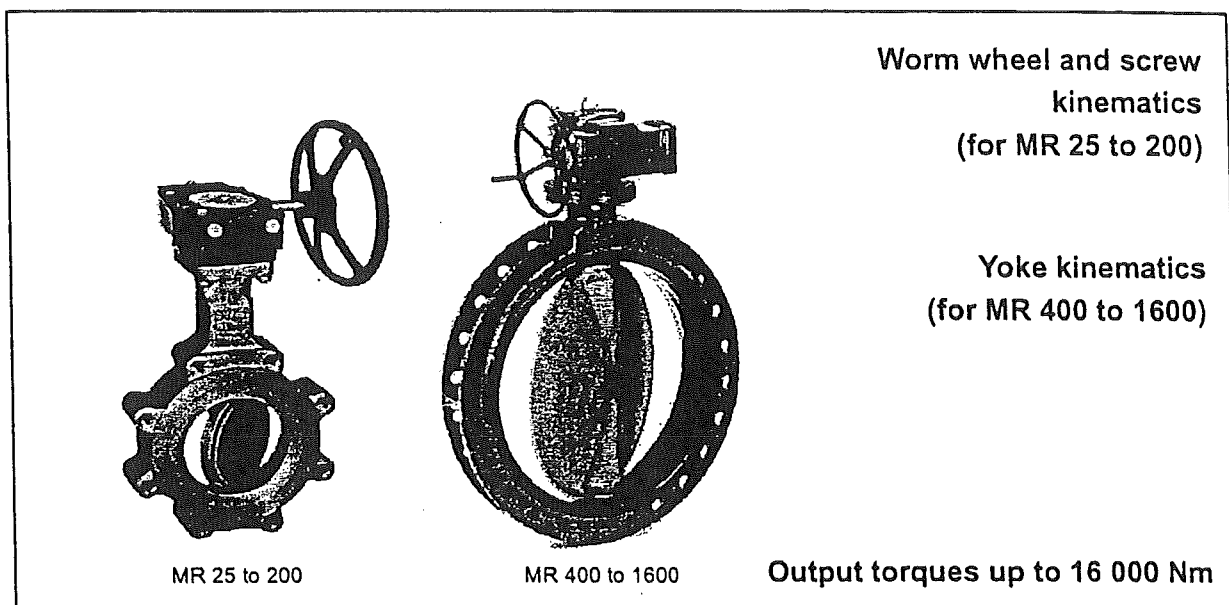


AMRI-KSB		DANAIS TBT2 "AL" A OREILLES TARAUEES Cl.150 DN 80 A 200 "AL" TBT2 LUG DANAIS VALVE Cl.150 SIZE 3" TO 8" DANAIS GEWINDEFLANSCHAUGENKLAPPE TBT2"AL" Cl.150 DN 80-200 SIEGE PLASTOMERE - PLASTOMER SEAT - PLASTOMER-SITZRING			Page 2/ 3
Repère	Qté	Numéro mécano	Désignation	Matière	
512	1		Bague de positionnement Ajusting ring Stellring	Acier inox Stainless steel Rostfreier Stahl	
543	1		Douille entretoise Spacer bush Abstandbuchse	Acier inox Stainless steel Rostfreier Stahl	
550	1		Obturateur Disc Scheibe	Acier inox 316 316 stainless steel Rostfreier Stahl 316	
551	1		Rondelle entretoise Spacer disc Abstandscheibe	Acier inox Stainless steel Rostfreier Stahl	
553.1	1		Butée Thrust insert Druckstück	Acier inox Stainless steel Rostfreier Stahl	
553.2	1		Butée DFNG 10 Thrust insert Druckstück	Acier inox + PTFE Stainless steel+PTFE Rostfreier Stahl+PTFE	
554	6		Rondelle plate Plain washer Scheibe	Acier inox Stainless steel Rostfreier Stahl	
559	1		Porte joint Gasket holder Dichtungshalter	Acier inox Stainless steel Rostfreier Stahl	
561.1	2		Clou cannelé Grooved nail Kerbnagel	Acier inox Stainless steel Rostfreier Stahl	
561.2	1		Goupille cannelée Grooved pin Kerbnagel	Acier inox Stainless steel Rostfreier Stahl	
561.3	1		Goupille cannelée Grooved pin Kerbnagel	Acier inox Stainless steel Rostfreier Stahl	
72-3	1		Bride de serrage Tightening flange Spannflansch	Acier inox Stainless steel Rostfreier Stahl	
901.1	6		Vis hexagonale Hexagon head screw Sechskantschraube	Acier inox Stainless steel Rostfreier Stahl	
902	4		Goujon Stud Stiftschraube	Acier inox Stainless steel Rostfreier Stahl	
904.1	6		Vis sans tête Socket screw Gewindestift	Acier inox Stainless steel Rostfreier Stahl	
904.2	6		Vis sans tête Socket screw Gewindestift	Acier inox Stainless steel Rostfreier Stahl	
920	4		Ecrou hexagonal Hexagon nut Sechskantmutter	Acier inox Stainless steel Rostfreier Stahl	

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AMRI-KSB		DANAIS TBT2 "AL" A OREILLES TARAUEES Cl.150 DN 80 A 200 "AL" TBT2 LUG DANAIS VALVE Cl.150 SIZE 3" TO 8" DANAIS GEWINDEFLANSCHAUGENKLAPPE TBT2"AL" Cl.150 DN 80-200 SIEGE PLASTOMERE - PLASTOMER SEAT - PLASTOMER-SITZRING		Page 3/ 3
Repère	Qté	Numéro mécano	Désignation	Matière
930.2	4		Frein equerre à aileron Retainer Sicherung	Acier inox Stainless steel Rostfreier Stahl
970	1		Plaque d'identité Identity plate Schild	Acier inox Stainless steel Rostfreier Stahl
VERSION AVEC MOLLER-BALG Model with MOLLER-BALG Ausführung mit MOLLER-BALG				
13-21	1		Rallonge Extension Verlängerung	A 351 gr. CF8 M
481	1		Soufflet Bellow Balg	MOLLER-BALG
733.1	1		Collier Clamp Schelle	Acier inox Stainless steel Rostfreier Stahl
733.2	1		Collier Clamp Schelle	Acier inox Stainless steel Rostfreier Stahl
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# MR series manual actuators



This document defines the MR series manual actuators designed for the operation of  $\frac{1}{4}$  turn valves by mounting plate ISO 5211.

## General features

The range of MR series manual actuators developed and manufactured by KSB-AMRI covers output torque values up to 16000 Nm. The MR series actuators, equipped with non reversible kinematics in all positions, have been designed for all applications and for the operation of any type ¼ turn valves (centred or double eccentric disc butterfly valves, ball valves,...).

Mounting plate according to ISO 5211 standard.

Equipped with an interchangeable insert, they can be easily fitted on different valve shaft (square end, flat end, key,...).

These actuators are supplied with a handwheel and a visual pointer. Factory lubricated, they do not need any maintenance.

The MR series actuators are equipped, in standard version, with adjustable mechanical travel stops:

- in the open and closed positions ( $\pm 2^\circ$ ) for MR 25 to 200.
- in the closed position ( $\pm 2,5^\circ$ ) for MR 400 to 1600.

For the actuators:

- MR 25 to 200: the gear casing is in JS 1030 ductile iron (previous standards: DIN: GGG40 / NF: FGS 400-15)
- MR 400 to 1600: the gear casing is in JL 1040 cast iron (previous standards: DIN: GG 25 / NF: FGL 250) or in JS 1030 ductile iron (previous standards: DIN: GGG40 / NF: FGS 400-15).

The actuator is mounted directly or by means of an adapter on ¼ turn valves mounting plates.

### Protection:

They are hose and fine dust proof and are protected against accidental immersion effects (protection degree: IP 67).

Variant: suitable construction with protection degree IP 68 (30 water column meters): Consult us.

### External coating:

Standard sealed version:

- Polyurethane paint (colour dark grey RAL 7016, 80 µm thickness).

Marine version:

- 2-coat system with colour dark grey epoxy paint finish RAL 7016, 150 µm total thickness.

### Working temperature range:

From -20° C to +80° C.

## Production range

Type	Nominal output torque (Nm)	Nominal input torque (Nm)	Number of turn Handwheel	ISO 5211 mounting plate	Maximal allowable dimensions for the shaft			
					Height	Driving by square	Driving by Flat	Driving by key
MR 25	250	27	7,5	F07 – F10	50	22	22	22
MR 50	500	42	9,5	F10 – F12	60	27	27	28
MR 100	1000	70	11,5	F12 or F14	70	36	36	42
MR 200	2000	100	16,5	F14 or F16	80	50	46	50
MR 400	4000	100	48,0	F16	80	60	55	72
MR 600	6000	170	53,5	F16 – F25	95	70	75	80
MR 800	8000	100	138,0	F16 – F25	95	70	75	80
MR 1200	12000	292	69,0	F25 – F30	110	90	85	120
MR 1600	16000	100	290,5	F25 – F30	110	90	85	120

\* Direct adaptation onto identical mounting plate.

Adaptation by intermediate flange onto different plate (different size or shape).

### Options (refer pages 11 to 16)

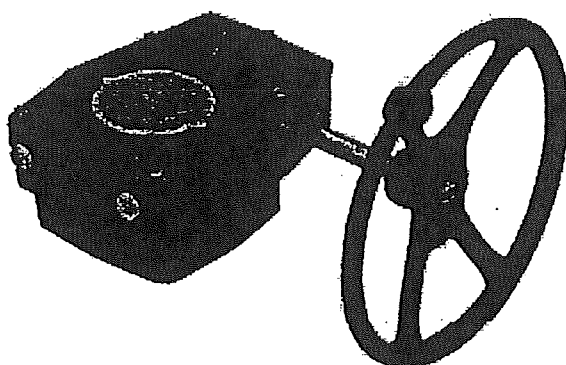
- operation by cardan joint, fountain key, and chain wheel, exchangeable with the handwheel on site,
- electric limit switch box AMTROBOX,
- visual indication by a flag,
- handwheel locking by chain and padlock,
- closing anticlock wise (consult us),
- special coating for particular environments (consult us),
- associated with ISORIA butterfly valves, the MR 25 to 200 actuators meet the requirements of APSAD (French insurance) (consult us),
- input number of turn (only MR400 to 1600): Adapt construction on request for a number of turn inferior to the input (consult us).
- Remote control devices.

## Specific features

### Range MR 25 to 200

2 different constructions (see details on pages 5 and 6) are available according to the intended application of the product.

#### Standard sealed version



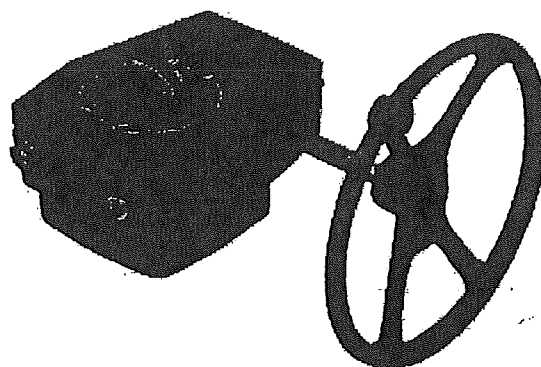
#### Application

- Non-saline industrial environment with medium corrosion level,
- No limit switch box possible.

#### External coating:

Polyurethane paint (colour dark grey RAL 7016, 80 µm thickness).

#### Marine version Reinforced protection and sealing VDI / VDE attachment interface



#### Application

- Marine,
- Industrial environment with high corrosion level,
- Buried version,
- Submersible version,
- Limit switch box AMTROBOX.

#### External coating:

Cataphoresis primary + colour dark grey epoxy paint finish RAL 7016, 150 µm total thickness.

Options: special paints.

### Range MR 400 to 1600

For some applications, reduction gears are required and there is the possibility of subsequent electrical motorization on site (see page 16) or remote actuation (see page 14, Variant: electric actuation).

This construction is not possible on all types.

In that case, reduction gears are required as indicated in the table below.

For subsequent electric motorization or remote actuation Reduction gear required	Replaces reduction gear as per documents Actuator selection
MR 400	MR 200
	MR 400
MR 800	MR 600
	MR 800
MR 1600	MR 1200
	MR 1600

## Operation

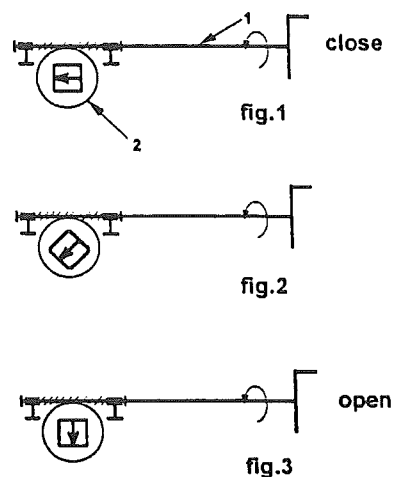
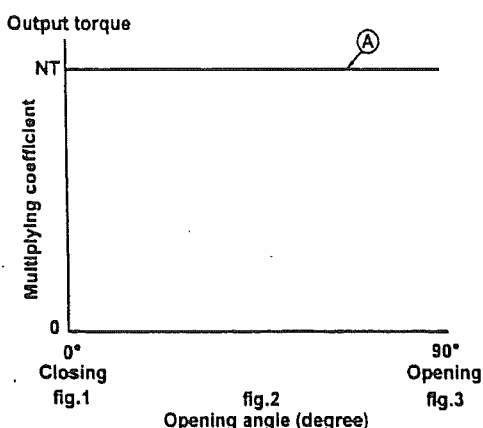
In standard version, MR actuators are designed to ensure clockwise valve closure.  
On request, anticlockwise arrangement is available.

### MR 25 to 200: worm wheel and screw non-reversible kinematics in all positions

The worm wheel and screw kinematics allows to deliver a constant output torque.

Operation is achieved by a device (handwheel, cardan joint, fountain key, chain wheel), linked to the operating screw ① driving in rotation the worm wheel ② integral with the valve shaft.

Graph A: constant output torque



### MR 400 to 1600: yoke non-reversible kinematics in all positions

The yoke kinematics allows to deliver an output torque compatible with the butterfly valves operation for a hydrodynamic torque (similar to the maximum torque).

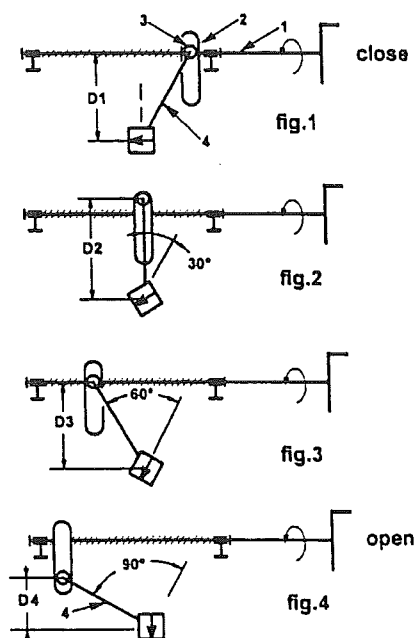
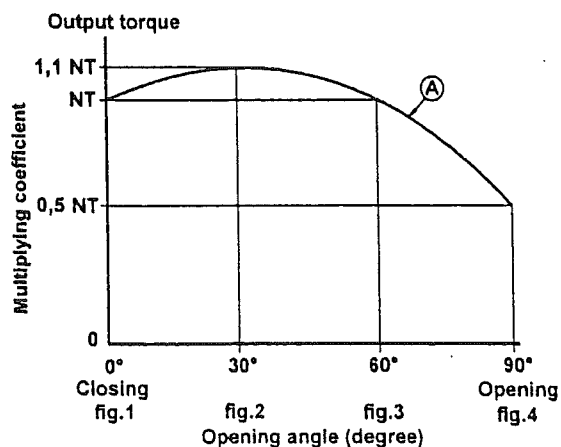
The movement transmission is carried out by the operating screw system ①, sliding operating nut ②, pressure pads ③, swingle bar ④.

Operation is achieved by a device (handwheel, cardan joint, fountain key, chain wheel), linked to the operating screw ① driving the nut in translation ②.

This movement creates sliding of the pressure pads ③ in the slot of the sliding nut ② and drives in rotation the swingle bar ④ integral with the valve shaft.

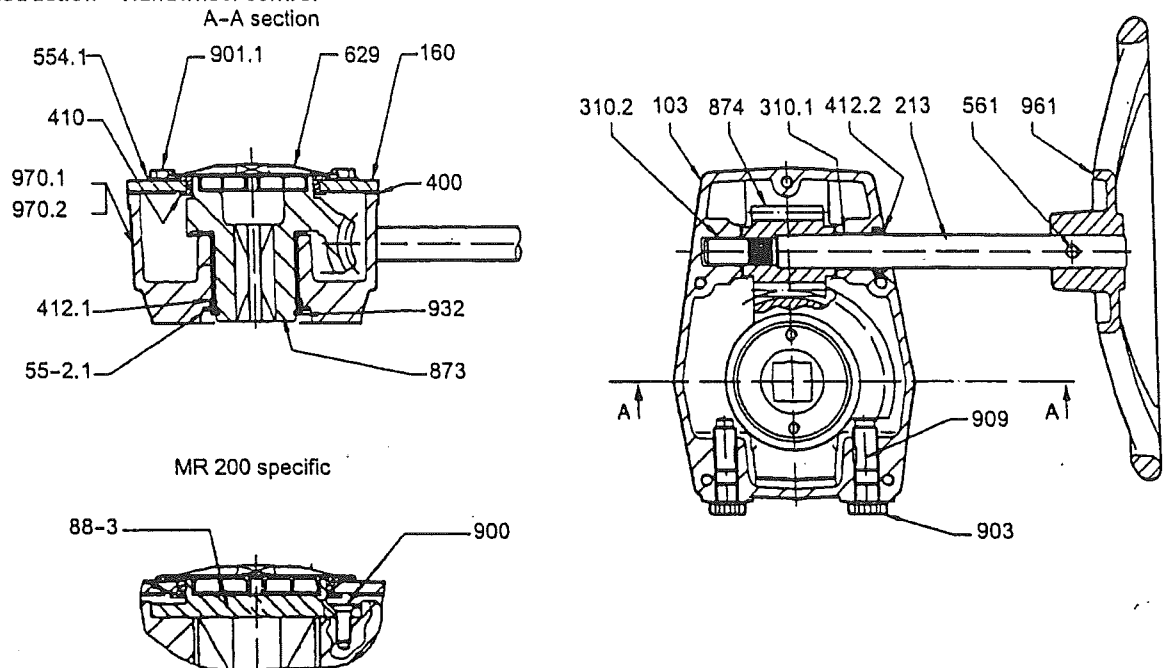
Graph of the yoke kinematics

Graph A: Output torque for constant F  $C = F \times D$



# MR 25, 50, 100 and 200 actuators: Standard sealed version

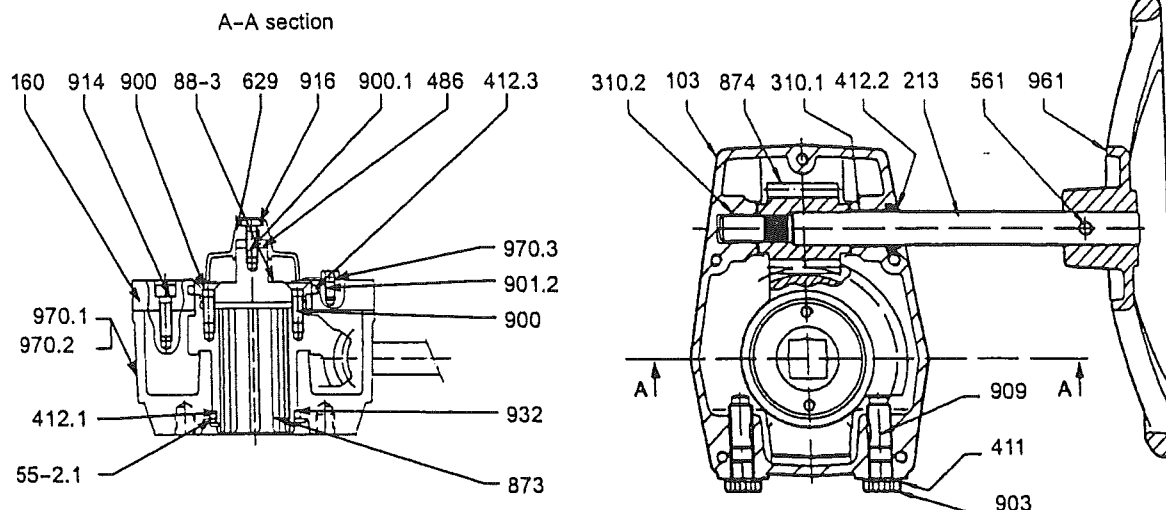
## Construction – Handwheel control



Item	Designation	Materials
103	Gear casing	JS 1030 ductile iron
160	Cover	Fe 360 B steel
213	Drive shaft	Stainless steel 17.4 type
310.1	Thrust bearing	Steel + PTFE
310.2	Thrust bearing	Steel + PTFE
400	Flat gasket	Cork / Nitrile
410	Profile ring	Nitrile
411	Gasket	Compound
412.1	O-ring	Nitrile
412.2	O-ring	Nitrile
55-2.1	Friction washer	Treated steel
554.1	Plain washer	Stainless steel A4
561	Grooved pin	Stainless steel
629	Pointer	Polyamide 6.6
873	Worm wheel	JS 1030 ductile iron
874	Screw	Treated steel
88-3	Leading unit	Treated steel (MR 200 only)
900	Countersunk head screw	Treated steel (MR 200 only)
901.1	Hexagon head screw	Stainless steel A4
903	Threaded plug	Polyethylene or stainless steel A4
909	Adjusting screw	Treated steel
932	Spring retaining ring	Steel
961	Handwheel	JS 1030 ductile iron
970.1	Identity plate	Stainless steel
970.2	Assembly instructions	Stainless steel

## MR 25, 50, 100 and 200 actuators: Marine VDI/VDE version

## Construction – Handwheel control

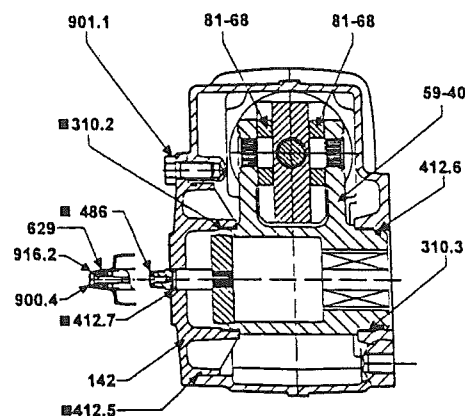
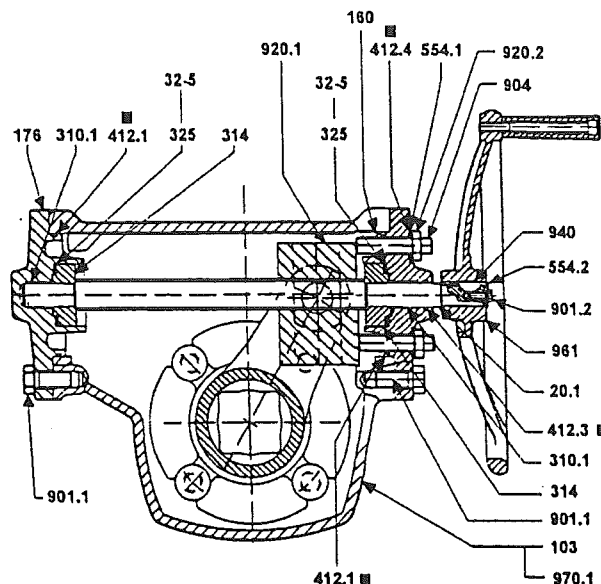


Item	Designation	Materials
103	Gear casing	JS 1030 ductile iron
160	Cover	Fe 360 B steel
213	Drive shaft	Stainless steel 17.4 type
310.1	Thrust bearing	Steel + PTFE
310.2	Thrust bearing	Steel + PTFE
411	Rondelle plate	Compound
412.1	O-ring	Nitrile
412.2	O-ring	Nitrile
412.3	O-ring	Nitrile
486	Ball	Stainless steel
55-2.1	Friction washer	Treated steel
561	Grooved pin	Stainless steel
629	Pointer	Polyamide 6.6
873	Worm wheel	JS 1030 ductile iron
874	Screw	Stainless steel
88-3	Leading unit	Stainless steel
900	Countersunk head screw	Stainless steel A4
900.1	Cheese head screw	Stainless steel A4
901.2	Hexagon head screw	Stainless steel A4
903	Threaded plug	Polyethylene or stainless steel A4
909	Adjusting screw	Treated steel
914	Hexagon socket head screw	Stainless steel A4
916	Plug	Polyethylene
932	Spring retaining ring	Stainless steel
961	Handwheel	JS 1030 ductile iron
970.1	Identity plate	Stainless steel
970.2	Assembly instructions	Stainless steel
970.3	Position plate	Stainless steel



## MR 400, 600 and 1200 actuators

## Construction – Handwheel control

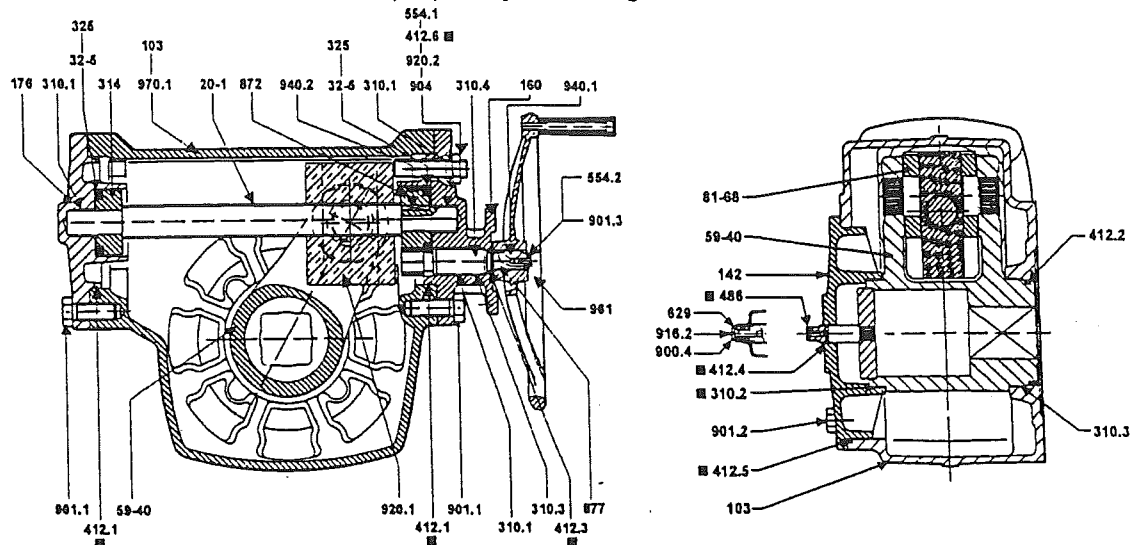


Item	Designation	Materials
103	Gear casing	JL 1040 cast iron or JS 1030 ductile iron
142	Cap	
160	Cover	
176	Bottom	
20-1	Operating screw	Phosphated / Nickel coated steel
310.1	Self-lubricating bearing	Steel + PTFE
310.2	Self-lubricating bearing	Steel + PTFE
310.3	Self-lubricating bearing	Steel + PTFE
314	Thrust washer	Phosphated steel
325	Needles thrust	Treated steel
32-5	Counter plate	Treated steel
412.1	O-ring	Nitrile
412.3	O-ring	Nitrile
412.4	O-ring	Nitrile
412.5	O-ring	Nitrile
412.6	O-ring	Nitrile
412.7	O-ring	Nitrile
486	Ball	Stainless steel
554.1	Washer	Stainless steel A4
554.2	Washer	Stainless steel A4
59-40	Chuck + pointer shaft	JS 1030 ductile iron + Stainless steel
629	Pointer	Polyamide 6.6
81-68	Pressure pad	Nitrured steel
900.4	Screw	Stainless steel A4
901.1	Screw	Stainless steel A4
901.2	Screw	Stainless steel A4
904	Screw	Stainless steel A4
916.2	Plug	Polyamide 6.6
920.1	Operating nut	JS 1060 ductile iron
920.2	Hexagon nut	Stainless steel A4
940	Parallel key	Stainless steel
961	Handwheel	JS 1030 ductile iron for MR 400 / Steel for MR 600 and 1200
970.1	Identity plate	Adhesive polyester coated

■ Parts included in the spare parts kits

## MR 800 and 1600 actuators

### Construction – Handwheel control and input primary reduction gear



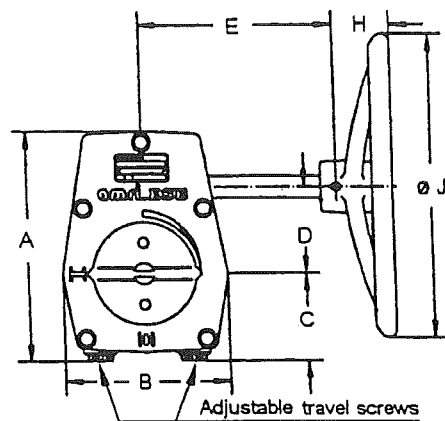
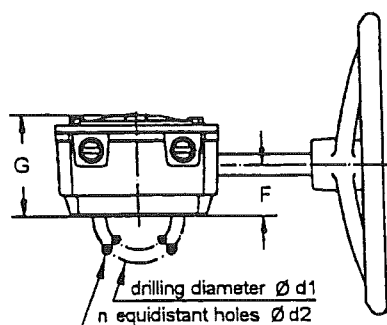
Item	Designation	Materials
103	Gear casing	JL 1040 cast iron or JS 1030 ductile iron
142	Cap	
160	Cover	
176	Bottom	
20-1	Operating screw	Phosphated / Nickel coated steel
310.1	Self-lubricating bearing	Steel + PTFE
310.2	Self-lubricating bearing	Steel + PTFE
310.3	Self-lubricating bearing	Steel + PTFE
310.4	Bearing	Steel + PTFE
314	Thrust washer	Phosphated steel
325	Needles thrust	Treated steel
32-5	Counter plate	Treated steel
412.1	O-ring	Nitrile
412.2	O-ring	Nitrile
412.3	O-ring	Nitrile
412.4	O-ring	Nitrile
412.5	O-ring	Nitrile
412.6	O-ring	Nitrile
486	Ball	Stainless steel
554.1	Washer	Stainless steel A4
554.2	Washer	Stainless steel A4
59.40	Chuck + pointer shaft	JS 1030 ductile iron + stainless steel
629	Pointer	Polyamide 6.6
81.68	Pressure pad	Nitrured steel
872	Handwheel	Phosphated steel
877	Pinion	Phosphated, nickel coated and treated steel
900.4	Screw	Stainless steel A4
901.1	Screw	Stainless steel A4
901.2	Screw	Stainless steel A4
901.3	Screw	Stainless steel A4
904	Screw	Stainless steel A4
916.2	Plug	Polyamide 6.6
920.1	Operating nut	Bronze
920.2	Hexagon nut	Stainless steel A4
940.1	Woodruff key	Stainless steel
940.2	Parallel key	Steel
961	Handwheel	JS 1030 ductile iron
970.1	Identity plate	Adhesive polyester coated

■ Parts included in the spare kits

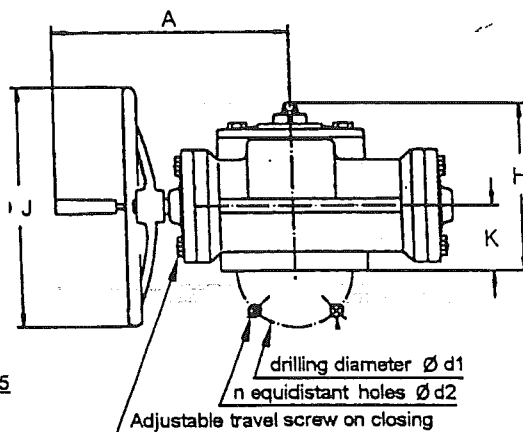
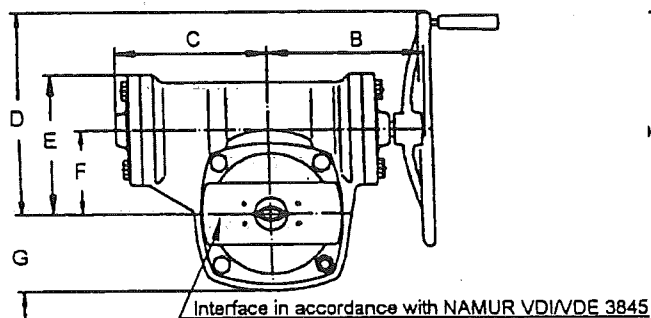
## MR 25 to 1600 actuators

Overall dimensions (mm) and weights (kg)  
Operation by handwheel

### MR 25 to 200



### MR 400 to 1600

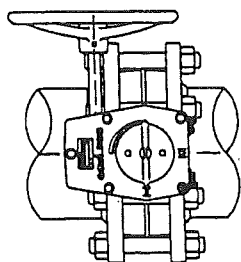


Type	Operation by handwheel											ISO 5211 interface				Weight
	A	B	C	D	E	F	Sealed version	Marine version	H	J	K	Ref.	Ød1	Ød2	n	
MR 25	172	124	66	64	142	38	62	92	42	225	—	F07 F10	70 102	M8 M10	4 4	7,0
MR 50	195	148	77	76	142	50	88	118	42	225	—	F10 F12	102 125	M10 M12	4 4	10,0
MR 100	218	172	88	88	190	62	100	130	43	350	—	F12	125	M12	4	15,0
MR 100	218	172	88	88	190	62	100	130	43	350	—	F14	140	M16	4	15,0
MR 200	266	240	108	117	227	73	123	153	43	350	—	F14	140	M16	4	24,0
MR 200	266	240	108	117	227	73	123	153	43	350	—	F16	165	M20	4	24,0
MR 400	332	230	229	300	208	125	115		246	350	95	F16	165	M20	4	58,0
MR 600	511	275	271	440	245	140	155		280	600	109	F16 F25	165 254	M20 M16	4 8	105,0
MR 800	394	295	271	315	245	140	155		280	350	109	F16 F25	165 254	M20 M16	4 8	110,0
MR 1200	680	320	337	580	338	180	180		336	800	131	F25 F30	254 298	M16 M20	8 8	175,0
MR 1600	446	342	337	352	338	180	180		336	350	131	F25 F30	254 298	M16 M20	8 8	183,0

## Mounting on valves

### MR 25 to 200

The actuator: one position only.

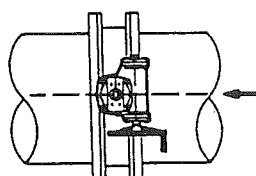


### MR 400 to 1600

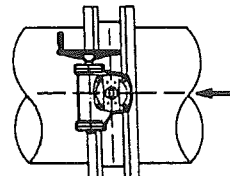
The actuator can be positioned at intervals of 90° (Standard arrangement = N / Position 1).

#### Arrangement N

Position 1



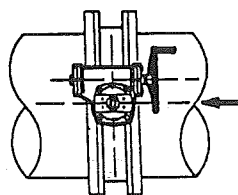
Position 2



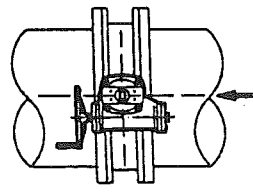
← Flow pressure direction in the valve (closed position)

#### Arrangement M

Position 1



Position 2



← Flow pressure direction in the valve (closed position)

These actuators are equipped with interchangeable inserts manufactured to the size and the form on different valve shaft for motorized operation (square end, flat end, key...).

Worm wheel with driving allowed mounting of the insert at intervals of 45° for MR 25 to 200.

Chuck with square end driving allowed mounting of the insert at intervals of 90° for MR 400 to 1600.

Square end



Flat end



Key end



(Representation: Insert for MR 25 to 200)

## Options

### • Other available versions

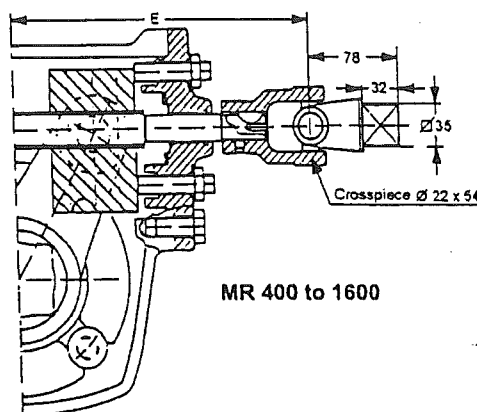
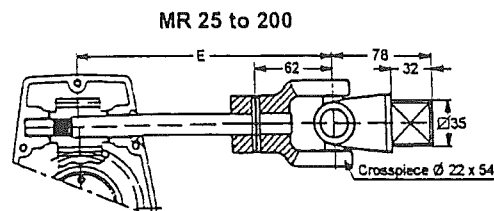
#### Operation by cardan joint (Treated steel or stainless steel)

For remote control from a deck stand, the drive shaft is equipped with a treated steel cardan joint with a 35 mm square end. The cardan joint is coated with polyurethane paint, colour dark grey RAL 7016.

The extension rod, inside square section 35 mm, is supplied with the deck stand to the required length (maxi. 6m).

The alternative cardan joint in stainless steel is also available. The Remote actuation via deck stand is defined page 14.

Type	E	Weight
MR 25	204	7,5
MR 50	204	10,0
MR 100	252	14,0
MR 200	290	23,0
MR 400	244	58,0
MR 600	285	105,0
MR 800	318	110,0
MR 1200	335	175,0
MR 1600	367	183,0



#### Operation by fountain key

For drinking water in underground circuits, the drive shaft is fitted with a plug square 30 or 50 mm in JS 1030 ductile iron.

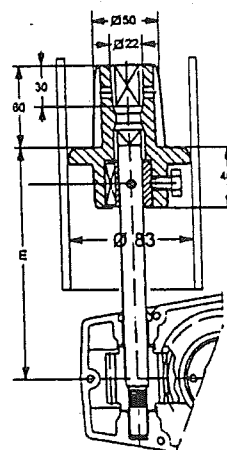
Actuators with plug square can be operated by:

- handwheel dia. 350 mm in ductile iron (JS 1030) (only square 30 mm),
- fountain key,
- straight or cranked wrench in ductile iron (JS 1030), length 220 or 370 mm,
- extension rod, in steel, square section 22 mm, fitted at its end with a plug square 30 or 50 mm.

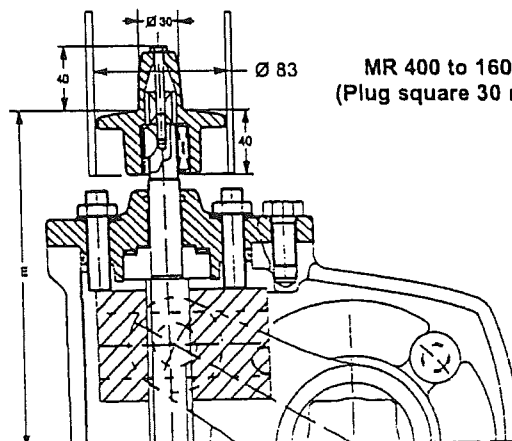
Note : the protective tube is not supplied by KSB-AMRI.

These Accessories for operation are defined page 15

Type	Square 30		Square 50	
	E	Weight	E	Weight
MR 25	165	6,5	165	7,0
MR 50	165	9,0	165	9,5
MR 100	212	12,5	212	13,0
MR 200	250	22,0	250	23,0
MR 400	222	57,0	222	59,0
MR 600	325	103,0	330	107,0
MR 800	295	108,0	295	111,0
MR 1200	370	173,0	375	177,0
MR 1600	345	180,0	345	184,0



MR 25 to 200  
(Plug square 50 mm)



MR 400 to 1600  
(Plug square 30 mm)

## Options

- Other available versions

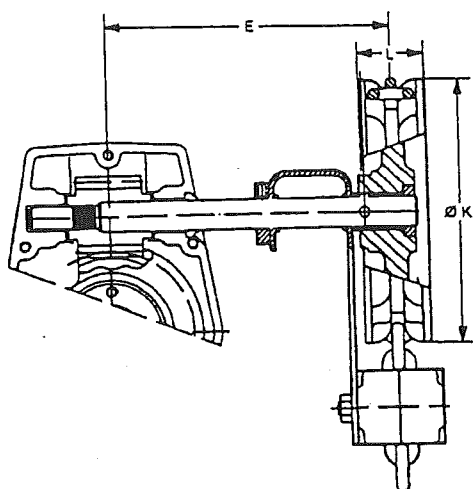
### Operation by chain wheel

When the pipework is at a higher level, or when the handwheel is not accessible, remote control can be made by a chain wheel fitted on the actuator shaft.

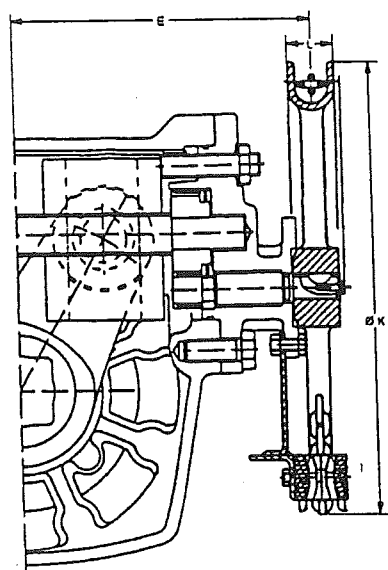
When ordering, the total length of pitched chain required should be specified (pitch 18 mm, wire dia. 6 mm, according to NF E 26-011 standard).

Chain in treated steel or in stainless steel.

MR 25 to 200



MR 400 to 1600



\* Weight of linear meter of pitched chain: 0,8 kg  
Dimensions are given in mm and weights in kg.

Type	E	K	Ø K	Weight
MR 25	160	200	37	10,5
MR 50	160	200	37	13,0
MR 100	207	300	40	19,0
MR 200	245	300	40	28,0
MR 400	202	400	40	70,0
MR 600				
MR 800	275	400	40	125,0
MR 1200				
MR 1600	325	400	40	200,0

Handwheel control with drive shaft extension: Consult us.

## Options

### • Other available versions

#### Handwheel control with extension

For some applications, the operating handwheel must be located further away from the reduction gear.

This version is obtained by means of a handwheel control extension:

- steel extension with protection by polyurethane paint RAL 7016, 80 mm thick as standard;
- drive shaft and attaching hardware of stainless steel;
- operating handwheel identical to the standard handwheel for the reduction gear.

The maximum length of the extension (dimension E) is 3 metres. Please consult us for greater lengths.

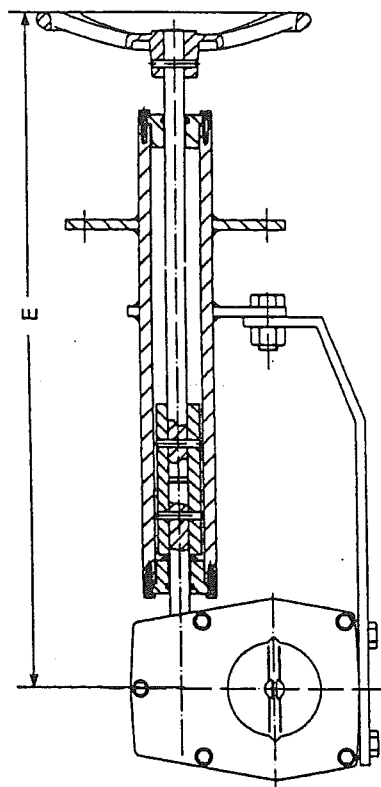
The minimum length is specified in the table below.

A support, to be installed on site by the customer, is strongly advisable in order to ensure the rigidity of the assembly.

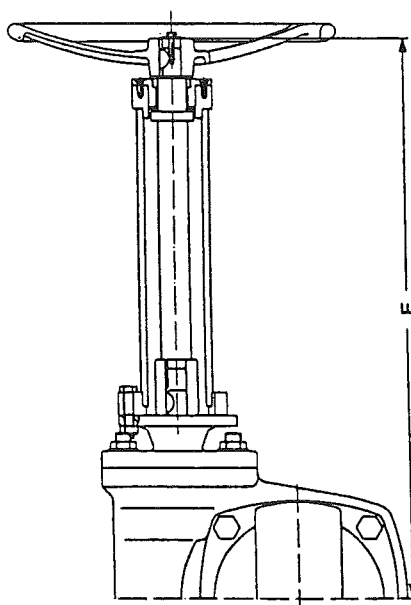
Recommended set-up for this version:

- valve fitted in horizontal position,
- MR with axis of operating shaft vertical,
- control extension with axis vertical.

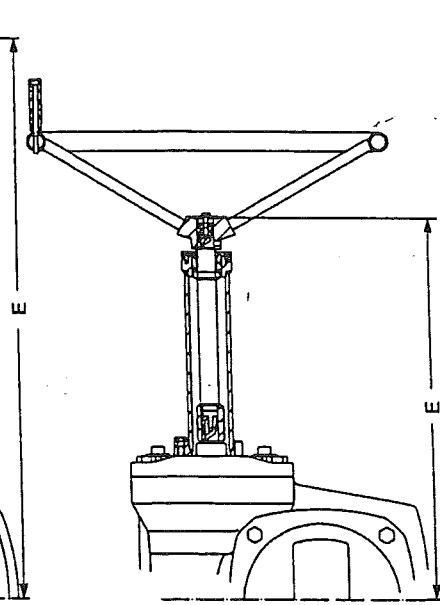
MR 25 to 200



MR 400, 800 and 1600



MR 600 to 1200



Type	E minimum mm
MR 25	500
MR 50	550
MR 100	600
MR 200	600
MR 400	500
MR 600	500
MR 800	500
MR 1200	600
MR 1600	600

Simpler solutions can be installed with the MR 25 to 200 series but this requires perfect guidance of the drive shaft on site. Please consult us.

## Options

### • Other available versions

#### Remote actuation via deck stand

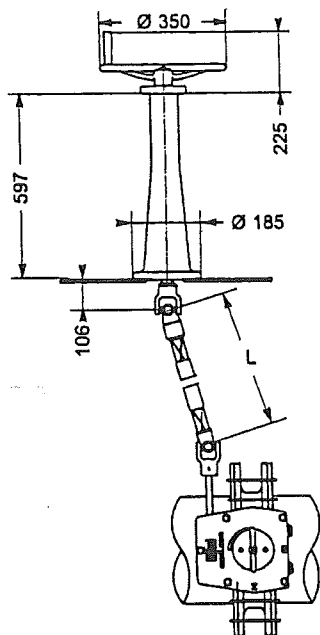
In some installations it is necessary to be able to operate the valves from a different level.  
In others, reasons of positioning or accessibility require the actuating device to be moved away from the valve.

The deck stand makes it possible to remotely operate, from a platform, the valve located at a lower level.  
Operation can be manual or electrical.

In such cases, the valve is equipped with a MR type manual actuator with output through cardan joint and transmission via a linkage assembly.

Misalignment between actuator output shaft and the deck stand shaft is catered for by provision of cardan joints.

However, the maximum angle between the linkage axis and the axis of the deck stand output shaft (or actuator shaft) must not exceed 30°.



Of cast construction, standard deck stands are hose and fine dust-proof (equivalent to IP 65).

- Deck stand made of nodular cast iron JS 1030,
- Handwheel made of nodular cast iron JS 1030,
- Torque-transmitting assembly made of steel,
- Cardan joint made of steel (standard) or stainless steel (option).

Dimension L must be at least equal to 150 mm and must not exceed 6 metres.

The basic deck stand model is not provided with a position indicator.  
This version is available as a design variant.

Protection by polyurethane coating, thickness 80 µm, anthracite grey RAL 7016.

This remote actuation feature is available for actuator types MR25, MR50, MR100, MR 200, MR400, MR800 and MR 1600  
For types MR600 and MR1200 please consult us.

#### Variant : Electric actuation

The valve is actuated via an electric motor which replaces the handwheel.

This actuation method is only possible for types MR400, MR800 and MR1600, which can be fitted with a motor and feature a cardan joint output.



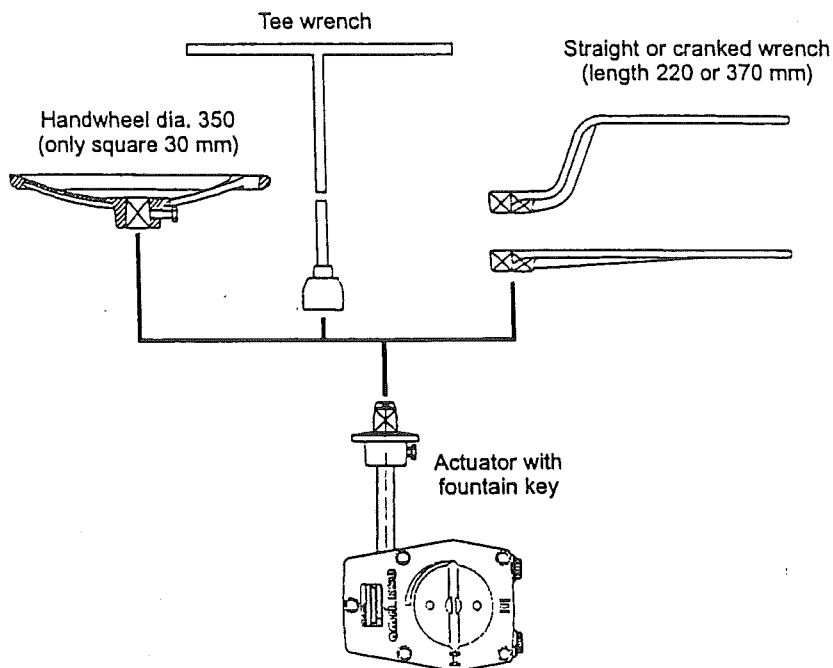
## Options

- Control accessories for MR controlled by fountain key

### Accessories for operation by fountain key

Fountain type actuating accessories have been designed for the operation of actuators with plug square 30 or 50 mm:

- cast iron handwheel, 350 diameter (30 square only),
- tee wrench,
- straight or cranked wrench, length 220 or 330 mm.

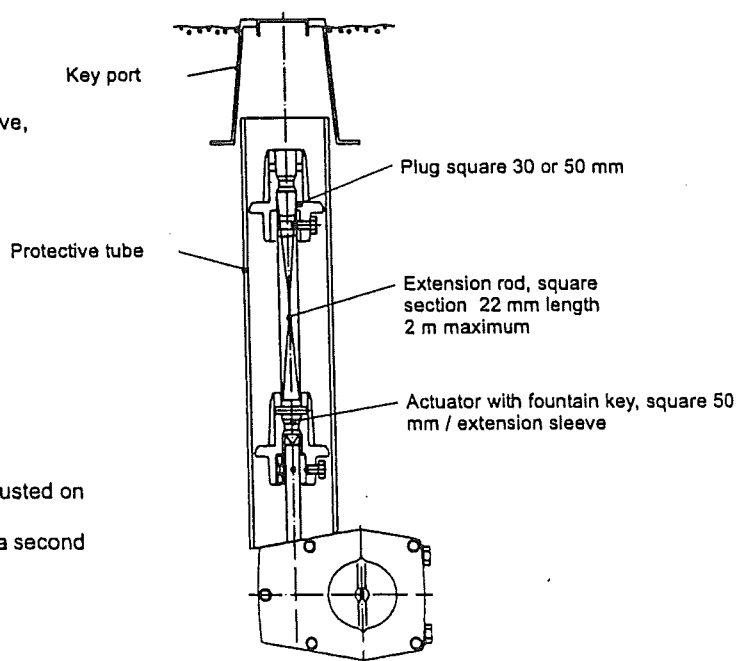


### Remote actuation for buried MR version

For buried and remote applications, a control extension is available.

This extension comprises:

- MR with mandatorily, control by 50 mm fountain key providing function of extension sleeve,
- square extension rod 22 mm, standard length 2 m + 30 or 50 square fountain key,
- key port and protective PVC tube.



Note: The length of the extension rod is to be adjusted on site by sawing.  
Additional extension is possible by adding a second extension sleeve and a second rod.

## Options

### • Limit switch indication box

MR actuators can be equipped with a limit switchbox AMTROBOX.

This switchbox can house up to three switches (one switch on open position, one switch on closed position and one adjustable switch over the full travel).

The switches can be:

- standard or explosion-proof micro-switches,
- standard or inherently safe proximity detectors.

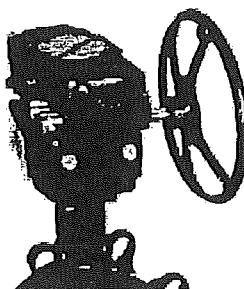
The connection is either made by cable gland or by a special connector.

In standard construction, the protection degree is IP 67.

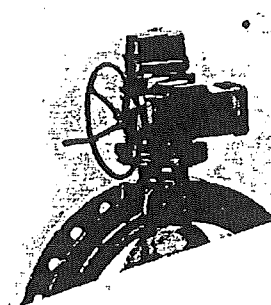
AMTROBOX is available both in intrinsically safe and explosion-proof version

Note: MR 25 to 200 to be configured in marine version (see page 3).

MR 25 to 200



MR 400 to 1600



### • Handwheel locking by chain and padlock

On request, MR actuators can be supplied with a fitting that allows handwheel locking by chain and padlock.

(Padlock not supplied by KSB-AMRI).

### • Flag indication

#### MR 25 to 200

In fire protection systems, when the valve position needs to be seen from a distance, the standard pointer can be replaced by a flag dimension 100x100, colour: yellow RAL 1003 (other colours on request).

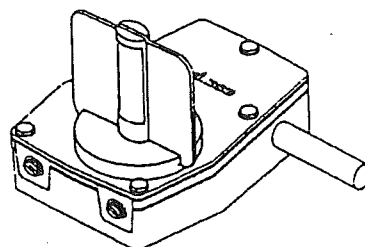
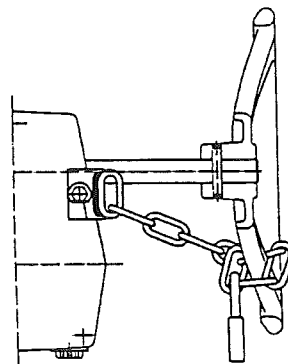
This specially designed actuator meet the requirements of APSAD (french insurance).

(MR 25 to 200 actuators associated with ISORIA butterfly valves).

#### MR 25 to 1600

red flag, dimensions 150 x 250 generally used for marine applications.

This flag can be adapted for the entire range.

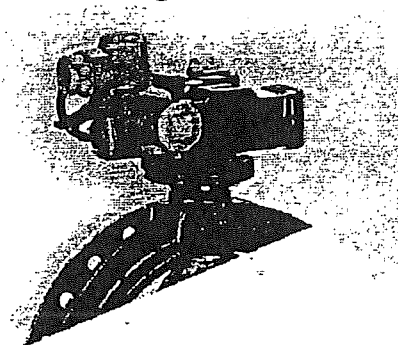


### • Motor operated actuators (MR 400, 800 and 1600 only)

It is possible, on request, to obtain an MR actuator for motorized operation by replacing the cast iron operating nut by one in bronze.

These actuators can be retrofitted for motorized operation (delivered with handwheel) or remote actuation with cardan joint output

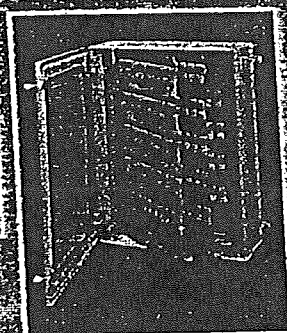
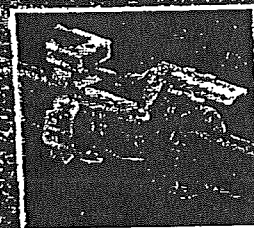
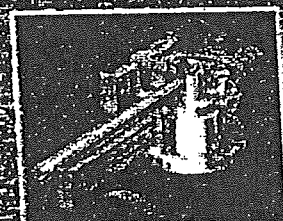
(remote actuation via deck stand with electric actuator).





# Permit to Work Management Systems

Eliminate Procedure Errors and Interlocks with Key Interlocks



an Operating Safety Solution In.....

## Human Factors Engineering



# the purpose and application of INTERLOCKS

The Oil & Gas and Chemical processing industries generally have a very disciplined approach to design and operating practice governed largely by well recognised international standards and enforced by

certification authorities. While good practice begins with good design – both are inevitably hostage to the 'human factor'.

Routine procedures are potentially dangerous if executed incorrectly or in unsafe conditions. The scope for injury and/or damage to plant or the environment may be increased significantly

when high temperature, high pressure or toxic/flammable product is present.

SFC 'CODED CARD' KEY INTERLOCKS are gaining increasing international recognition as an effective safety management tool designed to eliminate HUMAN ERROR or VIOLATIONS from process and pipeline operations even by human intervention.

Based on a 'key exchange' principle, SFC 'CODED CARD' KEY INTERLOCKS are mechanical devices which are fitted to process host equipment to control the in which it may be operated.

*They eliminate the scope for operator error or can remove any element of discretion that would permit a violation by mechanically compelling the operator to adhere to the prescribed operating sequence.*

Key interlocks are fitted typically to valves (manual or motorised), vessel closures, switches, access guards, instrument manifolds or any form of equipment operated by human intervention.

The interlock hardware is relatively simple and is designed to fit the host equipment without any modifications to its as-built construction. Depending on the process or the required level of sophistication, SFC 'CODED CARD' KEY INTERLOCKS can be customised with switches, sensors or microchips to interface/communicate with stand-alone PCs or with mainframe DCS (Distributed Control Systems) process management systems.



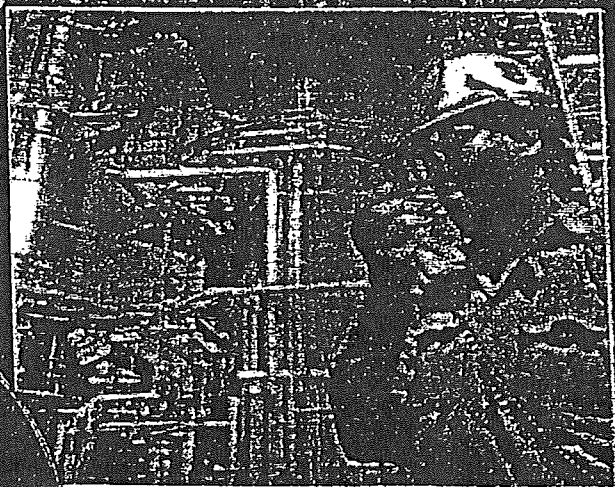
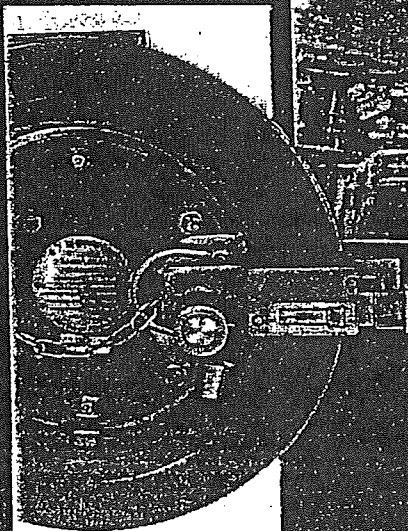
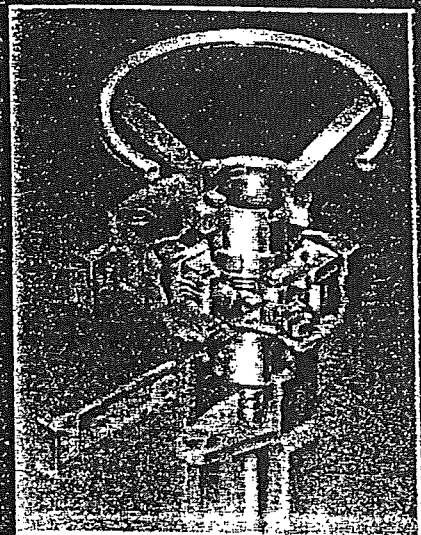




Engineers and designers play a critical role in society's survival and advancement. With this they bear great responsibility.

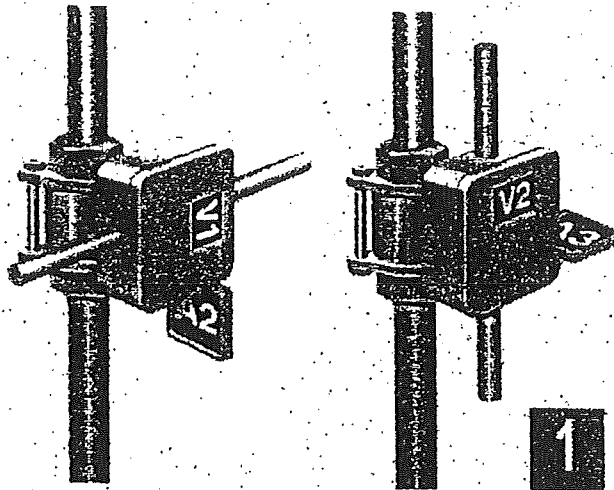
In this hydrocarbon age - personnel safety, plant protection, pollution and fragile ecosystems are all common concerns for which society demands 'RESPONSIBLE ENGINEERING'

BS4778 defines RISK as 'the combination of the probability, or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence'.



'70% of reported accidents in the Oil & Gas industry are attributable to HUMAN ERROR accounting for in excess of 90% of the financial loss to the industry.'

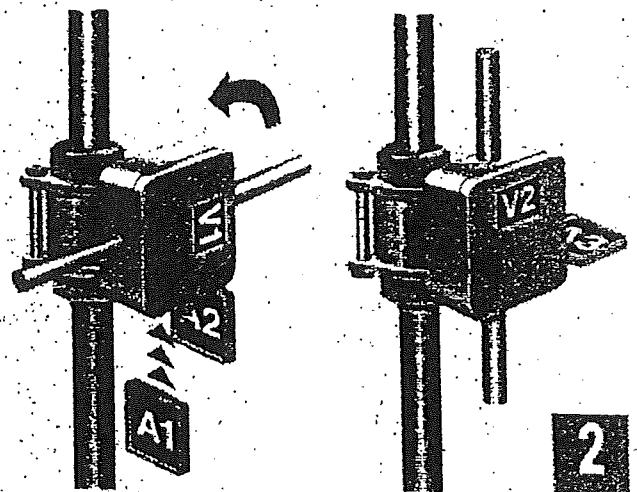
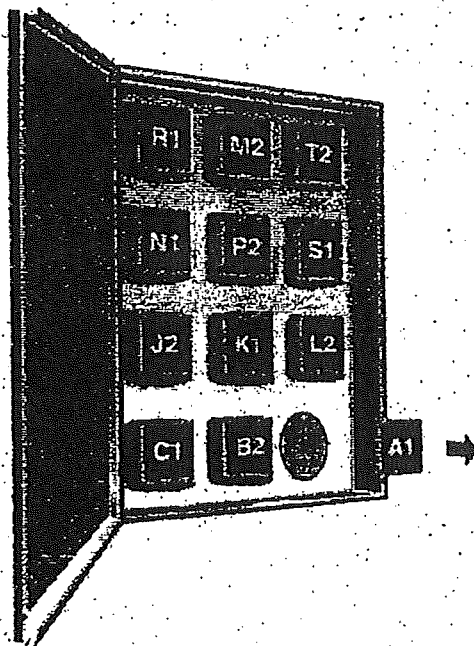
# THE PRINCIPLE OF KEY EXCHANGE INTERLOCKING



The illustrated sequence is the simplest arrangement interlocking a pair of valves where one is normally OPEN and the other is normally CLOSED. THE REQUIREMENT IS THAT BOTH VALVES MUST NEVER BE CLOSED AT THE SAME TIME.

**1** Valve 'V1' is shown Locked Closed (L.C.) with Key 'A2' trapped. Valve 'V2' is shown Locked Open (L.O.) - with Key 'A3' trapped.

Interlocks and their associated keys may be colour-coded and tagged to assist operators through the performance of the operating task. When used with Control Room Key Cabinet systems, interlocks can be customised to provide semi-intelligent or fully-intelligent data on the status of any interlocked process or pipeline package.



**2** Permit Key 'A1' is issued from the Control Room to initiate the changeover. (Removal of Key 'A1' exposes a fixed tag plate engraved with the system P&ID tag data etc.)

Key 'A1' is inserted into V1 - with both keys trapped the Valve Interlock assembly is unlocked and the valve may be operated to the OPEN position.

An interlock is essentially a dual-keyed assembly which locks its host process equipment in two positions - e.g. a valve lockable in both the 'OPEN' and 'CLOSED' positions or a switch lockable in the 'ON' and 'OFF' positions.

The standard key condition is one key trapped within the lock assembly and one key free.

Interlock keys are coded uniquely to dedicated interlocks and only the correct coded key permits unlocking and operation of the interlocked process equipment.

Production Operations and Maintenance Procedures managed by Permit to Work (PtW) systems can be regulated very effectively

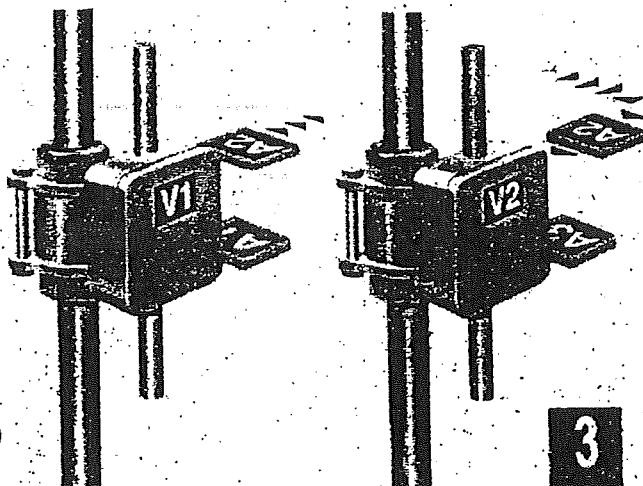
by interlocks which compel total adherence to the defined operating work sequence. Errors cannot occur and violations are impeded - interlocks remove the unpredictable 'HUMAN FACTOR' from the Risk/Safety equation in operations executed by human intervention.



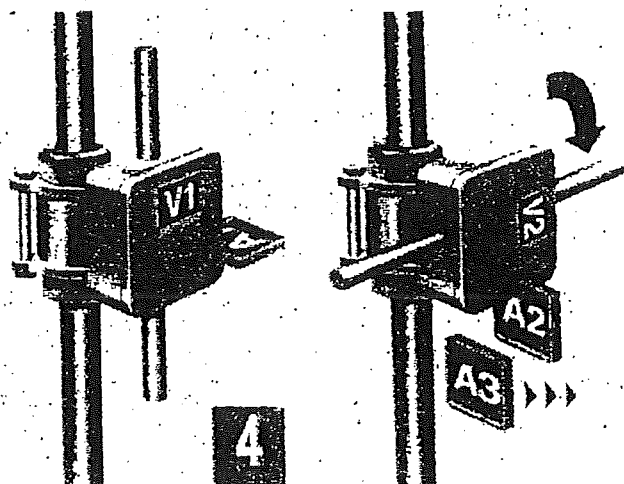
SFC 'CODED CARD' KEY INTERLOCK SYSTEMS are manufactured to BS EN ISO 9001 and are supplied fully fabricated ready to install and complete with full documentation. Individual fully-detailed product data sheets are available for any of the products illustrated and special product specifications and designs are available on request.

**3** Valve 'V1' is now locked in the OPEN position by removing Key 'A2'. (Both valves are now in the L.O. condition).

Key 'A2' is transferred and inserted to unlock Valve 'V2'.



**4** Valve 'V2' may be operated to the CLOSED position and Locked Closed by removing Key 'A3'. Key 'A3' is returned to the Control Room as positive confirmation of the completion of the work instruction, enabling the Work Permit to be closed-out.



Key interlock systems are gaining increasing recognition as an effective safety tool and are recommended in a number of internationally recognised standards for specific process applications including:-

**API RP 14E** - Design & Installation of Offshore Production Platform Piping Systems Para. 5.8.b (2) Relief Device Piping.

**API RP 520** - Pressure Relieving Systems for Refinery Services (Part II: Section 4 - Isolation Valve Requirements).

**NFPA 12** - National Fire Protection Association (USA) - Carbon Dioxide Extinguishing Systems - 1993 Edition.

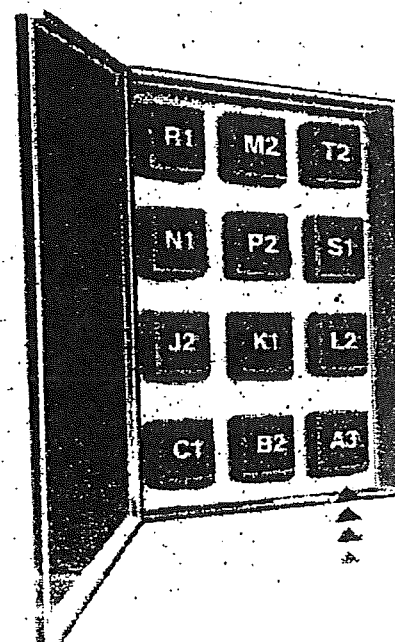
**BS 5306** - British Standard - Part 4 1986 - Specification for Carbon Dioxide Systems.

**BS 8010** - Code of Practice for Pipelines (Part 2 1992 - Sect. 2.8).

**BS 8010** - Code of Practice for Pipelines (Part 3 1993 - Sect. 6.6).

**1996 No.825** - (UK) The Pipelines Safety Regulations (Section 6 - Para. 37 of Guidance on Regulations - published by UK Health & Safety Executive).

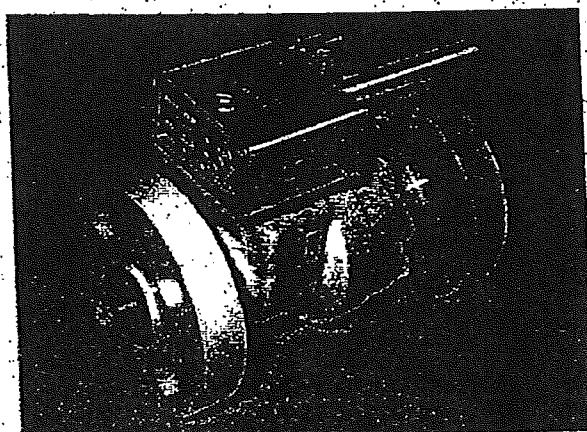
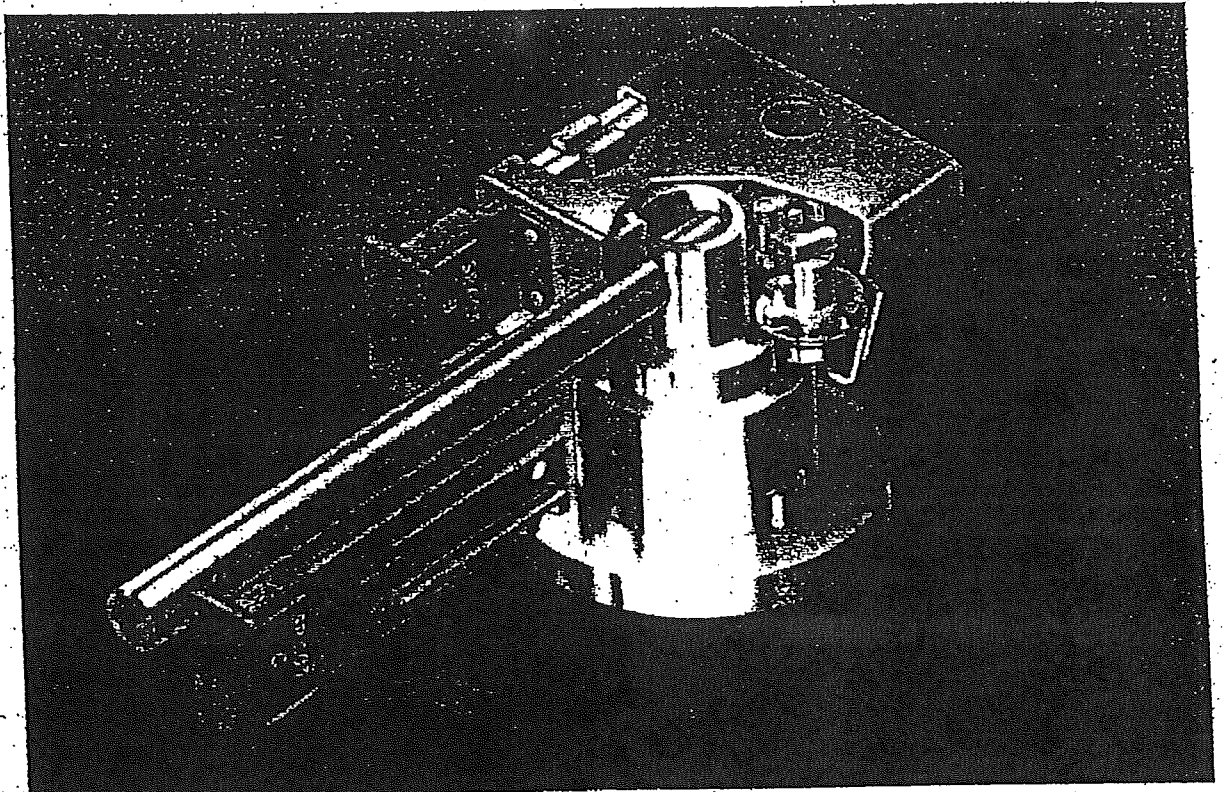
In the following pages, we provide technical descriptions and illustrations of interlock assemblies for a wide range of typical process and pipeline equipment operated by human intervention - including manually-operated valves, motorised valves, switches, closures etc. Smith Flow Control Limited has a programme of continuous product improvement and in consequence, the information given in this document may be subject to change or modification without prior notice.



## 90° LEVER-OPERATION VALVES

### 'QL' for concentric (spindle) mounting

Supplied with a purpose-machined mounting coupler which locates onto the valve spindle as a direct substitute for the original valve lever. Requires valve manufacturers' dimensioned valve topworks drawings to enable purpose-machining of mounting coupler adaptor kit.



The internal locking mechanism is fitted with anti-tamper and anti-override devices to provide a high degree of locking integrity and security.

Key entry apertures are weatherproof protected by internal self-sealing stainless steel weatherstrips which reform to re-seal the key entry aperture after removal of the key.

In either 'QL' or 'QLH' configuration the locking mechanism and keying functions are identical. The simple linear insertion of the 'coded card' key blade unlocks the assembly permitting operation of the valve. After operating the valve, the assembly may be locked again by simply withdrawing the appropriate key.

**'All 'Permit to Work' systems should incorporate a mechanical isolation procedure which involves the physical locking off and tagging of all isolation valves'**  
**Cullen - Nov. 1990**

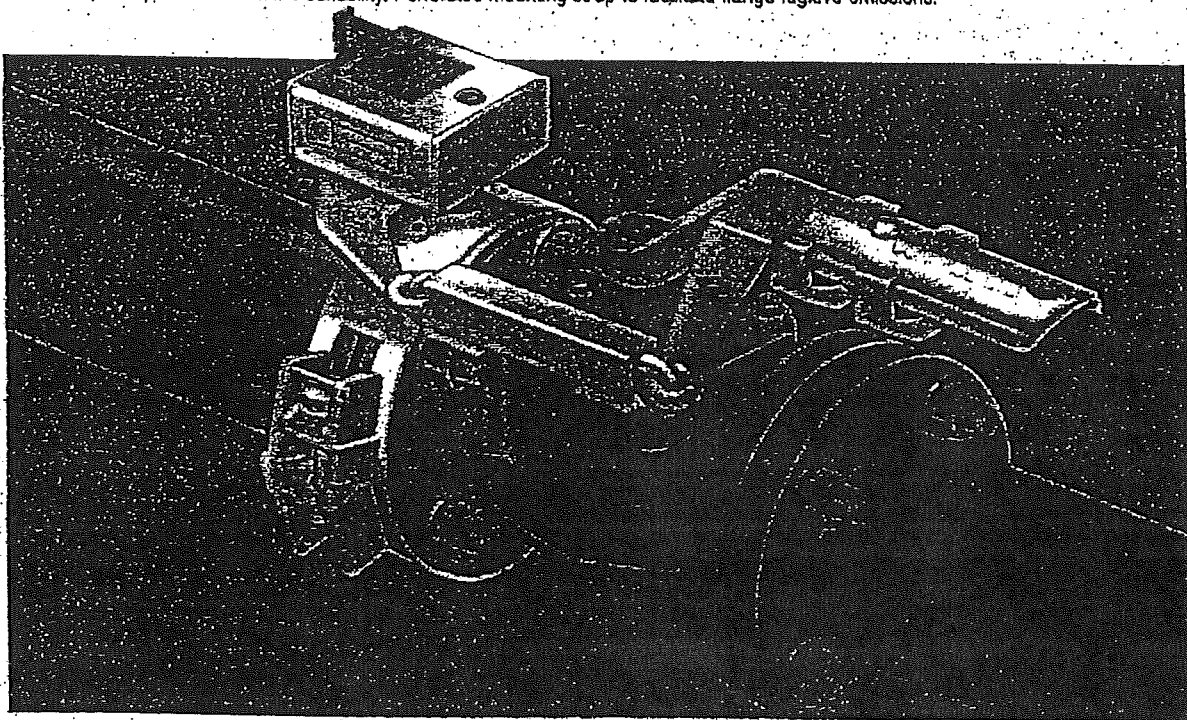
- No modifications to as-built certified/tested valve assembly.
- Manufactured in 316 Stainless Steel.
- Fire-test rated to +700°C.
- Low temperature rated to -57°C.
- Sea salt/corrosive mist tested.



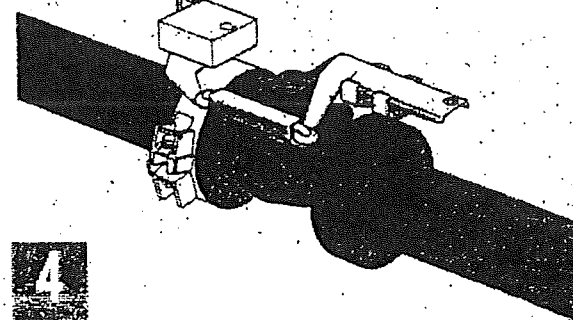
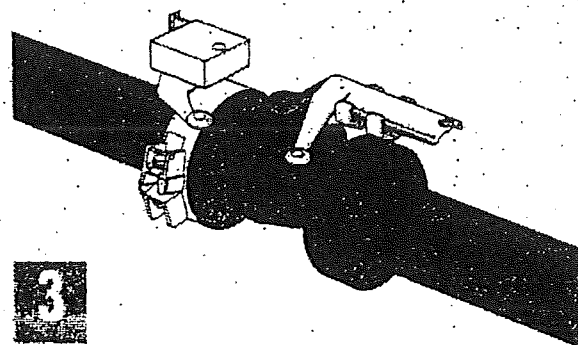
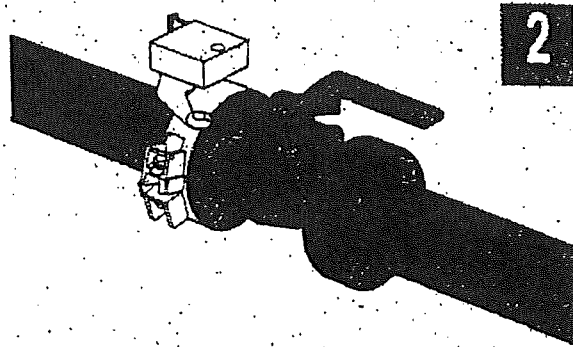
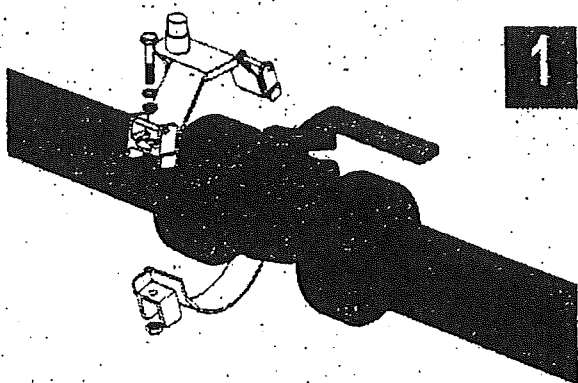
## SFC 'QL' and 'QLH' Coded Card Key Interlocks suitable for Lever-operated Ball, Butterfly or Plug Valves

### 'QLH' for universal mounting

The 'QLH' can be fitted to ANSI flanged valves retaining the original valve lever. Valve manufacturers' general catalogue data is usually adequate to determine suitability. Perforated mounting strap to facilitate flange fugitive emissions.



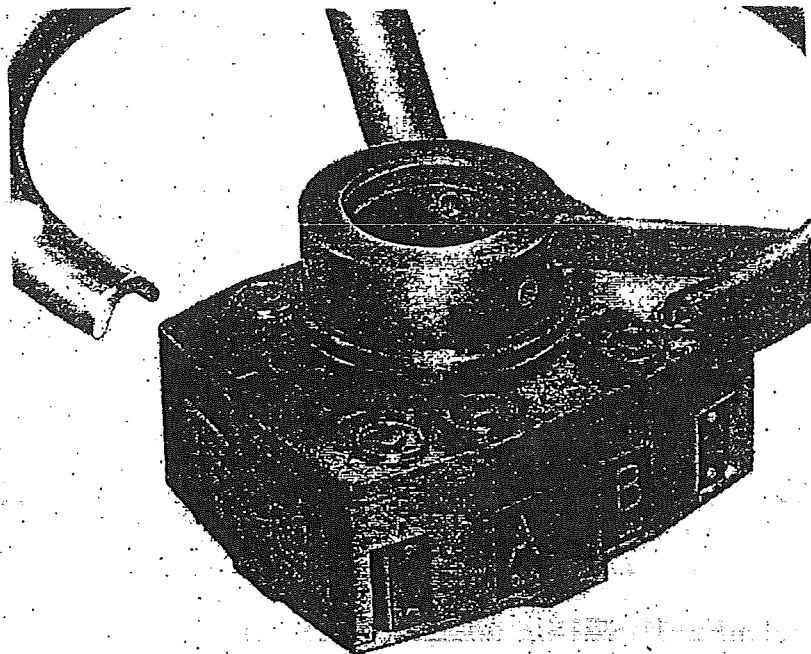
Valve control systems developed by Smith Flow Control help to ensure safety on the East Brae platform operated by Marathon Oil UK Ltd.



## MULTI-TURN HANDWHEEL OPERATION

### 'GL' for concentric (spindle/yoke) mounting

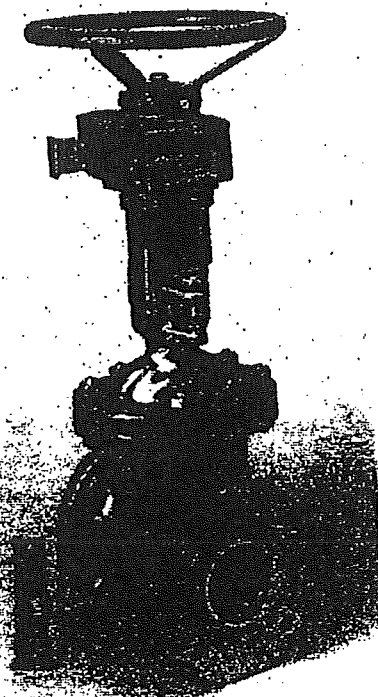
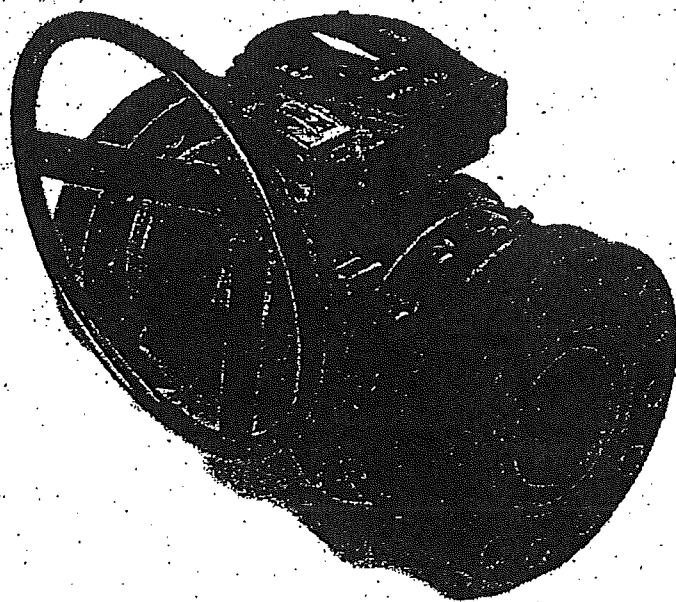
Supplied with a purpose-machined mounting coupler which locates onto the valve spindle or yoke sleeve as a direct substitute for the original valve handwheel. Requires valve manufacturers' dimensioned valve topworks drawings to enable purpose-machining of mounting coupler adaptor kit.



In either 'GL' or 'GLH' configuration the locking mechanism and keying functions are identical. The simple linear insertion of the 'coded card' key blade unlocks the assembly permitting operation of the valve. After operating the valve, the assembly may be locked again by simply withdrawing the appropriate key. The internal locking mechanisms are fitted with anti-tamper and anti-override devices to provide a high degree of locking integrity and security.

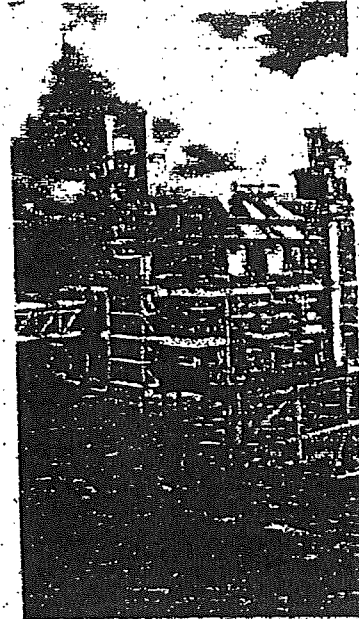
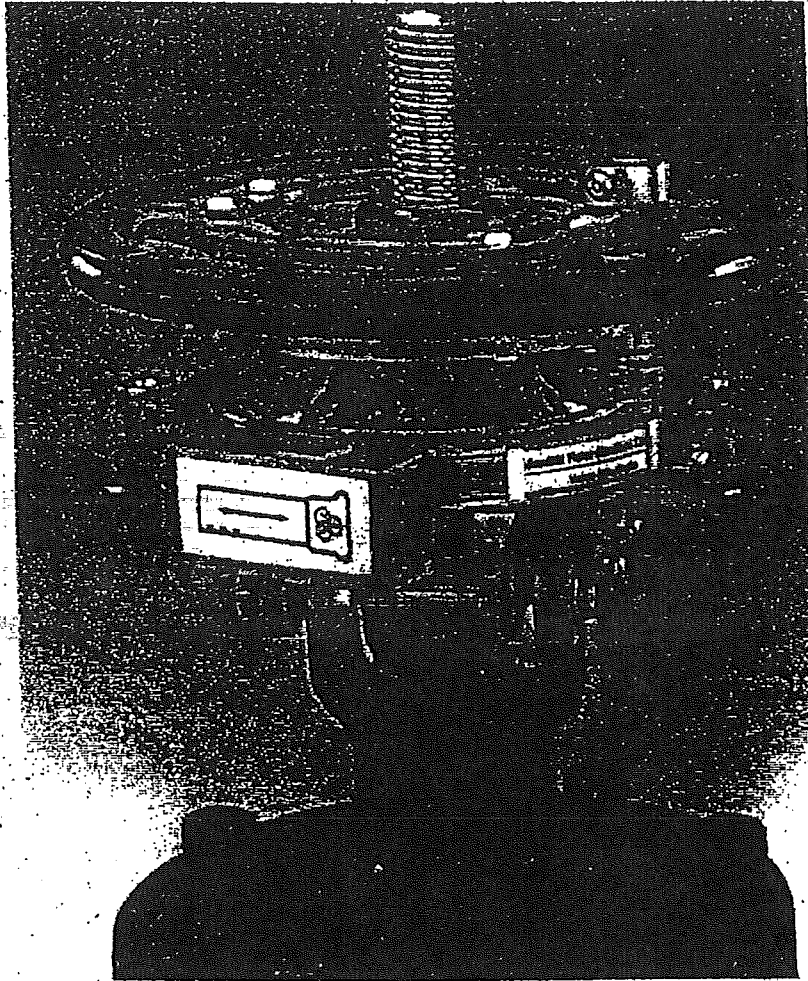
Key entry apertures are weatherproof protected by internal self-sealing stainless steel weatherstrips which reform to re-seal the key entry aperture after removal of the key.

- No modifications to as-built certified/tested valve assembly.
- Manufactured in 316 Stainless Steel.
- Fire-test rated to +700°C.
- Low temperature rated to -57°C.
- Sea salt/corrosive mist tested.

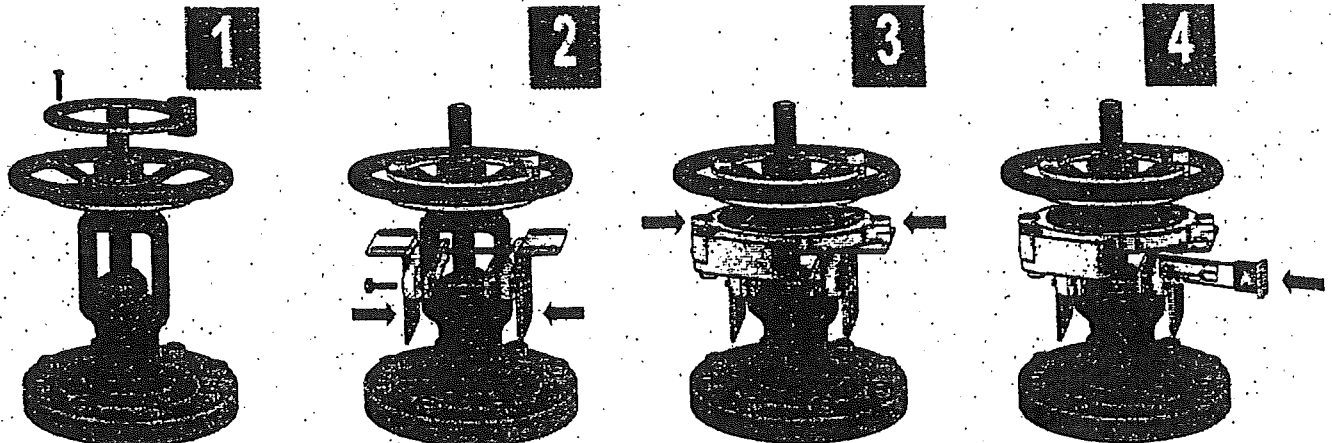


### 'GLH' for universal mounting

The 'GLH' can be adapted for conventional valve body castings retaining the original valve handwheel. Valve manufacturers' general catalogue data usually adequate to determine suitability.



Smith Flow Control systems are used to safeguard facilities in the Liverpool Bay gas and oil field operated by BHP Petroleum Limited.



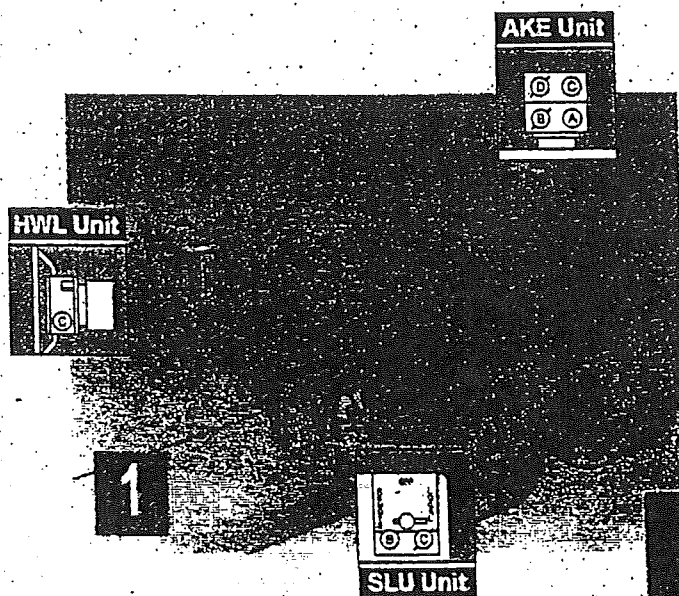


# ACTUATED VALVES - Interlocks for Electric, Hydraulic and Pneumatic Actuated Valves (MOV's)

## Electrically Actuated Valves

Electrically actuated valves (MOV's) are managed typically by mainframe DCS (Distributed Control Systems) software and are usually set in 'Remote Mode' for distant operation - e.g. routine pig launch/receive procedures.

Within a DCS system, such valves may be also electrically-interlocked with other MOV's or may be programmed for ESD functions.



1. Illustration showing trapped key arrangements for valve in OPEN position.

Note: Selector locked in 'REMOTE' mode (normal operating condition)

2. Illustration showing trapped key arrangements for valve in CLOSED position.

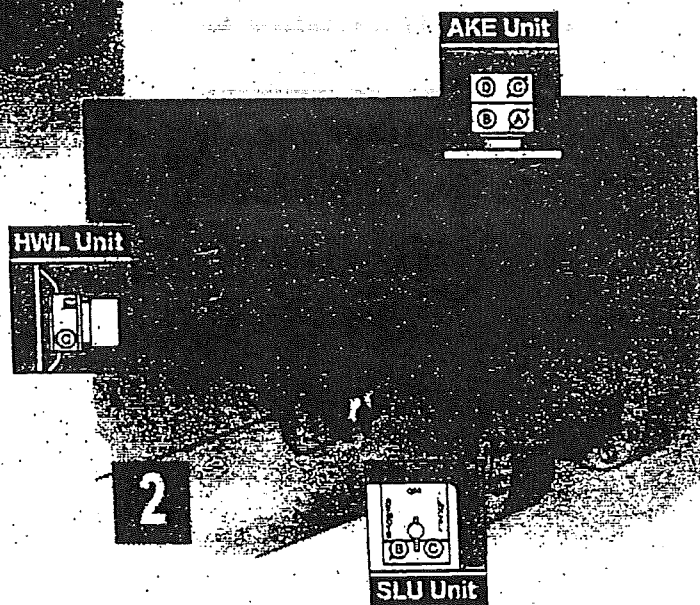
Note: Selector locked in 'OFF' position - valve de-energized - anti-condensation heating circuit unaffected.

LEGEND: ○ = Key free ○ = Key trapped

HWL unit = Handwheel over-ride lock.

SLU unit = Local/Remote Power Selector Isolation lock.

AKE unit = Position Proving Key Exchange Unit.



When MOV's are set in normal 'Remote Mode', the interlock assembly functions passively - permitting routine distantly instructed procedures. In the event of a non-routine (maintenance) procedure, the interlock system controls the conversion of the MOV to 'Local Mode' and 'Off Mode' settings and sequential trapping and releasing of keys to enable operation of other dependent interlocked equipment - e.g. valves, closures, switches etc.

## Hydraulic & Pneumatic Actuators

A range of comparable designs are also available for spring-return and double-acting hydraulic and pneumatic actuators. SFC's range of special process products also includes needle valve locks; temperature and pressure sensing locks and a range of signalling options to meet most process operating requirements.

Most process or pipeline systems incorporating MOV's will also have a range of manually-operated valves regulating sundry/secondary functions - e.g. draining, purging etc. Operating control of such valves previously has had to rely on operators following written instructions. The SFC Coded Card Key Interlock System for MOV's now provides an operating control method that can embrace all MOV's and manually-operated valves within a single operating management system without comprising primary DCS process or failsafe functions.

# CLOSURES

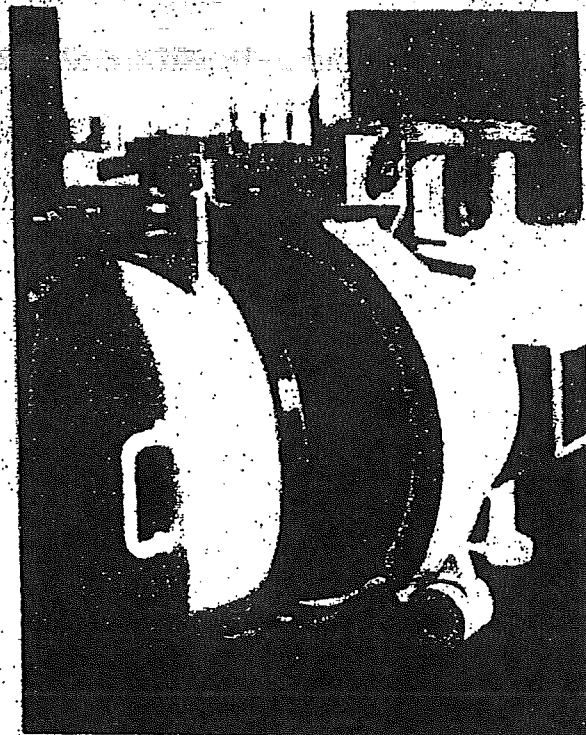
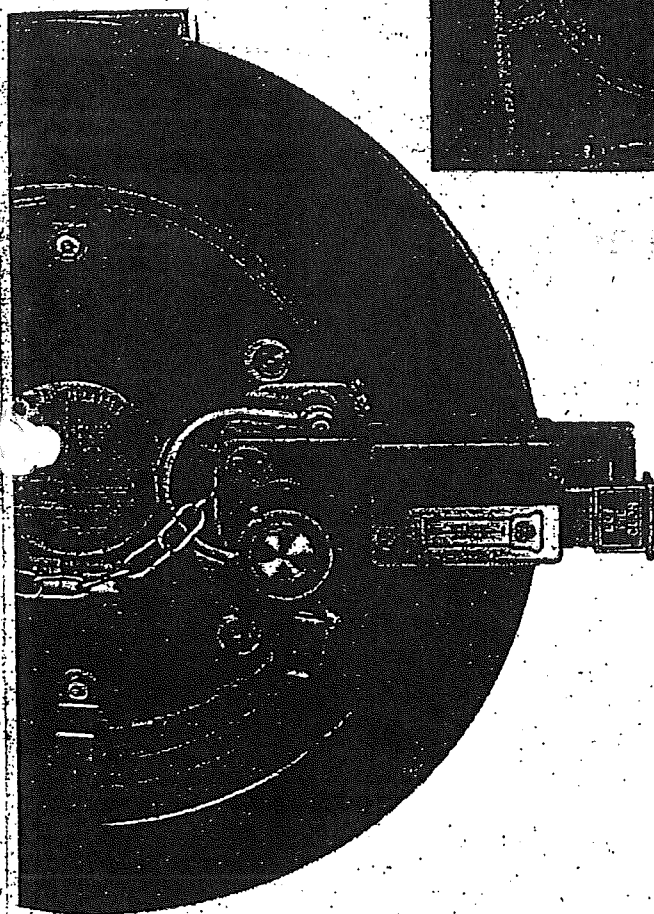
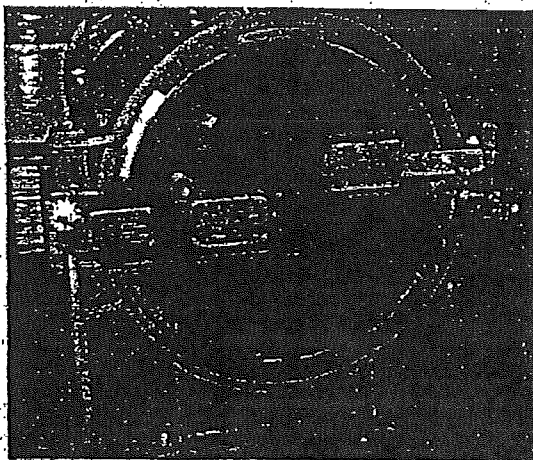
The singular greatest hazard associated with accessing pressurised vessels is the risk of opening the closure while the vessel is still pressurised or contains residual hazardous product.

Many closure designs incorporate bleed screws in the closure retaining mechanism - these are intended as a safety feature to provide indications of pressure or product being present. However, the formation of hydrates or wax congestion on the inside of the bleed hole, could obstruct product emission and mislead the operator to believing it safe to open the closure when in fact product is still present.

Otherwise, many closure designs claim it is impossible to open the closure when there is any pressure behind the closure. However, if there is pressure equalisation either side of the closure and the contained atmosphere is gas - there is again a significant risk of a serious accident. Bleed safety devices alone are inadequate to prevent inadvertent opening of closures.

The only reliable arrangement to prevent the possibility of unsafe opening of vessel closures is to interlock the closure opening mechanism with the vessel valves. No other arrangement can ensure absolute safety in this critical situation.

Only by positively ensuring total isolation, venting, draining, purging/flushing etc. can the operator attempt to open the closure in complete safety.



SFC Type DL/3 Coded Card Key Interlocks can be adapted to all types of closures including split-collar constructions, band-locks and rack & pinion operated rotating closures.

Interlocking of closures with vessel valves is recommended in several international standards including BS 8010 - Parts 2 & 3, ASME VIII - Division 1 and SI 825 - The Pipelines Safety Regulations 1996 (UK).

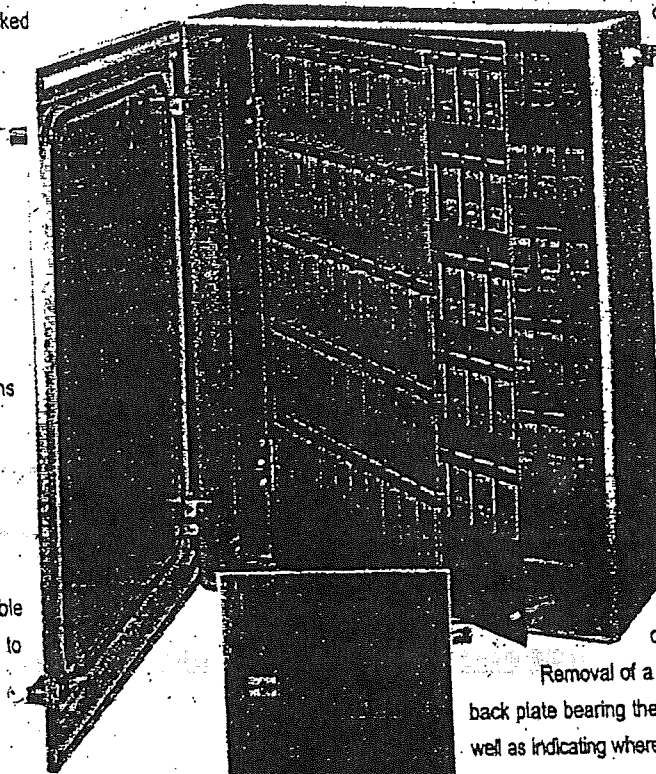
# CONTROL ROOM KEY CABINETS

## SFC 'VISUAL ALERT' AND PERMIT TO WORK KEY CABINET MANAGEMENT SYSTEM

SFC 'Visual Alert' Key Cabinets provide an effective and infallible management control system against unauthorised or

inadvertent operation of interlocked valves or associated process equipment by keeping the coded keys which initiate the operation of critical valves under secure supervisory control.

The SFC 'Visual Alert' Key Cabinet Management System maintains the operation of critical valve process operations totally within the control of the Operating Authority, enabling Permit to Work (PtW) procedures to be carried out safely and efficiently. The system concept is totally flexible and is designed in each case to integrate with each clients' operating system and working practices.



Each interlocked system has a dedicated engraved tag location within the Key Cabinet. During periods of normal

operations, all interlock system 'permit' keys are visually displayed and located within the Key Cabinet on dedicated tagged key slots. Each Key Cabinet tag is engraved with the relevant package data - this same engraved data is also replicated on each system key. At any time, it is possible to tell at a glance the status of any interlocked system or individual locked valve.

Planned work procedures can be initiated by the issue of the interlock 'permit' key.

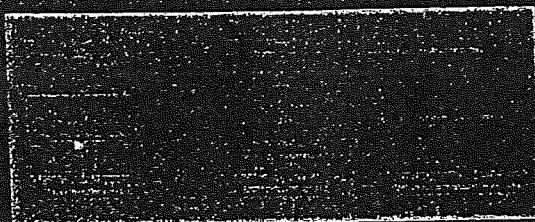
Removal of a key reveals the engraved tag back plate bearing the notation 'Work in Progress' as well as indicating where the work is actually taking place.

- Manufactured as standard to IP55 - higher IP ratings available to special order.
- Fabricated from high grade cold rolled steel - epoxy resin spray finish.
- 316 stainless steel option for external locations.
- Twin-locked cabinet door for security.

Key Cabinets can be customised to include Mimic Graphics which duplicate the P & ID layout of the

process on which is engraved a matrix of the interlocked valves and their respective operating keys. This provides a visual indication of all possible permutations of the status of each interlocked valve dependant on which of the system keys are present or absent from the Key Cabinet.

For sophisticated process or pipeline applications, SFC have developed an intelligent key system where keys located in the



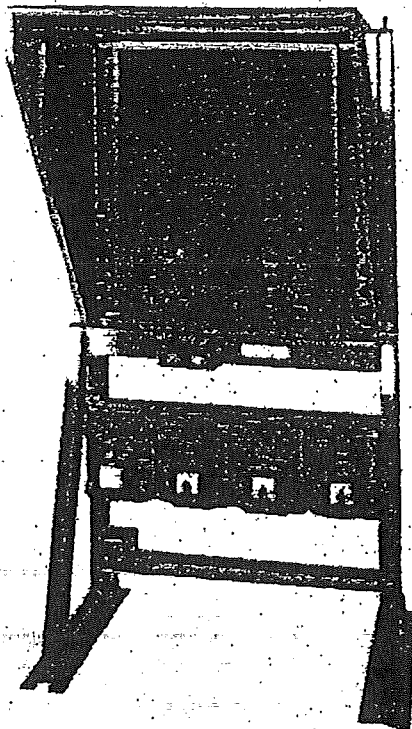
key cabinet can be read electronically to confirm the status of any interlocked package.

The system can be operated using a standard stand-alone IBM compatible PC - system status data can be displayed in simple alpha-numeric or in mimic graphic format replicating the package P & ID.

Features available include PIN password system for cabinet access security and interfacing capability for downloading processed data into mainframe DCS systems.



## SPECIALS



Routine pig launch/receive procedures in DCS managed systems are commonly executed in 'Remote' mode.

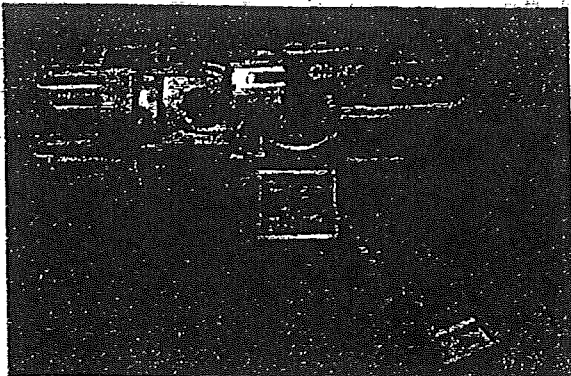
The non-routine task of loading/unloading pigs is invariably a locally executed task that requires conversion of the DCS to 'Local' mode and a means of ensuring the parallel safe condition of manually-operated sundry services valves (i.e vent, drain and purge etc) with that of the main MOV's.

The picture shows a typical SFC Operator Deck Panel interfacing the DCS with a fully integrated pig trap key interlock system.

The fabricated unit houses (intrinsically safe) indicator lamps and pushbuttons in a scale mimic board and incorporates solenoid interlocked rotary switches in 'Exd' flameproof/explosion-proof housings which govern the local operation of the main MOV's with sequenced logic from the DCS.

Opening of the vessel closure is restricted and is dependent on complete execution of the interlocked operating procedure which will ensure all the required process parameters are met - i.e. total isolation, venting, draining, purging etc. Only then will the system yield the correct appropriate key to enable opening of the closure.

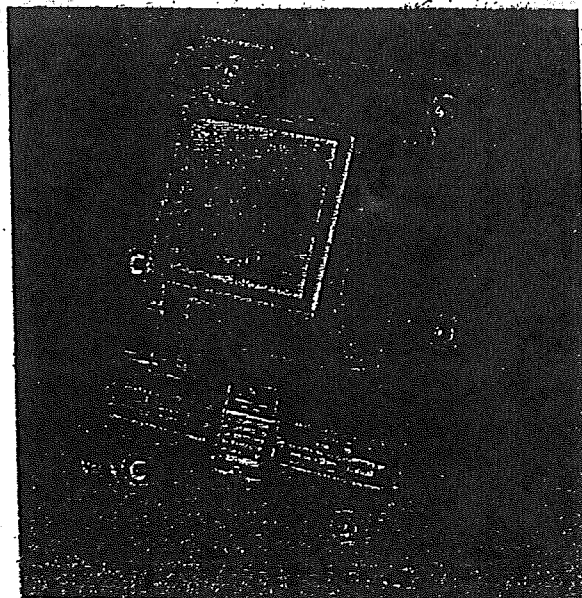
Deck Panels are designed to meet client operating requirements and are fabricated in 316 stainless steel to IP 65.



Assembly illustration courtesy of Oliver Valves showing an SFC interlock assembly fitted to their Shell EL 'F' type double block and bleed.

Typical applications for this assembly include a test loop where on a plant maintenance schedule the valve would be closed shutting off the signal to a pressure transmitter which in turn would trigger shutdown of the system.

Otherwise, similar configurations could be used to prevent accidental closure of a valve on critical instruments such as pressure alarms and trip switches.



Electrical Switch units or Solenoid Key Release units available to Standard Industrial specification or Flameproof certified to BS 5501 Parts 1 & 5 (EN50014-018) EEx d IIB-ingress protection to IP65.

The units shown are just a small selection of the wide range of special product designs available from SFC. We are always pleased to receive enquiries for special or unique process safety requirements for which our designers will likely have a ready design solution.

## SERVICES

SFC are geared to provide total turn-key services to clients from initial consultation through site survey, design and manufacturing to installation & commissioning.

We also offer and recommend on-site training to field operations groups and maintenance crews. A number of training aids are available including video, CD and sample hardware kits. Custom-made training packages and aids are also available to suit client's unique needs.

The company operates internationally through a network of associated companies and distributors/agents.

Founded in 1985, SFC has a comprehensive track record of successful installations for most of the leading international operating companies in all five continents.

### ASSOCIATED COMPANIES

#### **CASTELL INTERLOCKS INC.**

P.O. Box 18485  
21 Kenton Lands Road  
Erfanger,  
Kentucky 41018,  
U.S.A.

Tel. +1 606 341 3075  
Fax: +1 606 341 2302

#### **CEF SAFETY SYSTEMS B.V.**

Deltaweg 69  
2289 Rijswijk  
The Netherlands

Tel. +31 (0)70 3192 129  
Fax: +31 (0)70 3192 128

#### **FORTRESS SECURITY PTY. LTD.**

4 Jarrah Drive  
Braeside  
Victoria 3185  
Australia

Tel. +61 (0)3 9587 4699  
Fax: +61 (0)3 9587 4130

#### **HALMA ASIA PTE LTD.**

54 Genting Lane,  
# 05-02 Hwang Kio Corridor II  
Singapore 349562  
Tel. +65 745 2835  
Fax: +65 745 0467

#### **SERV TRAYVOU INTERVERROUILLAGE S.A.**

56-58 Rue Brulefer  
93106 Montreuil Cedex  
France

Tel. +33 (0)1 48 59 43 31  
Fax: +33 (0)1 48 59 58 50



## ACCREDITATIONS

TUV Product Services GmbH  
Tübingen/Regensburg  
Helmstraße 31  
D-72074 Tübingen

Formular 001/0-01/0-02 2/16  
Revised: 9-01-01/0-01/0-02

**TUV**  
PRODUCT SERVICE

# Zeichen- Genehmigungs-Ausweis Test Mark Award Certificate

Nr.  
No.

93 05 18999 501

Zeichnung des Antragstellers  
Drawing of Applicant

Antragsteller  
Applicant

Zeichnung  
Drawing

Das Produkt  
The Item

Special Plans Control Ltd., (PVT. Ltd.)

Die Ware ist  
The Item is

a Wirewound Resistor, 100k, 1/4W, 5% Tol.

ist  
is

ein Produkt, das unter besonderen Umständen und unter besonderen Bedingungen  
TUV Product Services GmbH für seine Zulassung

genehmigt ist. Nach der Zulassung ist es

a product which has been approved under special conditions and under special conditions  
TUV Product Services GmbH as shown on this page

Es ist nicht zulässig, das Produkt ohne die Zulassung zu verwenden.

Antragsteller  
Applicant

100k

Genehmigt nach  
Approved in accordance with

TUV PS PG 23/04 11.92 PP

Genehmigung des Generals  
Approval of the General

Genehmigung des Generals  
Approval of the General

Typen

Typen

GLA  
GLB  
GLC  
GLD  
GLE  
GLF

Zeichnung


Zeichnung

Zeichnung

## PETANS LIMITED

REGISTERED IN ENGLAND ON 11/01/01

COMBINED OFFSHORE SURVIVAL & FIRE FIGHTING REFRESHER



This is to Certify that

DAVID L. JONES


has attended a

Combined Offshore Survival & Fire Fighting

**PETANS LIMITED**

INCORPORATED IN ENGLAND ON 17TH FEBRUARY 1908

COMBINED OFFSHORE SURVIVAL & FIRE FIGHTING REFRESHER




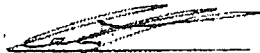
This is to Certify that


SERGEANT J. PIERCE  
has attended a  
*Combined Offshore Survival & Fire Fighting Refresher Course*  
Includes R.T.T.T.  
Duration Three Days


Approved by the Petroleum Training Institution (P.T.I.)

Held at the Marine Station, Harland and Wolff Dock, Liverpool from 22nd APRIL 1994

  
For Hargrave International

  
The Marine Ltd  
R.T.C. Dept. R.T.T., A.A.S.  
Commercial Manager

 1994

  
Lloyd's Register  
Quality Assurance

CERTIFICATE OF APPROVAL

To certify that the Quality Management System of:

**Smith Flow Control Ltd**  
**Witham, Essex, U.K.**

is certified by Lloyd's Register Quality Assurance  
against Quality Management System Standards:

**BS EN ISO 9001:1994**  
**EN ISO 9001:1994**  
**ISO 9001:1994**

by Management System as applicable to:

**structure of SFC, Ellis and Capstall type safety**  
**or fitting on to host equipment, including**  
**or fit standard locks to valves and doors.**

Original Approval	1st December 1993
Current Certificate	1st December 1996
Certificate Lapse	30th November 1999

M. A. R. Smith  
on behalf of LRQA

By maintaining its systems to the national standards issued solely for customers to LRQA

**SFC are totally committed to Quality Management in product quality and personnel capability.**

The company secured ISO 9001 accreditation at its first assessment by Lloyds Register in December 1993 and has retained its accreditation in all subsequent bi-annual reviews.

The SFC product range has also secured TÜV approval and SFC as a company is otherwise endorsed by most of the international major operating companies as 'approved vendors'.

Training is a central part of the management culture at SFC and all site technicians hold valid 'Survival & Fire Fighting' qualifications and are medically fit to UKCOA standards (minimum).

The company also has a dedicated R&D operation with ring-fenced resources working to maintain the company's position as innovators and leaders in all the significant developments in this field for the past decade.





S.E.R.V. TRAYVOU INTERVERROUILLAGE S.A.

56-58, rue Brulefer 93106 Montreuil Cedex - FRANCE

TÉL. : 01 48 18 15 15 FAX : 01 48 59 68 50

— A —  
HALMA  
GROUP  
COMPANY

HALMA  
GROUP  
COMPANY

**NOTICE DE MONTAGE**  
**INSTALLATION MANUAL**

**TYPE MGL ET BGL  
VANNES A VOLANT MULTI-TOURS  
OU A REDUCTEUR  
SERIE SFC**

**SERV TRAYVOU INTERVERROUILLAGE**

Cette notice de montage a pour objet les vannes à volant multi-tours ou à réducteur.

Obtenir l'autorisation de travail et s'assurer que les vannes peuvent être manoeuvrées.

Assurer vous que la vanne à verrouiller possède bien le même repère que la serrure devant être installée sur celle-ci

Vérifier que la séquence de manoeuvre est correcte.

Pour les serrures à une entrée de clé le réglage ne s'effectue que dans une seule position.

Selon les conditions d'exploitation, il peut être souhaitable de verrouiller la vanne dans des positions intermédiaires; ces serrures permettent cette opération.

## **SOMMAIRE**

**Montage des serrures**

**Reglage des serrures déjà en service**

**Demontage des serrures**

## MONTAGE DES SERRURES

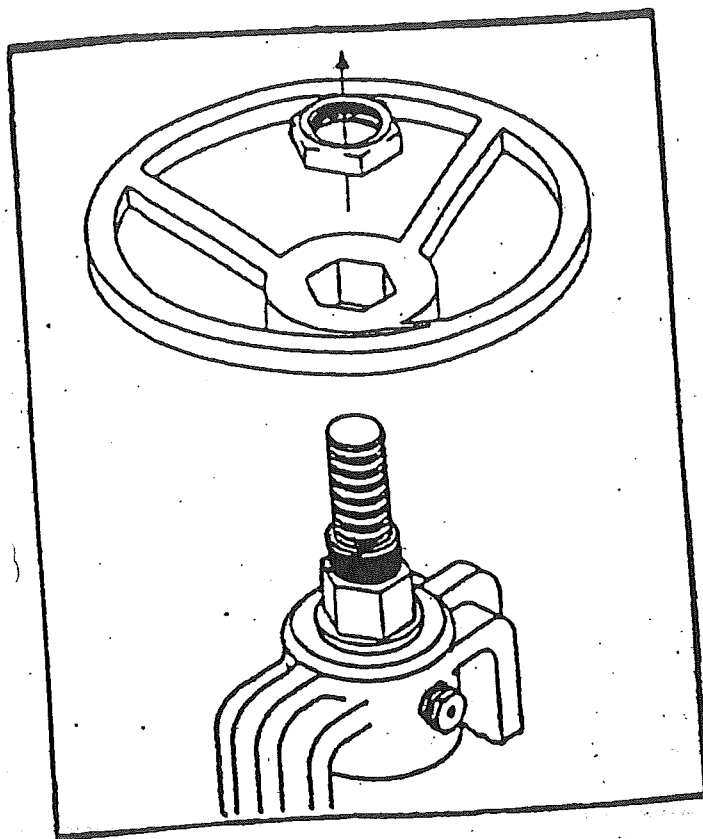


Fig 1. Déposer le volant existant.

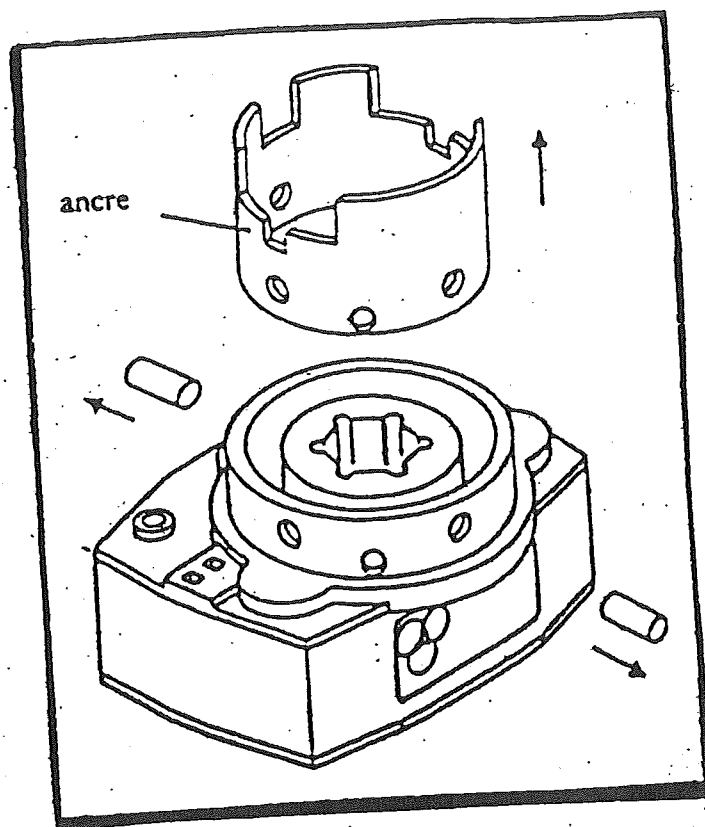


Fig 2. Désaccoupler la pièce définie "ancre" en enlevant les goujons provisoires.

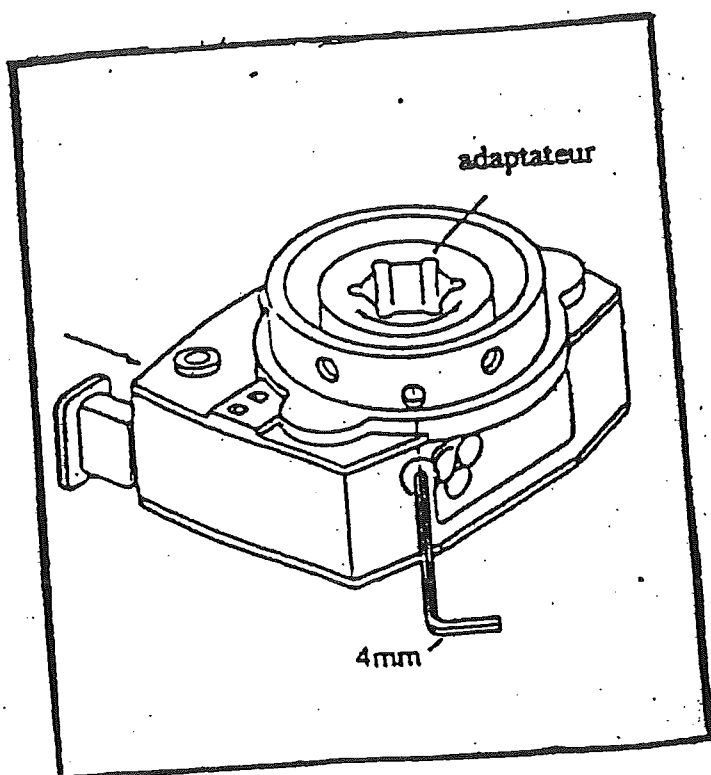


Fig 3. Avec les deux clés engagées dans la serrure tourner l'adaptateur et avec la clé 6 pans de 4mm desserrer complètement les vis.

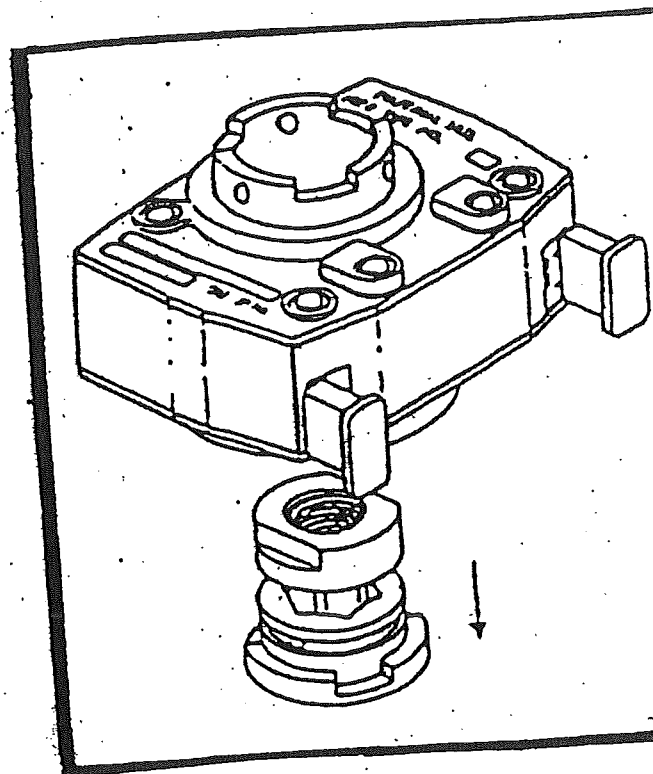


Fig 4. Déboîter l'adaptateur de la serrure.

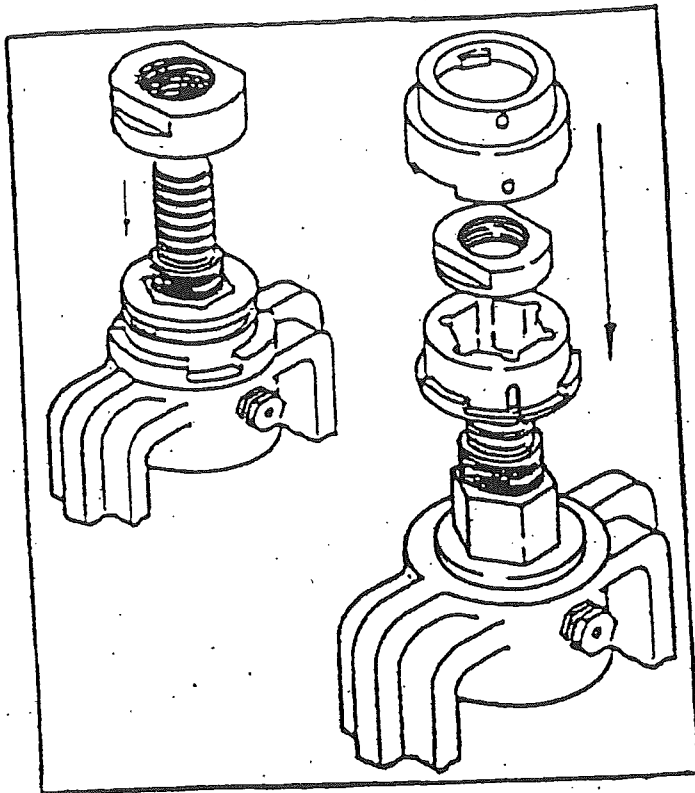


Fig 5. Monter l'adaptateur sur la tête de vanne en lieu et place du volant avec son écrou de serrage.  
Lors du montage, coller avec de la loctite frein filet faible.

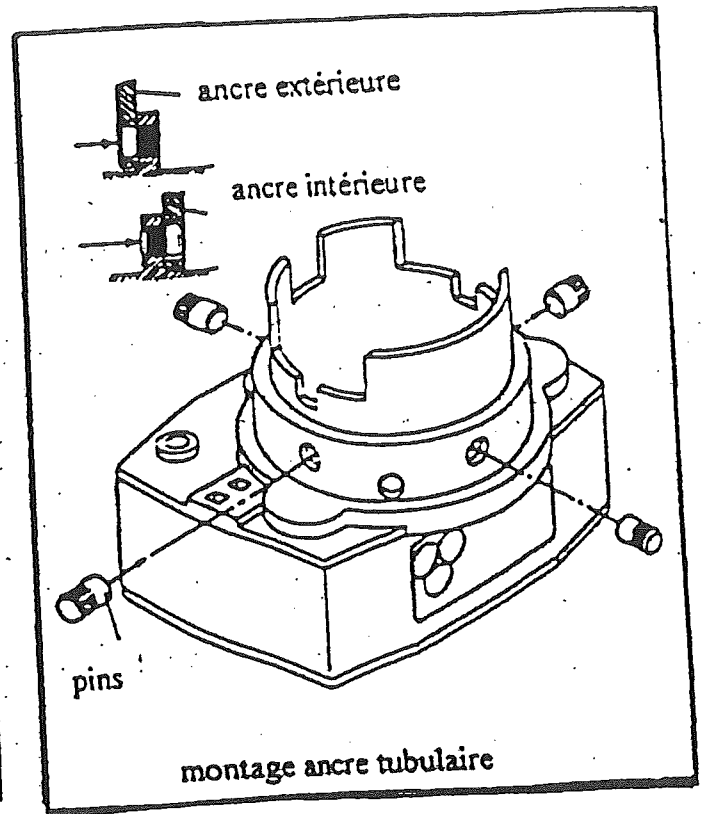


Fig 6. Emboîter l'ancre sur la serrure en fonction de la position souhaitée des entrées de clé.

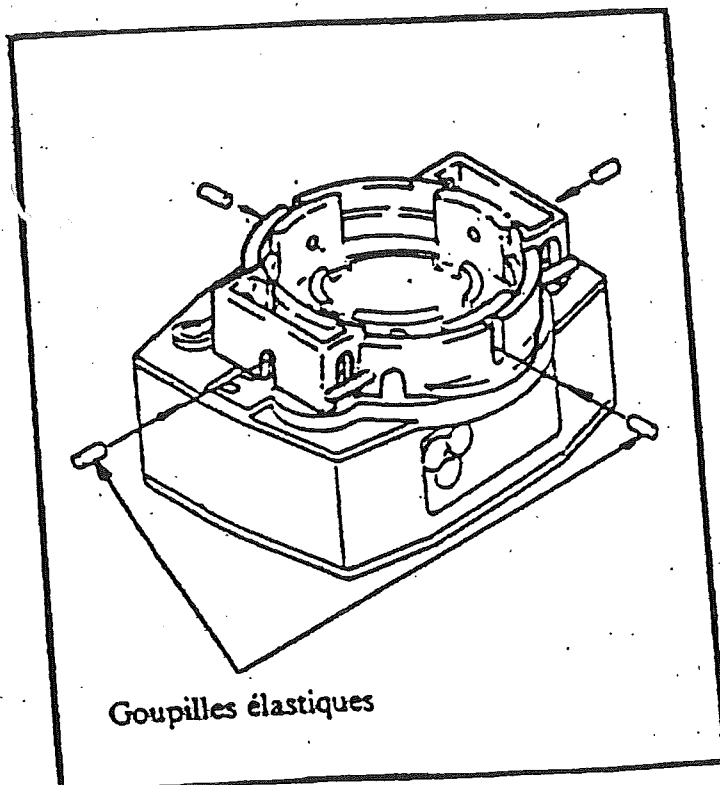


Fig 6b. Montage ancre universelle.

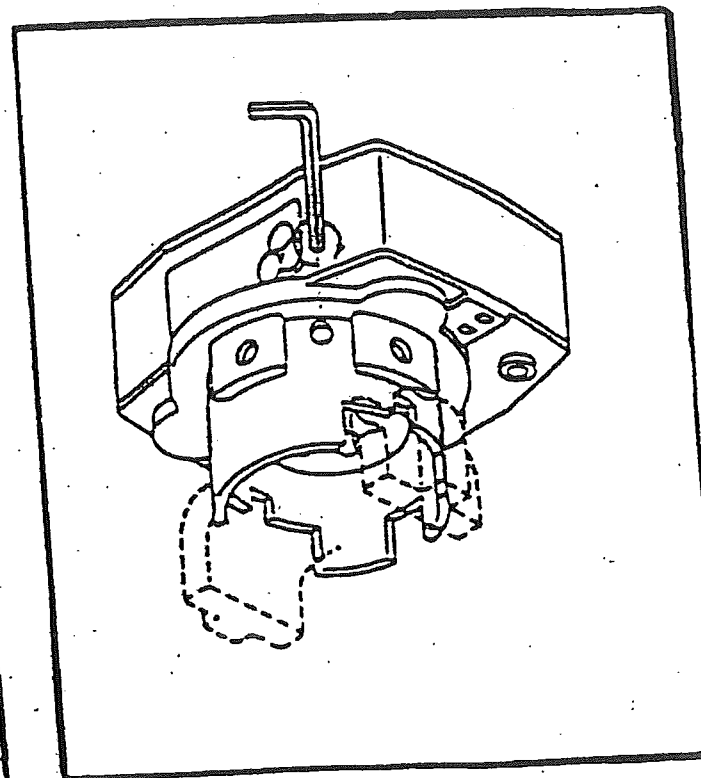


Fig 7. Emboîter la serrure sur l'adaptateur s'assurer que les vis 'BTR' les plus longues correspondent aux trous les plus profonds, serrer les vis 'BTR' en manoeuvrant la vanne d'un tour, cette opération peut nécessiter le



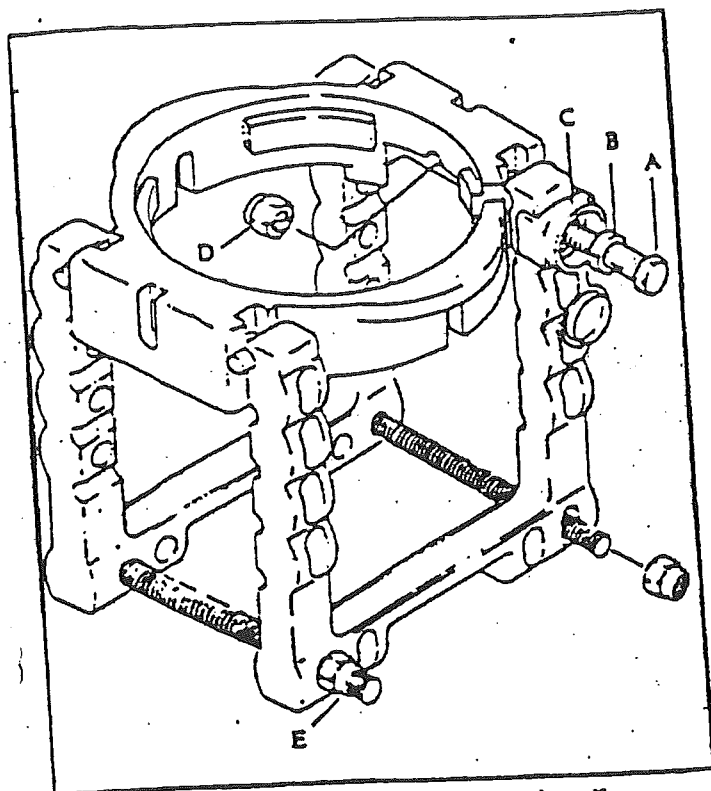


Fig 8. Si l'ancre universelle est fournie, aligner les crampons avec la serrure et la vanne afin de s'assurer qu'il n'y a pas d'obstructions (si c'est le cas, ajuster en coupant les crampons à la taille voulue).

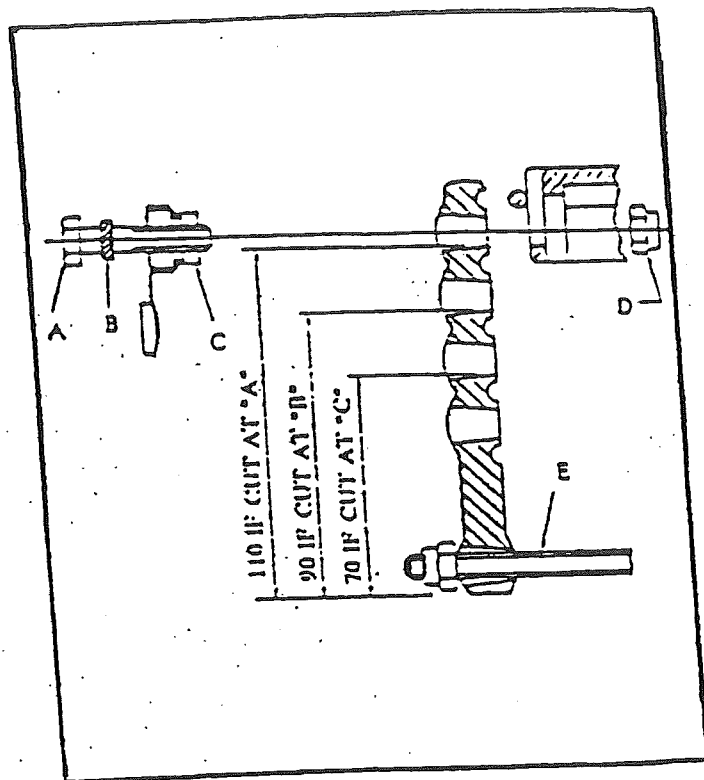


Fig 9. Fixer les crampons à la serrure en introduisant la vis 'A', la rondelle 'B', et le cache 'C', à travers le crampon et le collier de serrage et visser à fond l'écrou 'D', jusqu'à ce que les crampons soient serrés contre le corps de la vanne. Tiges filetées et écrous freins 'E', sont fournis pour ancrage supplémentaire si besoin.

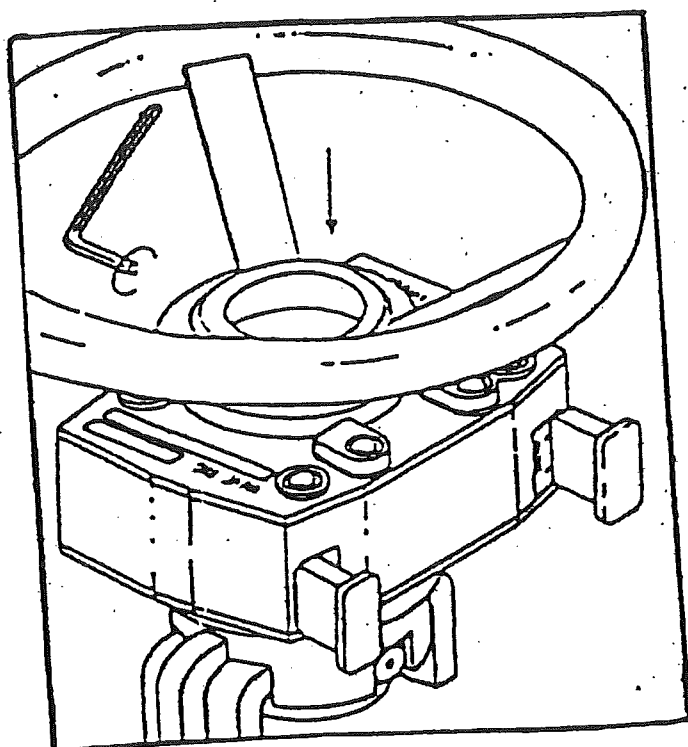


Fig 10. Fixer le volant sur la serrure.

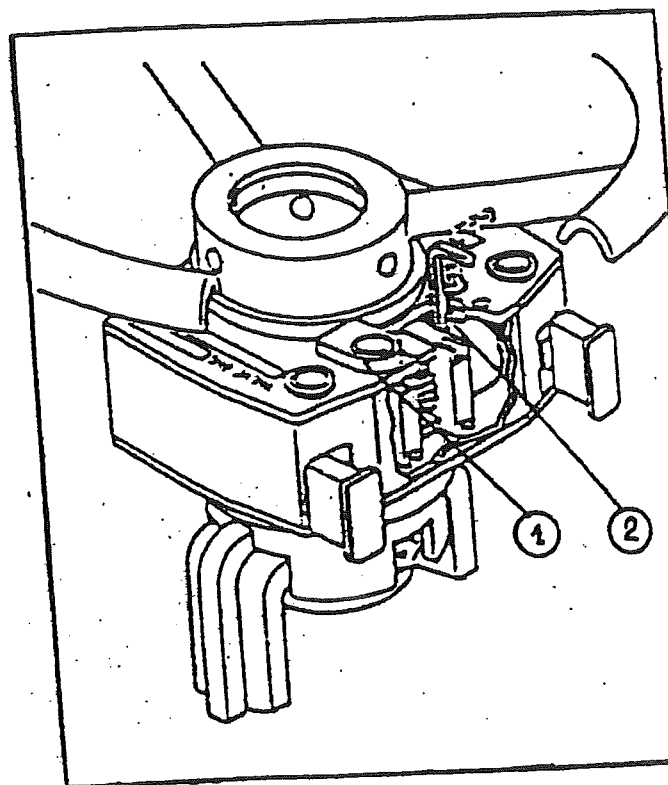
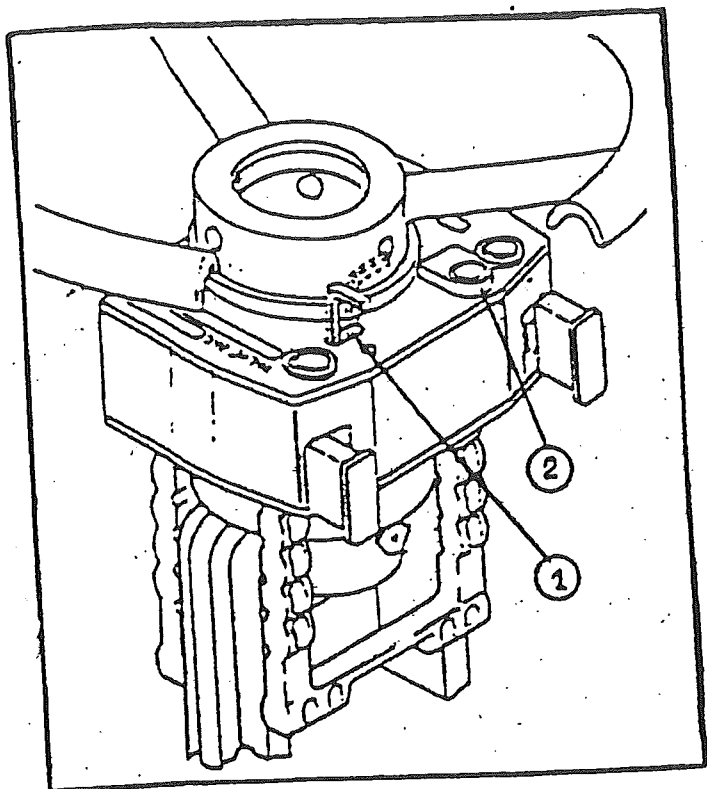
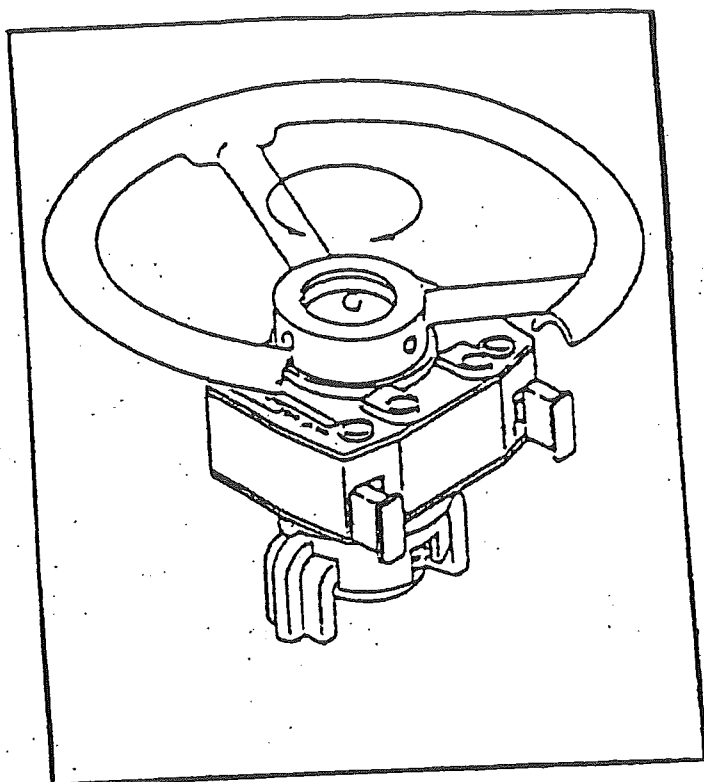


Fig 11. Reglage de la position de libération de clé vanne ouverte. (clé de droite)

Ouvrir complètement la vanne, ouvrir le cache de droite 2 donnant accès aux 2



**Fig 12. Reglage de la position de libération de clé vanne fermée. (clé de gauche)**  
 Fermer complètement la vanne, ouvrir le cache de gauche 1 donnant accès aux 2 vis, refermer le cache 1.



**Fig 13. Vérifier le fonctionnement de la serrure.**

## REMARQUES IMPORTANTES

Les serrures sont libérées avec clé(s) libre(s) dans toutes les positions. Il est donc, nécessaire de respecter scrupuleusement les procédures des figures 10 et 11 et 12.

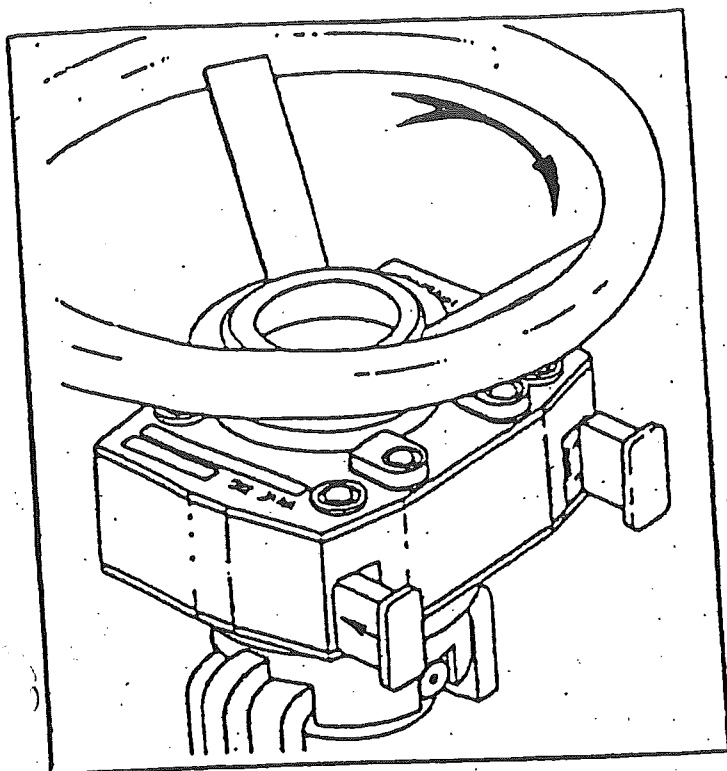
Pour les serrures à une entrée de clé, le réglage ne s'effectue que dans une seule position (Fig 10 ou 11 ou 12).

Dans certains cas, il peut être souhaitable de verrouiller la vanne dans des positions intermédiaires; ces serrures permettent cette opération selon les conditions d'exploitations.

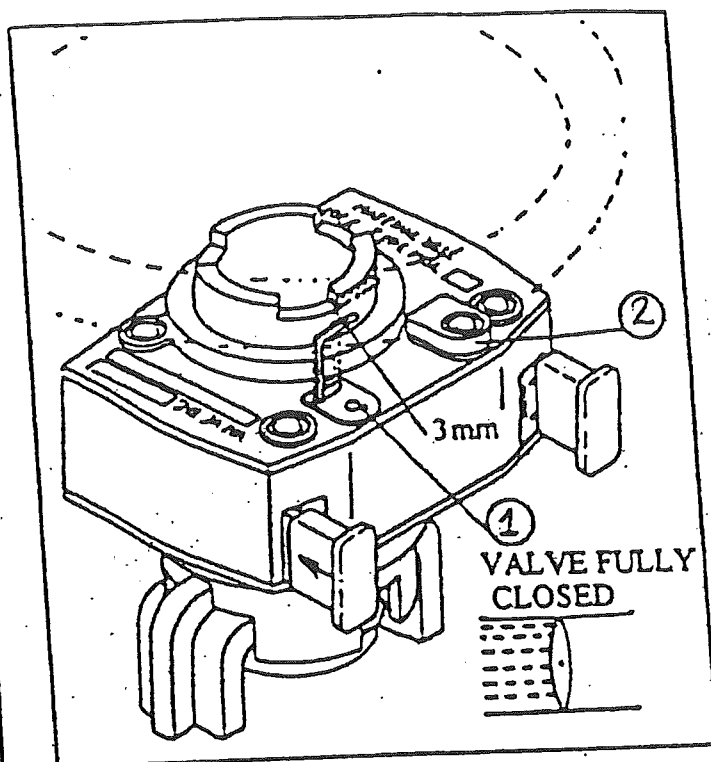
## VERIFICATION DU FONCTIONNEMENT

Insérer la clé libre dans la serrure et s'assurer que la clé de droite ne se libère que lorsque la vanne est entièrement ouverte et que la clé de gauche ne se libère que lorsque la vanne est entièrement fermée.

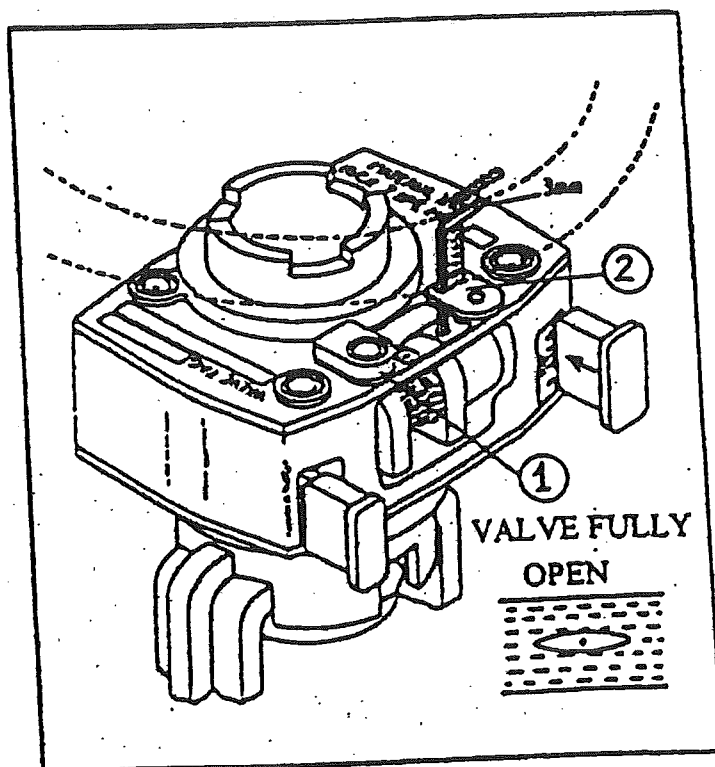
## REGLAGE DES SERRURES DEJA EN SERVICE



**Fig 1. REGLAGE DE LA POSITION CLE LIBRE VANNE VERROUILLEE FERMEE**  
Introduire la clé manquante afin de déverrouiller la serrure. Se mettre en position clé libre (gauche) vanne verrouillée fermée.



**Fig 2. Ouvrir le cache de gauche (rep 1).** donnant accès à la vis pointeau (clé 6 pans mâle de 3mm); la desserrer de 1,5 tour maximum. Refermer la vanne en position de fermeture absolue en manoeuvrant le volant de la serrure.  
Resserrer la vis pointeau et refermer le cache (voir vue éclatée serrure SFC).



**Fig 3. REGLAGE DE LA POSITION CLE LIBRE VANNE VERROUILLEE OUVERTE.**  
Introduire la clé manquante afin de déverrouiller la serrure. Se mettre en position clé libre (droite) vanne verrouillée ouverte. Effectuer le réglage défini dans Fig 2 en ouvrant complètement la vanne. Mais sous le cache de droite (rep.2).

## DEMONTAGE DES SERRURES

## A) DEREGLAGE DE LA POSITION DE LIBERATION DE CLE

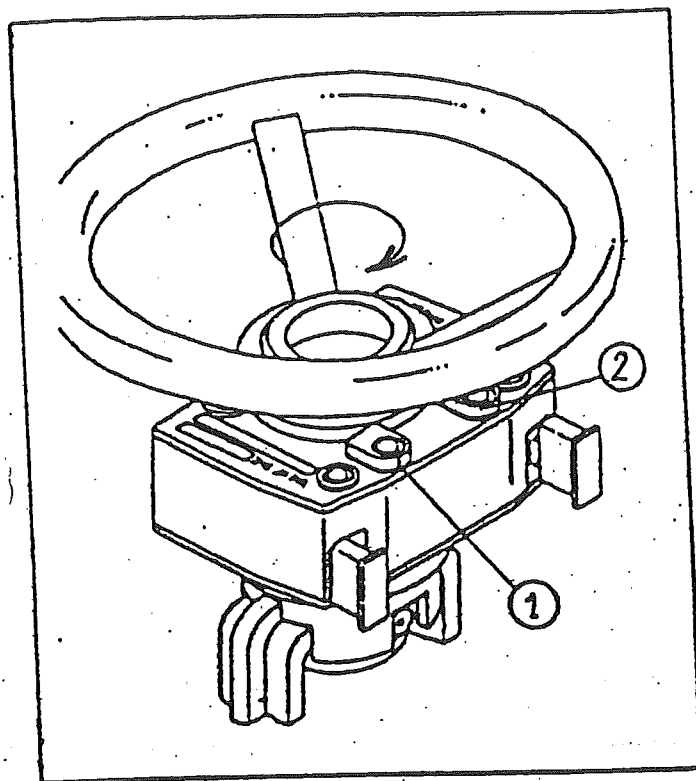


Fig 1. Mettre en position clé libre vanne verrouillée fermée (clé gauche).  
Ouvrir le cache de gauche REP 1.  
Desserrer de 1.5 tour maxi la vise pointeau (clé alène de 3mm).  
Refermer le cache.

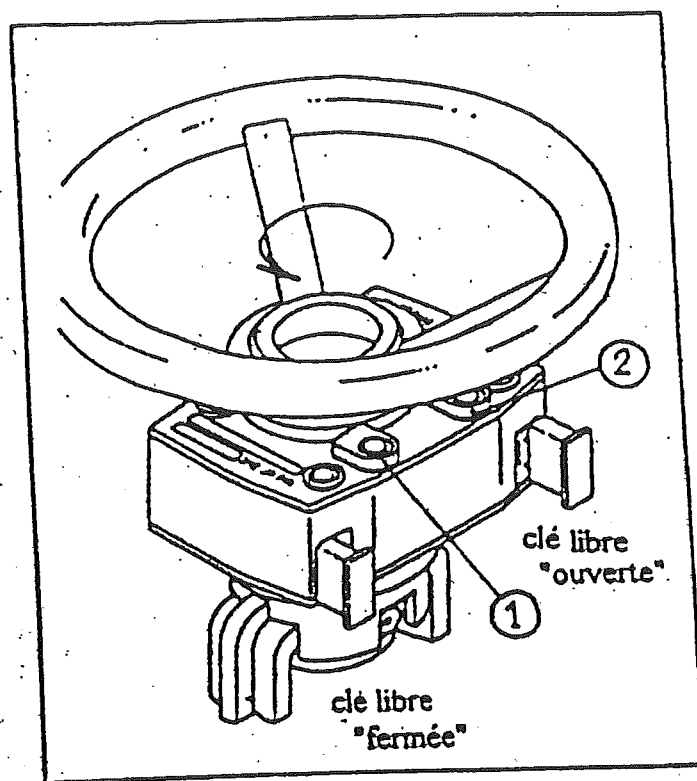
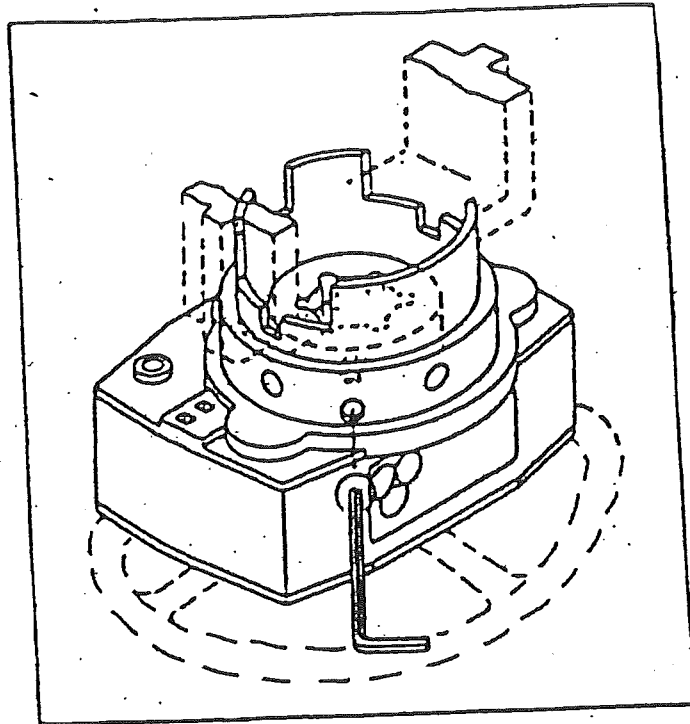


Fig 2. Mettre en position clé libre vanne verrouillée ouverte (clé droite)  
Ouvrir le cache de droite REP 2.  
Desserrer de 1.5 tour maxi la vise pointeau.  
Refermer le cache.

LES 2 CLES SONT MAINTENANT LIBRES QUELQUE SOIT LA POSITION DE LA VANNE.

## B) DEMONTAGE DE LA SERRURE



- 1) A l'aide d'une clé 6 pans alène de 4mm desserrer la vis pointeau qui fixe la serrure à l'adaptateur. Pour se faire un trou de visite est prévu sur la serrure. A l'aide du volant, aligner les vis une à une en face du trou pour les desserrer. (Eviter de les enlever complètement de leur logement.)
- 2) Tirer la serrure à l'aide du volant. La vanne est maintenant dépourvue de serrure.

Pour le remontage voir chapitre montage de la serrure.

## C) REMONTAGE DE LA SERRURE

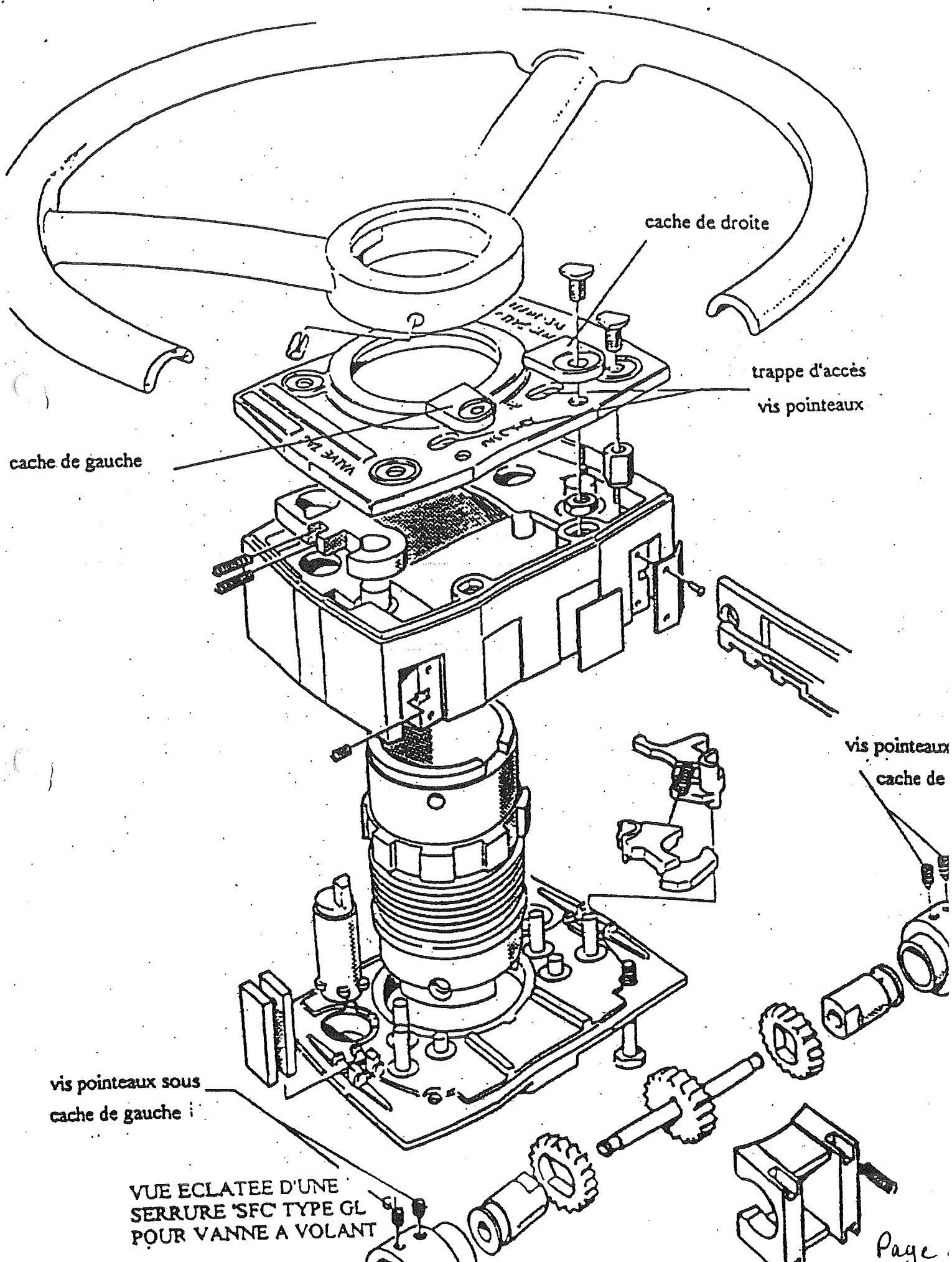
Sur la même vanne : faire les opérations en sens inverse.

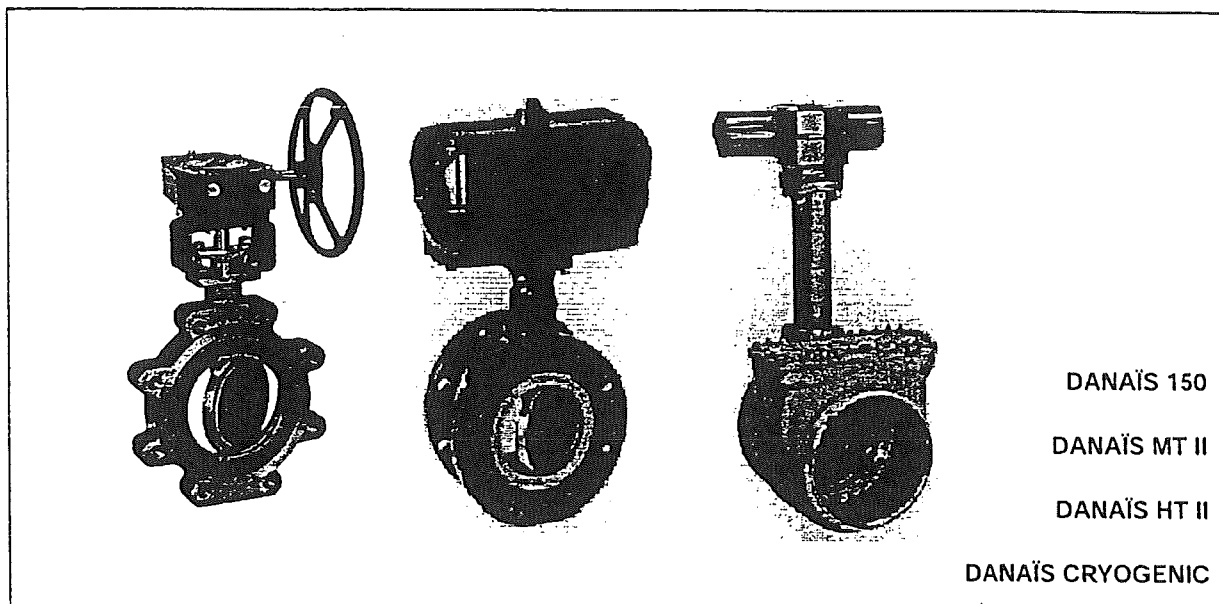
Sur une vanne neuve : se reporter § 1 au début de la notice.

Pour le remontage de la serrure sur une vanne neuve, se reporter § 1 au début de la notice.

PROCEDURE DE DEMONTAGE : Il faut impérativement que les deux clés soient dans la serrure.







1. Declaration of conformity.....	2
2. General.....	3
3. Safety.....	3
4. Transport and interim storage.....	4
5. Description of valves.....	5
6. Installation.....	8
7. Commissioning / Decommissioning.....	12
8. Maintenance / Repair.....	12
9. Trouble shooting.....	13

CE

## 1. Declaration of conformity

Hereby we,

KSB S.A.S.  
Zone industrielle Gagnaire Fonsèche  
24490 LA ROCHE CHALAIS  
Registered Office: 92635 - Gennevilliers  
France

declare that the valves listed below comply:

- with the requirements of the Pressure Equipment Directive 97/23/EC.

Description of the valve types:

<b>Butterfly valves</b>		
- DANAIS MT II	class 150	DN 50-1650
-	PN 25	DN 50-600
-	class 300	DN 50-600
-	class 600	DN 100-900
- DANAIS HT II	class 150	DN 50-600
-	PN 25	DN 50-600
-	class 300	DN 50-600
- DANAIS 150	PN 25	DN 50-600
- DANAIS Cryogenic	class 150	DN 50-2000
Wafer, Lug,	class 300	DN 50-1500
Flanged	class 600	DN 100-120
- DANAIS Cryogenic	class 150	DN 150-1200
Buttweld		

As per harmonized European standards:  
and other standards / directives:

EN 10213-2; EN 10213-4

Suitable for:

Fluids group 1 and 2

Conformity Assessment Procedure:

Module H

Name and address of the authorizing and  
monitoring notified body:

Lloyd's Register Verification Limited  
71 Fenchurch Street,  
London  
EC3M 4BS  
England

Number of notified body:

0038

Number of Certificate:

RPS 0160325/01

- with the requirements AD 2000 - AD A4.

Description of the valve types:

<b>Butterfly valves</b>		
- DANAIS MT II	class 150	DN 50-600
-	PN 25	DN 50-600
-	class 300	DN 50-600
- DANAIS 150	PN 25	DN 50-600

As standards:

AD 2000

Name and address of the inspection body:

TÜV Rheinland France  
6, rue Halévy  
75009 Paris  
France

Number of certificate:

AF 03.00126

Michel Delobel

rev.5 - 03/05

Quality Assurance

(This document was prepared electronically and is valid without signature)

## 2. General

These operating instructions apply to KSB offset disc butterfly valves (see section 5).

Design, manufacturing and testing of the KSB valves are subject to a Quality Assurance System according to EN ISO 9001 and to the European Pressure Equipment Directive 97/23/EC (PED).

Correct installation and maintenance or repair are mandatory to ensure trouble free operation of the valves.

The manufacturer cannot be made liable for these valves if operating instructions are not being observed.

**ATTENTION** The valves must not be operated beyond the limits defined in the operating instructions/contractual documentation/type leaflet. Any use beyond the above conditions will lead to overload which the valves cannot withstand.



Nonobservance of this warning may lead to personal injury or property damage, e.g.:

- Injury caused by escaping fluids (cold/hot, toxic, flammable, corrosive or under pressure)
- Incorrect operation or destruction of the valve.

The descriptions and instructions in this manual refer to the standard versions but also apply to the related variants.

These operating instructions do not take into consideration:

- incidents which may occur during installation, operation and maintenance.
- the local safety regulations. It is the user's responsibility to ensure that these are also observed by the installation staff involved.

For actuated valves, the specified connection parameters and the installation and maintenance instructions - including the operating manual for the actuator - must be observed.

**ATTENTION** Handling a valve requires skilled and experienced personnel.

The personnel in charge of operation, maintenance and installation of this valve must be aware of the interaction between the valve and the plant.

Operator's errors concerning the valve may have serious consequences for the entire plant, e.g.:

- fluid may escape
- downtime of the plant/machine
- adverse effect/reduction/increase of the efficiency/function of a plant/machine.

For further questions or in case of damage to the valve, please contact your KSB Sales Office.

For further questions and supplementary orders, especially when ordering spare parts, please always state the indications of the marking plate.

The specifications (operating data) of the valves are listed in the technical documentation & type leaflet of the related valve (see also section 5).

When returning valves to the manufacturer, please refer to section 4.

## 3. Safety

This manual contains basic instructions to be complied with during operation and maintenance. It is therefore vital for the fitter and the operator/user to read this manual before installing/commissioning the valve. Also, this manual must always be available at the site where the valve is installed.

It is not enough to observe the general instructions listed in the section "safety", the specific safety instructions listed in the other sections should also be observed.

## 3.1. Safety Symbols in these Operating Instructions

Safety instructions put forth in this instruction manual, the nonobservance of which would involve the risk of personal injury, they are specially marked with the general hazard symbol:



in accordance with ISO 3864-B.3.1.  
or with the electric voltage warning sign:



In accordance with ISO 3864-B.3.6.

Safety instructions the nonobservance of which would involve hazard to the valve and jeopardize its operation have been marked with the word

**ATTENTION**

Instructions directly attached to the valve, (e.g. nominal pressure) must be complied with and maintained in a legible condition.

## 3.2. Qualification and training of personnel

The personnel for operation, maintenance, inspection and installation must be adequately qualified for the work involved. The personnel responsibility, competence and supervision must be clearly defined by the user. If the personnel in question is not already in possession of the required know-how, appropriate training and instructions must be provided. If deemed necessary, the manufacturer/supplier will provide such training and instructions at the user's request. In addition, the user is responsible for ensuring that the contents of these operating instructions are fully understood by the personnel involved.

## 3.3. Danger or nonobservance of the safety instructions

Nonobservance of the safety instructions may lead to personal injury and danger for both the environment and the valve itself. Nonobservance of these safety instructions will also forfeit the user's warranty.

Such noncompliance could result in for example:

- failure of essential functions of the valve/plant
- failure of prescribed maintenance and repair practices
- hazard to people by electrical, mechanical or chemical effects
- hazard to the environment due to leakage of hazardous substances

## 3.4. Safety Consciousness

The safety instructions contained in this manual, the applicable national accident prevention regulations and any of the user's own applicable internal work, operation or safety instructions must be fully complied with.

## 3.5. Safety Instructions for the User/Operator

Any hot or cold parts of the valve (e.g. body or handle or actuator) that could cause a hazard must be protected by the user against accidental contact.

Leakage of hazardous substance (e.g. flammable, corrosive, toxic, hot) must be drained so as to avoid all danger to people or the environment. All relevant laws must be observed.



Electrical hazards must be effectively prevented. (For details, please refer to the IEC 364 or equivalent national standard and/or local utility energy supply regulations).

### 3.6. Safety Instructions for Maintenance, Inspection and Installation work

#### 3.6.1. General

The user is responsible for ensuring that all maintenance, inspection and installation work is carried out by authorized, adequately qualified staff who are thoroughly familiar with this instruction manual.

Any work on a valve may only be performed when the valve is un-pressurized and has cooled down to 60 °C or has warmed up to 0 °C.

Any work on actuated valves may only be done after that the actuator has been disconnected from its energy supply.

The procedure described in the operating instructions to shut down the actuator must be observed. Valves in contact with hazardous media must be decontaminated. Immediately following completion of the work, all safety relevant and protective devices must be reinstalled and/or re-enabled. Prior to recommissioning, refer to the points listed under section 7 Commissioning.

#### 3.6.2. End of line installation

Use as end of line and downstream dismantling at ambient temperature of standard range:

Valves Type 1 (annular shape): use as end of line and downstream dismantling are not authorized.

Valves Type 4 (lug) and Type 7 (flanged): use as end of line and downstream dismantling are authorized, but for DANAIS 150, subject to cares explained at chapter 6.1.

Valves		Gas or liquids		Liquids	
		Hazardous	Non hazardous	Hazardous	Non hazardous
DANAIS MTII DANAIS HT	Class 150	All sizes: not authorized	All sizes: $\Delta PS = 15$ bar max.	All sizes: $\Delta PS = 15$ bar max.	All sizes: $\Delta PS = 15$ bar max.
	PN 25	All sizes: not authorized	All sizes: $\Delta PS = 19$ bar max.	All sizes: $\Delta PS = 19$ bar max.	All sizes: $\Delta PS = 19$ bar max.
	Class 400	All sizes: not authorized	All sizes: $\Delta PS = 38$ bar max.	All sizes: $\Delta PS = 38$ bar max.	All sizes: $\Delta PS = 38$ bar max.
DANAIS 150 DANAIS 150 DANAIS 150	PN 25	All sizes: not authorized	All sizes: $\Delta PS = 15$ bar max.	All sizes: $\Delta PS = 15$ bar max.	All sizes: $\Delta PS = 15$ bar max.
	Class 150	All sizes: not authorized	All sizes: $\Delta PS = 15$ bar max.	All sizes: $\Delta PS = 15$ bar max.	All sizes: $\Delta PS = 15$ bar max.
	Class 400	All sizes: not authorized	All sizes: $\Delta PS = 38$ bar max.	All sizes: $\Delta PS = 38$ bar max.	All sizes: $\Delta PS = 38$ bar max.
DANAIS DANAIS DANAIS	Class 150	All sizes: not authorized	All sizes: not authorized	All sizes: not authorized	All sizes: not authorized
	Class 400	All sizes: not authorized	All sizes: not authorized	All sizes: not authorized	All sizes: not authorized
	Class 600	All sizes: not authorized	All sizes: not authorized	All sizes: not authorized	All sizes: not authorized
DANAIS DANAIS DANAIS	Class 150	All sizes: not authorized	non applicable	non applicable	All sizes: $\Delta PS = 10$ bar max.
	Class 400	All sizes: not authorized	non applicable	non applicable	All sizes: $\Delta PS = 10$ bar max.
	Class 600	All sizes: not authorized	non applicable	non applicable	All sizes: $\Delta PS = 10$ bar max.

$\Delta PS$ : Differential pressure

\* Liquids whose vapour pressure at the maximum allowable temperature is greater than 0.5 bar above normal atmospheric pressure (1013 mbar)

\*\* When shaft material is 316L,  $\Delta PS$  is reduced to 10 bar max.

NB: A valve fitted at the end of a pipe with a blind flange downstream is not to be considered as an end of pipe service.

#### 3.7. Unauthorized Modification and Manufacturing of Spare Parts

The equipment shall not be altered or modified in any way prior to consultation with the manufacturer. Genuine spare parts and accessories authorized by the manufacturer will ensure operational safety. The manufacturer cannot be held responsible for damage resulting from the use of non-genuine parts or accessories.

#### 3.8. Inadmissible Modes of Operation

Operational safety and reliability of the valve supplied is only warranted for its designated use as defined in section 2

"General"

of the operating instructions. The limits stated in the technical documentation must not be exceeded under any circumstances.

### 4. Transport and Interim Storage

#### 4.1. Transport

The valves in the as-supplied condition are ready for operation.

**ATTENTION** For transport and storage, the valves must always be maintained in the semi-closed position and be packed in cardboard, crate or case with suitable protection (dessicant, thermowelded barrier).

**ATTENTION** To prevent damage, do not hang the valve by its handle or actuator. After delivery or prior to installation, the valve should be checked for damage during transit.

#### 4.2. Interim Storage

The valves must be stored in such a way that correct operation is assured even after prolonged storage.

This comprises: - Storing at 5° from the closed position

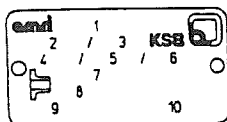
- Suitable measures against contamination, frost and corrosion (e.g. by using thermowelded plastic bags with dessicant, protection caps and plugs onto threaded holes).

## 5. Description of valves

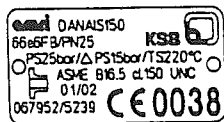
The sectional drawings shown hereafter are examples for the general design of our valves. For drawings and other information pertaining to a specific valve series, please refer to the relevant type leaflets and specific technical drawings.

### 5.1. Marking

The valves are marked to PED 97/23/EC.



Marking of the identity plate



Example

- 1 - Valve type model
- 2 - Internal material code
- 3 - Valve PN /Class designation
- 4 - Maximum allowable pressure
- 5 - Maximum allowable pressure at end of line or for downstream dismantling
- 6 - Maximum allowable temperature
- 7 - Pipe flange drilling pattern (if known)
- 8 - Month and year of production
- 9 - Equipment serial number
- 10 - CE marking with notified body identification number

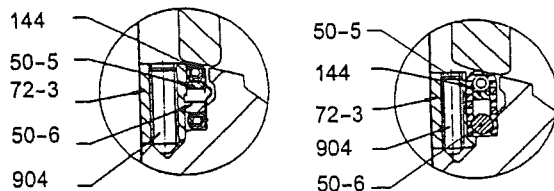
PS	50	65	80	100	125	150	≥200
10							
16							
25							
≥40							

Valves for hazardous liquids and gaz (group 1) according to table 6 of annex II (PED)

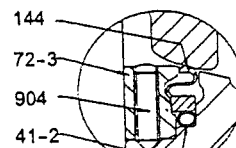
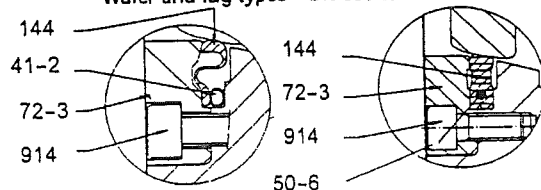
### 5.2. Drawings and documents

Type	Size (mm)	Type series bookplate no.
DANAIS MT II Class 150	50-600	8460.1
	650-1650	Specific technical drawing
DANAIS MT II Class 300	50-600	8461.1
DANAIS HT II Class 150	50-600	8460.1
DANAIS HT II Class 300	50-600	8461.1

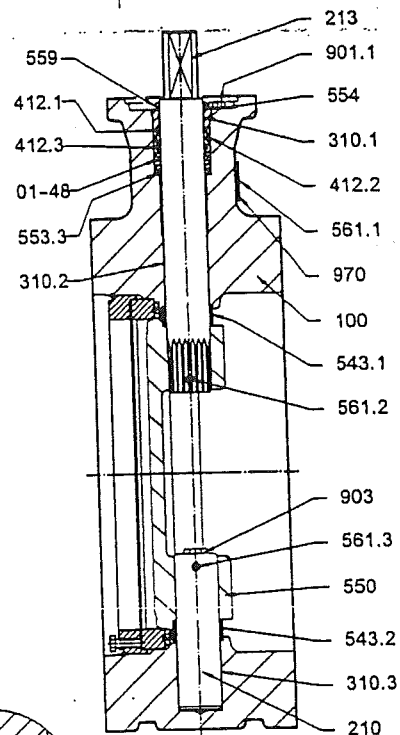
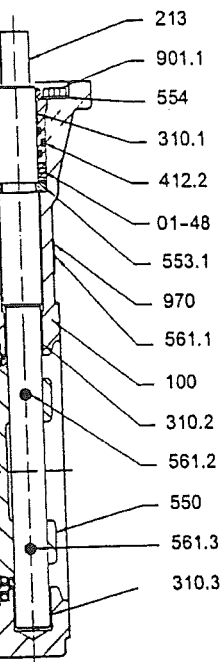
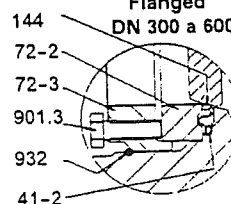
All types DN 50 to 250



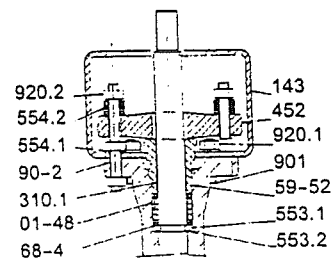
Wafer and lug types - DN 300 to 600



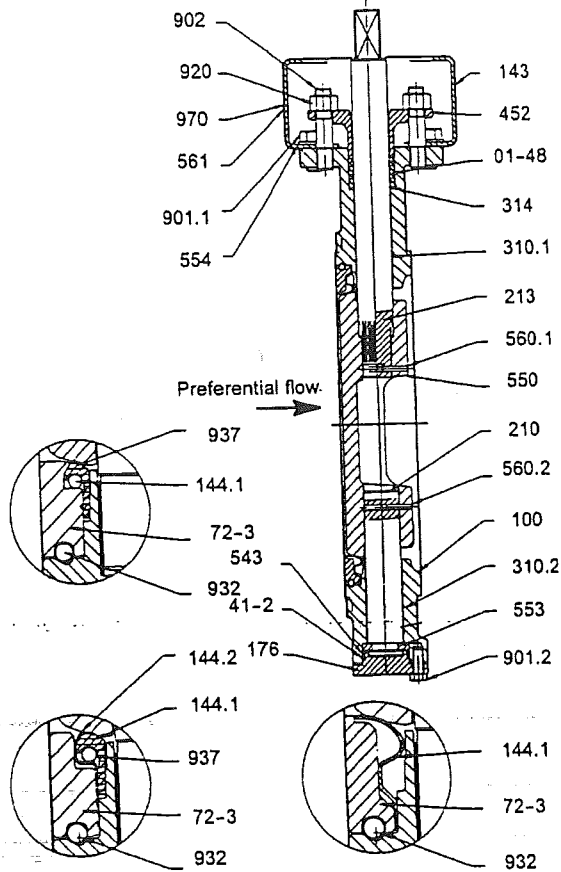
Flanged  
DN 300 a 600



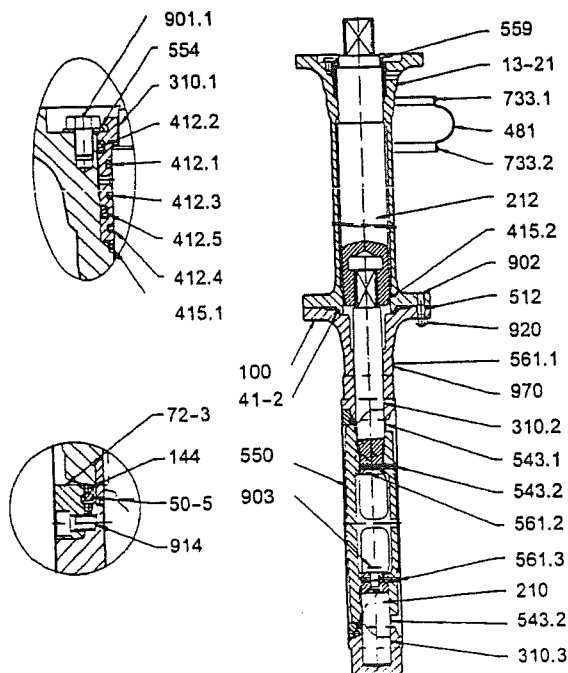
Version HT



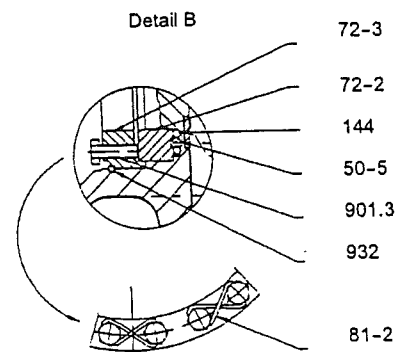
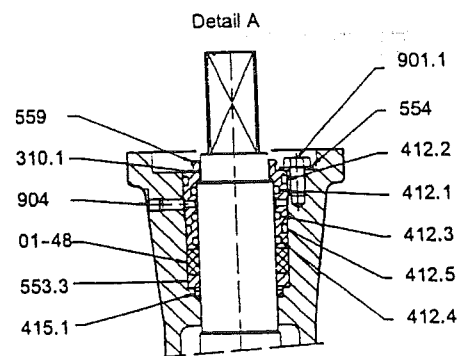
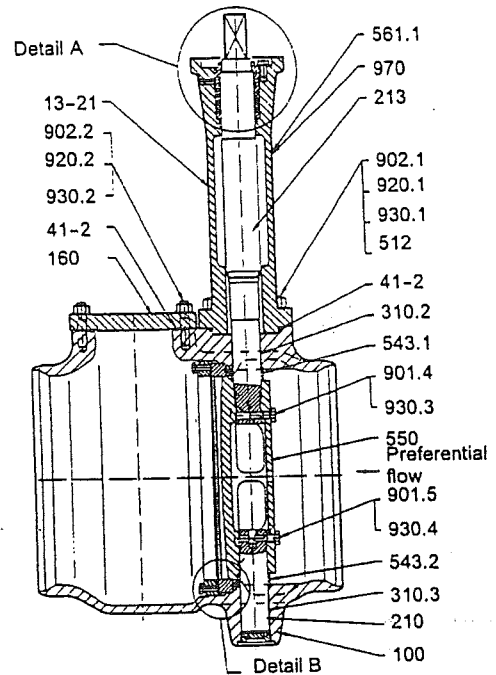
Type	Size (mm)	Type series booklet no.
DANAIS 150	50 - 600	8446.1



Type	Size (mm)	Type series booklet no.
DANAIS Cryogenic Wafer, Lug, Flanged	50 - 2000	Technical drawings



Type	Size (mm)	Type series booklet no.
DANAIS Cryogenic butt weld	150 - 1200	Specific technical drawing





### 5.3. List of Components

Part No.	Name of Parts
01-48	Fire-safe sealing packing
13-21	Extension
41-2	Static ring
50-5	Reaction ring
50-6	Tightening ring
59-52	Trigger
68-4	Foil
72-2	Centring flange
72-3	Tightening flange
81-2	Wire
100	Body
143	Yoke
144	Seat
144.1	Plastomer / Metallic seat
144.2	Fire safe seat
160	Cover
176	Bottom
210	Shaft
212	Intermediate shaft
213	Operating shaft
310.*	Plain bearing
314	Wedge
412.*	O-ring
415	Lip seal ring
452	Packing gland
481	Bellows
486	Ball
512	Adjusting ring
543.*	Spacer bush
550	Disc
553.*	Thrust
554	Plain washer
559	Gasket holder
560.*	Pin
561	Grooved nail
733	Clamp
900.*	Anti blow-out screw
901.*	Hexagon head screw
902	Stud
903	Threaded plug
904	Grub screw
914	Hexgon socket head screw
916	Plug
920.*	Hexagon nut
930	Retainer
932	Inner ring
937	Elastic wire
940.*	Key
970	Identity plate
*	Repetitive part

### 5.4. Functioning principle

#### Description

The valve consists mainly of a body (100), operating shaft (213), shaft (210), disc (550) and different types of seats (144).

**Disc-shaft connection:** The operating shaft (213) is connected to the disc (550) by grooved pins, splines or taper pins.

#### Stem seal area:

**MT II type:** realized by elastomer O-Ring (412) fitted into a gasket holder (559). Fire safety is achieved by a graphite packing (01-48) tightened by the gasket holder (559), screws (901.1) and washers (554).

**HT II type:** achieved by a graphite packing (01-48) compressed by the trigger (59-52) studs (902) and nuts (920).

**150 type:** realized by a sealing packing (01-48) tightened by a packing gland (452) studs (902) and nuts (920).

**Cryogenic type:** realized by elastomer O-Ring (412) fitted into a gasket holder (559). Fire safety is achieved by a graphite packing (01-48) tightened by the gasket holder (559), screws (901.1) and washers (554). Lip seal ring (415.1) tightened by the gasket holder (559), the sealing packing (01-48), screws (901.1) and washers (554).

#### Flow seal area:

**MT II, HT II and Cryogenic types:** the seat (144) is tightened in the body (100) by a tightening flange (72-2) which is maintained by radial screws (904) or axial screws (901).

**MT II and HT II flanged type:** the seat (144) is tightened in the body (100) by a tightening flange (72-2) which is maintained by radial screws (904) or axial screws (901).

**150 type:** the seat (144) is tightened in the body (100) by a tightening flange (72-2) which is held in place by the mounting between customer piping flanges.

#### Bonnet seal area:

**CRYOGENIC types:** It is made by a metallic seal (41-2) tightened by the extension (13-21), studs (902) and nuts (920).

The compression of the seating disc edge out of the seat is achieved by double eccentric kinematics.

The axis of the shafts and disc is offset to valve axis and eccentric to pipe axis.

**Operation:** The valves are quarter-turn operated manually by handles or gear box or hydraulic, pneumatic and electric actuators bolted on the valve top plate (as per ISO 5211 standard).

## 6. Installation

### 6.1. General

**ATTENTION** To avoid leakage, deformation or rupture of the body, the piping should be laid out in such a way that no thrust or bending forces act on the valve bodies (100) when they are installed and operational.

**ATTENTION** The sealing faces of the flanges must be clean and undamaged.



It is mandatory to add gaskets between body and piping flanges. To insert the valve between flanges, pull apart the two pipes flanges to obtain sufficient clearance between valves flanges and piping flanges. All holes provided in the flanges must be used for the flange connection (does not apply for butt-weld type valves).



If construction work is still in progress, non-mounted valves must be protected against dust, sand and building material etc. (cover with suitable means).

Do not use valve handles and gear handwheels as footholds!



Valves and pipes used for high ( $> 60^{\circ}\text{C}$ ) or low ( $< 0^{\circ}\text{C}$ ) temperatures must either be fitted with a protective insulation, or there must be warning signs fitted showing that it is dangerous to touch these valves.



If a valve is used as end-valve in a pipe, this valve should be protected against unauthorized or unintentional opening to prevent personal injury or damage to property.



To guarantee a good operation of the valves at temperatures  $< 0^{\circ}\text{C}$  it is necessary to eliminate all the water (steam or liquid) inside the piping to avoid freezing at the seat gasket or lower shaft level.



#### **DANAIS 150 body type 4 (lug type) :**

Specific instructions for end of line use:  
(see figure 1)

- it is mandatory to insert the valve between flanges in the preferential direction, pressure upstream.
- tighten the tightening flange 72-3 against the piping flange.

#### Specific instructions for downstream dismantling:

Check the position of the valve on the piping (direction of the arrow on the yoke)

In case of piping dismantling downstream side (see figure 1):

- make sure that the valve is in the closed position
- remove the piping downstream side.

In case of piping dismantling upstream side (see figure 2):

- depressurize and drain off the downstream piping
- remove the piping upstream side.

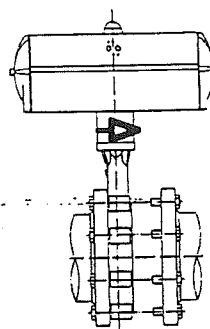


Figure 1

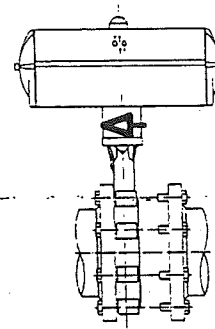
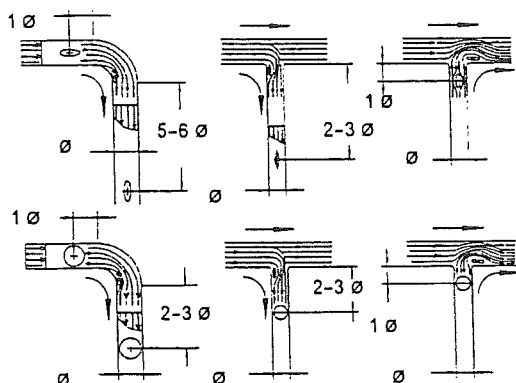


Figure 2

It is advised to put in place a blind flange for safety reasons.

## 6.2. Installation conditions

### 6.2.1. Recommended minimum distances between the position of the valve and of the T-piece or elbow.

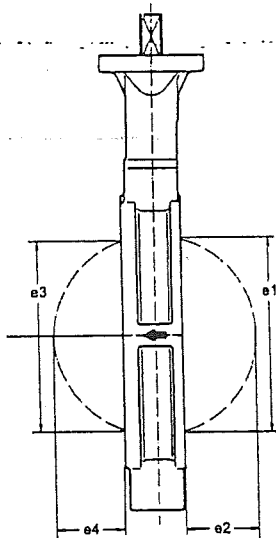


Also valid for valve placed at pump discharge

### 6.2.2. Flanging dimensions

Connection to the piping.

Piping flanges must match the following dimensions.



e1: min. allowable diameter on upstream flange face

e3: min. allowable diameter on downstream flange face

#### 6.2.2.1. DANAIS MT II, HT II and Cryogenic

Wafer and Lug type class 150 and PN 25

Size	NPS	e1	e2	e3	e4
50	2	36	9		
65	2 1/2	49	13	13	1
80	3	62	18	38	6
100	4	81	24	67	17
125	5	103	33	91	23
150	6	131	48	117	33
200	8	177	70	163	51
250	10	226	91	212	70
300	12	266	108	254	87
350	14	309	123	297	103
400	16	360	145	346	121
450	18	420	169	408	147
500	20	456	182	444	160
600	24	546	213	537	197

#### Flanged type class 150 and PN 25

Size	NPS	e1	e2	e3	e4
50-65	2-2 1/2				
80	3			18	2
100	4			52	8
125	5			81	17
150	6			112	29
200	8			158	46
250	10	27	1	208	65
300	12	214	52	197	42
350	14	263	70	245	58
400	16	306	82	269	70
450	18	376	111	359	97
500	20	417	128	399	112
600	24	505	157	487	141

#### Wafer and Lug type class 300

Size	NPS	e1	e2	e3	e4
50	2	36	9		
65	2 1/2	49	13	13	1
80	3	62	18	38	6
100	4	81	24	64	13
125	5	100	31	87	21
150	6	130	46	115	31
200	8	174	64	158	46
250	10	222	84	204	62
300	12	260	96	249	81
350	14	299	105	292	96
400	16	350	125	340	113
450	18	408	147	397	133
500	20	445	160	438	150
600	24	542	201	531	185

#### Flanged type class 300

Size	NPS	e1	e2	e3	e4
50-65	2-2 1/2				
80	3			18	2
100	4			48	7
125	5			75	15
150	6			106	25
200	8			150	39
250	10			198	56
300	12	80	6		
350	14	154	20	99	8
400	16	219	36	182	24
450	18	291	57	257	43
500	20	329	68	293	53
600	24	425	96	394	80

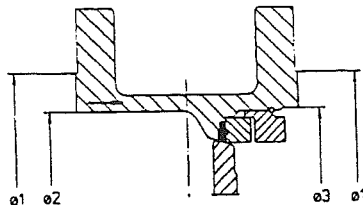
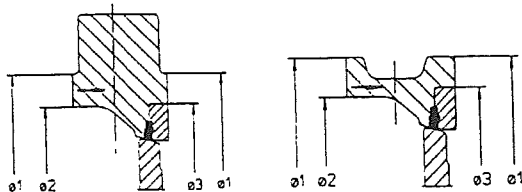
#### 6.2.2.2. DANAIS 150

Size	NPS	e1	e2	e3	e4
50	2	23	0	33	3.5
65	2 1/2	41	6	48	9
80	3	59	13	61	15
100	4	78	18	81	21
125	5	99	27	103	30
150	6	127	39	131	43
200	8	177	62	175	59
250	10	225	82	230	80
300	12	265	96	266	98
350	14	308	112	311	116
400	16	359	133	358	132
450	18	418	155	418	160
500	20	455	167	455	175
600	24	546	201	546	211

### 6.2.3. Flange gasket

The dimensional compatibility of the flange gasket must be checked to ensure the connection quality, according to the dimensions defined hereunder:

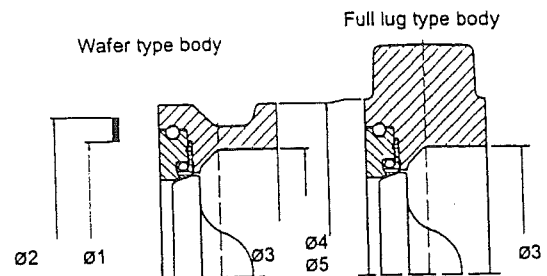
#### 6.2.3.1. DANAIS MT II, HT II TIGHTNESS AREA AT FLANGE FACING



Size	NPS	Class 150 / PN 25						Class 300					
		Wafer			Lug			Lug			Flanged		
		Ø1	Ø2	Ø3	Ø1	Ø2	Ø3	Ø1	Ø2	Ø3	Ø1	Ø2	Ø3
50	2	93	61	73	92.1	61	73	92.1	71	73			
65	2 1/2	117	73	91	104.8	73	91	104.8	84	91			
80	3	127	90	106	127	89	106	127	94	106			
100	4	157.5	120	128	157.2	114	128	157.2	120	128			
125	5	180	141	148	185.7	141	148	185.7	144	148			
150	6	216	170	173	215.9	168	173	215.9	167	173			
200	8	260	220	226	269.9	220	226	269.9	220	226			
250	10	314	273	273	323.8	273	273	323.8	270	273			
300	12	362	322	330	381	322	330	381	339	323			
350	14	411	354	385	412.8	381	385	412.8	368	373			
400	16	470	406	438	470	433	438	470	421	423			
450	18	530	462	498	533.4	492	498	533.4	474	487			
500	20	572	508	538	584.2	531	538	584.2	518	526			
600	24	676	607	640	692.2	637	640	692.2	625	622			

Size	NPS	Class 300								
		Wafer			Lug					
		Ø1	Ø2	Ø3	Ø1	Ø2	Ø3	Ø1	Ø2	Ø3
50	2	93	61	73	92.1	61	73	92.1	71	73
65	2 1/2	117	73	91	104.8	73	91	104.8	88	91
80	3	127	90	106	127	89	106	127	100	106
100	4	157	114	128	157.2	114	128	157.2	120	128
125	5	185.7	141	148	185.7	141	148	185.7	144	148
150	6	215.9	168	173	215.9	168	173	215.9	167	173
200	8	269.9	220	226	269.9	220	226	269.9	220	226
250	10	323.8	273	273	323.8	273	273	323.8	281	273
300	12	381	327	330	381	327	330	381	324	323
350	14	412.8	382	385	412.8	382	385	412.8	382	373
400	16	470	433	438	470	433	438	470	422	423
450	18	533.4	494	498	533.4	494	498	533.4	489	487
500	20	584.2	536	538	584.2	536	538	584.2	528	526
600	24	692.2	639	640	692.2	639	640	692.2	625	622

#### 6.2.3.2. DANAIS 150 GASKET DIMENSIONS



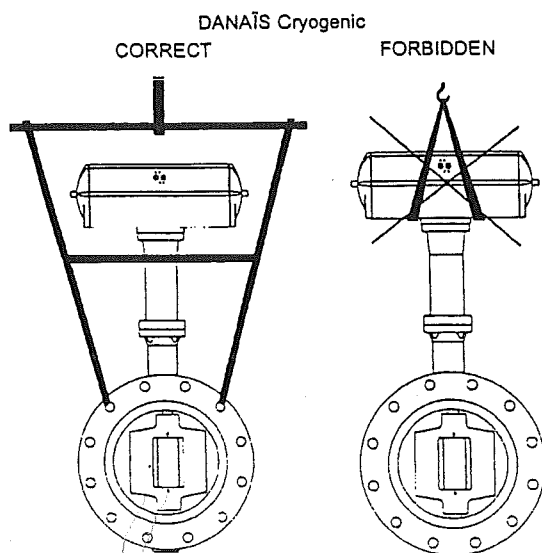
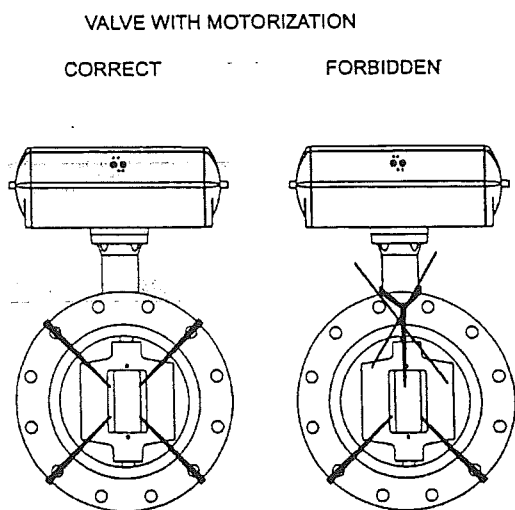
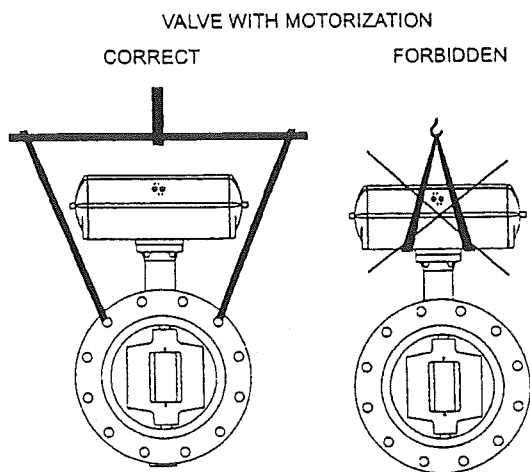
- Ø 1: max. internal diameter
- Ø 2: min. external diameter
- Ø 3: min. internal diameter
- Ø 4: max. external diameter for wafer type body
- Ø 5: max. external diameter for full lug type body

Size	NPS	Flange sealing					Connection
		Min. area		Max. area			
		Ø1	Ø2	Ø3	Ø4	Ø5	
50	2	69,6	84,6	62	90,5	91	All
65	2½	83,6	98,6	75	108	104	(1)
				75	108	117	(2)
80	3	101,2	116,6	91	125	126	(3)
				91	125	131	(4)
100	4	126,6	142,6	117	154	156,5	All
125	5	153,6	169,6	144	183	185	
150	6	180,6	199,1	171	214	215	
200	8	231,5	253,5	222	267	269	(5)
				222	267	265	(6)
250	10	286,9	305,5	275	321,5	323	All
300	12	339,3	358,5	327	377	380	(7)
				327	377	388	(8)
350	14	374,6	400	359	411,5	412	(3)
				359	411,5	428	(4)
400	16	425,9	452	410	467,5	469	All
450	18	478,5	510	461	530,5	532,5	
500	20	528	562	512	581,5	583,5	
600	24	635	671	614	689,5	691,5	

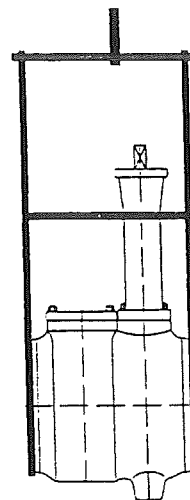
- (1) PN 10/16/20 - ASME B16.5 cl 150 - JIS 10K
- (2) PN 25 - JIS 16K/20K
- (3) PN 20 - ASME B 16.5 cl150
- (4) PN 10/16/25 - JIS 10K/16K/20K
- (5) PN 10/20 - ASME B 16.5 cl150
- (6) PN 16/25 - JIS 10K/16K/20K
- (7) PN 10/16/20 - ASME B16.5 cl 150
- (8) PN 25 - JIS 10K/16K/20K

### 6.3. Handling

Handling means may be necessary to install large sizes valves. They must be used as shown.



DANAIS Cryogenic Buttweld



### 6.4. Recommendations for installation

The wafer, lug and flanged valves have to be inserted lightly between flanges with flange gaskets.

#### Before assembly

- Verify that the disc and the seat are free of solid particles like chips, packing material, etc...
- Verify that pipeline flanges are located on the same centreline and are parallel.
- Verify that dimensions of gaskets flange are compatible with the dimensions mentioned in the table 6.2.3.
- Verify that nothing hinders the complete moving of the disc during opening or closing, in particular at the internal weld seams or at the pipe ends.
- Pull apart the pipeline flanges to allow valve and gaskets insertion.

#### During assembly

- Place the disc in closed position.
- Insert valve between pipeflanges and center using several tie-rods.
- Screw up progressively the nuts until metal complete tightness is achieved between the valve body, the pipeline flanges and gaskets.
- Operate the valve several times to ensure that there is no valve disc obstruction.
- During transport, the valve may have been subjected to important temperature differences or the vibrations making it necessary to retighten the packing. Before performing this operation, please read the maintenance manual.

### 6.5. Actuated valves



Electrical cables may only be connected by qualified personnel.



The applicable electrical regulations (e.g. IEC and national standards), also for equipment in hazardous locations, must be observed. All electrical equipment such as actuator, switchboard, magnetic valve drive, limit switch etc. must be installed in floodproof dry locations. Voltage and frequency must match the valves stated on the identity plate.



Cryogenic type BW: special device like "bracket" used for the positioning of pipe and butt weld ends of valve will be in austenitic stainless steel and the spot welding will be as light as possible and made with suitable material filler metal and the lowest acceptable energy. The welding spot will be eliminated by flush grinding.



The seat (144) and the disc edge shall be protected against the metallic projections resulting from welding or grinding.



During welding on site, the temperature of the body shell will be lower than 150 °C at a distance of 100 mm from the butt weld end.

## 7. Commissioning/Decommissioning

### 7.1. Commissioning

#### 7.1.1. General

Prior to commissioning the valve, the pressure, temperature and material data stated on the valve should be compared to the actual operating conditions in the piping system to check whether the valve can withstand the loads occurring in the system.



Possible pressure surges (waterhammer) must not be exceed the highest admissible pressure. Adequate precautions should be taken. In new pipe systems and especially after repair work, the system should be flushed with the valves fully open to remove solids, e.g. weld beads, which may damage the seats.

#### 7.1.2. Operation

The position of the disc is indicated by the pointer of the actuator or by handle lever. The valves are closed by turning in the clockwise direction (top view) and opened in the counterclockwise direction.

#### 7.1.3. Functional Check

The following functions should be checked: Before commissioning, the shut-off-function of the valves should be checked by repeated opening and closing.

#### 7.1.4. Actuated valves

Adjustable end stops and torque limiter of actuators have been adjusted in factory.

### 7.2. Decommissioning

During extended shutdown periods, liquids liable to change their condition due to polymerization, crystallization, solidification etc. must be drained from the piping system. If necessary, the piping system should be flushed with the valves fully open.

## 8. Maintenance/Repair

### 8.1. Safety Instructions

Maintenance and repair work may only be carried out by skilled and qualified personnel.

For all maintenance and repair work, the safety instructions listed below and also the general notes in section 2 must be observed. Always use suitable spare parts and tools, even in case of emergency, otherwise correct operation of the valves cannot be assured.

### 8.2. Valve removal from piping and actuator disconnecting

Identify the valve by identity plate.



Please check what is the relevant spare kit. Place the disc in closing position



The entire valve must be unpressurized and must have cooled down sufficiently so that the temperature of the medium is lower than 60 °C, to prevent scalding or warmed so that the temperature is higher than 0 °C.



Opening pressurized valves will cause danger to life and limb! If toxic or highly flammable substances or liquids whose residues may cause corrosion by interaction with the air humidity were handled by the valve, then the valve should be drained and flushed or vented. If necessary, wear safety clothing and a face guard/mask. Depending on the installation position, any liquid remaining in the valve may have to be removed.

Prior to possible transport, the valves must be flushed and drained carefully. If you have any questions please contact your KSB Sales Office.



If actuators powered by an external source of energy (electric, pneumatic, hydraulic) need to be removed from the valves or dismantled, the energy supply must be shut down prior to starting any repair work.

Remove the valve from the piping with its actuator. Identify the mounting position of the actuator. Disconnect the actuator and take care of all bolting parts.

### 8.3. Spares

Use the relevant spare parts included in the kits. Please refer to leaflets.

All constitutive parts of kit and flange gaskets must be replaced.



During the mounting /dismantling of the valve, the operations must be respected step by step to prevent injuries and material damages.

During the tests, closing and opening valves, care must be taken that no operator interferes with the disc travel.

### 8.4. Valve disassembly and re-assembly

See manual of maintenance reference:

Reference	Manual of maintenance
DANAIS MT II, HT II	R355-70037
DANAIS 150	8450.815
DANAIS Cryogenic wafer, lug, flanged	R355-70036
DANAIS Cryogenic BW	R355-70032

## 9 Troubleshooting

### 9.1 General

All repair and service work must be carried out by qualified personnel using suitable tools and genuine spare parts.  
The previous safety instructions must be observed.

### 9.2 Faults & Remedies

Cover or extension leakage (between the shaft and the flange)	
Downstream/Upstream leakage	
Shaft leakage	
Flange leakage	
Over torque	
No opening	
No closing	
Hard point	
Vibration / Fluttering	
Foreign particles in the valve	Actuator on safe position - Open the valve, line without fluid or flow, remove the particle - inspect seal/disc - replace seal/disc
Broken body	Defect due to water hammer Search for the reasons. Replace / Repair the valve
Broken or warped disc	Defect due to water hammer Search the reasons. Replace / Repair the valve
Damaged disc, corroded disc	Repair the valve - Replacement of seal
Broken shaft, twisted shaft	Analyse the defect / research of causes / replace shaft
Wrong flange gasket	Check type and dimensions
Wrong flanging	Check type and flange bolting torque
Wrong flanging size	Follow instructions given in KSB technical leaflet
Wrong face to face, non parallel flanges	Flanging has to be modified in accordance with KSB technical leaflet requirements.
Flow conditions	Check the technical offer versus service conditions
Wrong operating conditions	
Damaged actuator	Check sizing versus operating conditions (see KSB)
Defective sealing	Search the reasons Tighten or replace sealing packing Replace O-rings
Defective sealing	Actuator on safe position Open the valve line without fluid or flow ( 0° C < temperature < 60° C) Inspect metallic seals, sealing area Replace metallic seals, repair sealing area.



## MAINTENANCE MANUAL DANAIS TBT II

R355-070036  
Date : 06/01

### 1- SCOPE

The aim of this document is to define the removal/installation procedure of DANAIS TBT II for installation of spare parts kits.


### 2- GENERAL INFORMATIONS

The tightness performances of the metal/metal and PTFE seated DANAIS valves will be maintained only if the cleanliness conditions are complied with during the removal/installation at site. This is particularly mandatory for the parts for which the cleanliness and quality conditions of the surface finish are essential. For each operation, all steps shall be taken to avoid possible shocks.

In addition, the tools used for intervention shall be clean and in good operating.

According to the required level of maintenance, 2 types of spare part kits are offered :

**KIT 1 : Kit for commissioning start up** : it is the first aid kit for a few used for upstream/downstream leakage. It is advisable to have one kit for ten valves installed.

It is composed by the parts noted :  on the technical sheets

**KIT 2 : Kit for two years operation** : it is the kit of maintenance. It must be used for leakage at shaft passage or bad operating (difficulty to operate, bearings wear,...). It is recommended to have one kit 2 for 5 to 10 valves and for a service time of 2 years.

It is composed by the parts noted :  on the technical sheets

### 3- EQUIPMENT REQUIRED - INTERVENTION MEANS

#### **3-1 Handling equipment**

On site : lifting block, hoist, slings.  
In workshop : travelling crane

#### **3-2 Consumables**

- clean rags or workshop paper
- solvent (e.g. trichlorethylene)
- flap wheel, abrasive paper (Grade 400)
- felt disc
- aluminium powder
- PTFE (spray)
- molybdenum disulphide (e.g. Molykote 321R)
- silicone grease (e.g. Molykote III)

## MAINTENANCE MANUAL DANAIS TBT II

R355-070036  
Date : 06/01

### 3-3 Instructions for preparation

- Body (100) : clean thoroughly and eliminate traces of grease on the metallic and neck seat sealing surfaces using trichlorethylene. If necessary, polish these sealing surfaces using grade 400 abrasive paper.
- Disc (550) : clean thoroughly and eliminate traces of grease on the disc edge using trichlorethylene. If necessary, polish this edge to eliminate scratches using grade 400 abrasive paper and complete the operation with polishing composition.
- Shaft (213, 210 and/or 212) : eliminate traces of grease on the sealing surfaces using trichlorethylene.  
Polish these surfaces using grade 400 abrasive paper.  
Coat the sealing surfaces with molybdenum disulphide. Allow to dry and polish using a clean rag.
- Extension (13-21) : clean thoroughly and eliminate traces of grease on the metallic and neck seat sealing surfaces using trichlorethylene. If necessary, polish these sealing surfaces using grade 400 abrasive paper.
- Flanges and internal parts : clean thoroughly and eliminate traces of grease using trichlorethylene.
- Bolting : After solvent cleaning, coat with varnish or molybdenum disulphide in paste

### 4- MAINTENANCE SHEET'S CHOICE

This manual is composed of several procedures noted "SHEET A - ... - ... or D - ... - ....  
Each of them describes the maintenance operation for different body's shape, size, class, etc....

See the table on the following page to find the right maintenance sheet in accordance with the valve's type.

## MAINTENANCE SHEET SELECTION FOR DANAIS TBT II

D for Dismantling  
A for Assembling

M for Metal seal ring  
P for PTFE seal ring

ND	WAFER AND LUG TYPE BODIES			FLANGED BODIES		
	CL 150	CL 300	CL 600	CL 150	CL 300	CL 600
50-2"	KIT 1M : D - 1 - 1 A - 1 - 1 KIT 1P : D - 1 - 4 A - 1 - 4 KIT 2 : D - 2 - 1 A - 2 - 1		KIT 1 : D - 1 - 1 A - 1 - 1 KIT 2 : D - 2 - 5 A - 2 - 5		KIT 1M : D - 1 - 1 A - 1 - 1 KIT 1P : D - 1 - 4 A - 1 - 4 KIT 2 : D - 2 - 6 A - 2 - 6	KIT 1 : D - 1 - 1 A - 1 - 1 KIT 2 : D - 2 - 5 A - 2 - 5
65-2"1/2						
80-3"						
100-4"						
125-5"						
150-6"						
200-8"	KIT 1M : D - 1 - 2 A - 1 - 2 KIT 1P : D - 1 - 5 A - 1 - 5 KIT 2 : D - 2 - 3 A - 2 - 3	KIT 1 : D - 1 - 2 A - 1 - 2 KIT 2 : D - 2 - 2 A - 2 - 2	KIT 1 : D - 1 - 2 A - 1 - 2 KIT 2 : D - 2 - 5 A - 2 - 5	KIT 1M : D - 1 - 3 A - 1 - 3 KIT 1P : D - 1 - 6 A - 1 - 6 KIT 2 : D - 2 - 3 A - 2 - 3	KIT 1 : D - 1 - 3 A - 1 - 3 KIT 2 : D - 2 - 2 A - 2 - 2	KIT 1 : D - 1 - 3 A - 1 - 3 KIT 2 : D - 2 - 5 A - 2 - 5
250-10"						
300-12"						
350-14"						
400-16"						
450-18"						
500-20"	KIT 1M : D - 1 - 2 A - 1 - 2 KIT 1P : D - 1 - 5 A - 1 - 5 KIT 2 : D - 2 - 3 A - 2 - 3	KIT 1 : D - 1 - 2 A - 1 - 2 KIT 2 : D - 2 - 2 A - 2 - 2	KIT 1 : D - 1 - 2 A - 1 - 2 KIT 2 : D - 2 - 5 A - 2 - 5	KIT 1M : D - 1 - 3 A - 1 - 3 KIT 1P : D - 1 - 6 A - 1 - 6 KIT 2 : D - 2 - 3 A - 2 - 3	KIT 1 : D - 1 - 3 A - 1 - 3 KIT 2 : D - 2 - 2 A - 2 - 2	KIT 1 : D - 1 - 3 A - 1 - 3 KIT 2 : D - 2 - 5 A - 2 - 5
550-22"						
600-24"						
650-26"						
700-28"						
750-30"						
800-32"	KIT 1M : D - 1 - 2 A - 1 - 2 KIT 1P : D - 1 - 5 A - 1 - 5 KIT 2 : D - 2 - 3 A - 2 - 3	KIT 1 : D - 1 - 2 A - 1 - 2 KIT 2 : D - 2 - 2 A - 2 - 2	KIT 1 : D - 1 - 2 A - 1 - 2 KIT 2 : D - 2 - 5 A - 2 - 5	KIT 1M : D - 1 - 3 A - 1 - 3 KIT 1P : D - 1 - 6 A - 1 - 6 KIT 2 : D - 2 - 3 A - 2 - 3	KIT 1 : D - 1 - 3 A - 1 - 3 KIT 2 : D - 2 - 2 A - 2 - 2	KIT 1 : D - 1 - 3 A - 1 - 3 KIT 2 : D - 2 - 5 A - 2 - 5
"						
"						
1650-66"						

MAINTENANCE MANUAL  
DANAIS TBT II

R355-070036  
Date : 06/01

SHEET D - 1 - 1

KIT 1 : METAL SEAT DISMANTLING

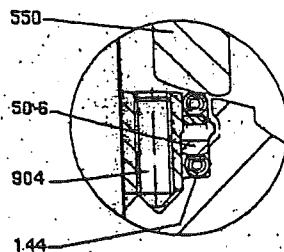
WAFER AND LUG BODIES CL150, CL300 AND CL600 : NPS ≤ 250-10"

FLANGED BODIES CL150 : NPS = 50-2"

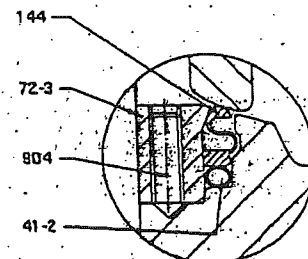
FLANGED BODIES CL300 AND CL600 : NPS ≤ 80-3"

- 1- Close the valve
- 2- Identify and disconnect the electric, hydraulic or pneumatic connections of the actuator
- 3- Sling the actuator
- 4- Remove the valve from the piping and lay it flat on a workstand with the seat facing up
- 5- Loosen and remove the tightening flange screws (904) and the tightening flange (72-3)

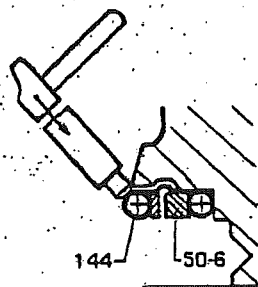
For a standard metal seat



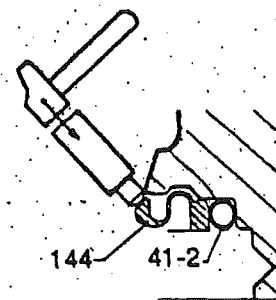
For a H.P. metal seat



- 6- Open the disc (550) with the actuator
- 7- Using a drift, strongly strike the accessible contour of the seat (144), until complete removal of the seat, as shown hereafter



- 8- Using a screwdriver, remove the tightening ring (50-6)



- 8- Remove the static joint (41-2)

MAINTENANCE MANUAL  
DANAIS TBT II

R355-070036  
Date : 06/01

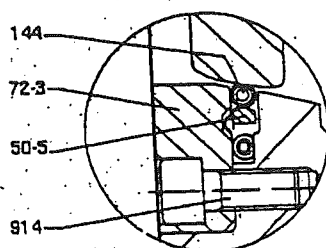
SHEET D - 1 - 2

KIT 1 : METAL SEAT DISMANTLING

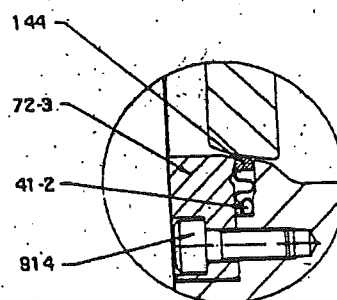
WAFFER AND LUG BODIES CL150, CL300 AND CL600 : NPS  $\geq$  300-12"

- 1- Close the valve
- 2- Identify and disconnect the electric, hydraulic or pneumatic connections of the actuator
- 3- Sling the actuator
- 4- Remove the valve from the piping and lay it flat on a workstand with the seat facing up
- 5- Loosen and remove the tightening flange screws (914)

For a standard metal seat



For a H.P. metal seat



- 6- Remove the tightening flange (72-3), the seat (144) and the static joint (50-5) or (41-2)

MAINTENANCE MANUAL  
DANAIS TBT II

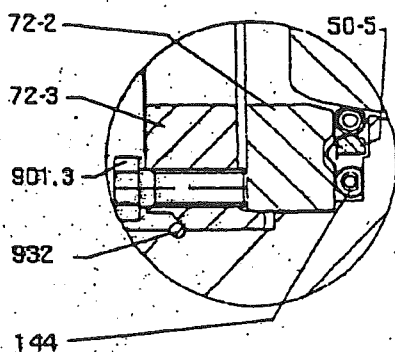
R355-070036  
Date : 06/01

SHEET D - 1 - 3

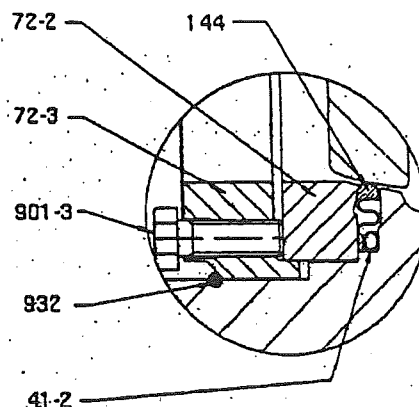
KIT 1 : METAL SEAT DISMANTLING

FLANGED BODIES CL150 : NPS  $\geq$  65-2"1/2  
FLANGED BODIES CL300 AND CL600 : NPS  $\geq$  100-4"

For a standard metal seat



For a H.P. metal seat



- 1- Close the valve
- 2- Identify and disconnect the electric, hydraulic or pneumatic connections of the actuator
- 3- Sling the actuator
- 4- Remove the valve from the piping and lay it flat on a workstand with the seat facing up
- 5- Remove the wire (81-2) from the screws head (901-3)
- 6- Loosen and remove the tightening flange screws (901-3)
- 7- Remove the retaining ring (932) with a screwdriver into an extremity
- 8- Remove the tightening flange (72-3) and the centering flange (72-2)
- 9- Remove the seat (144)
- 10- Remove the reaction ring (50-5) or the static joint (41-2) out of the seat

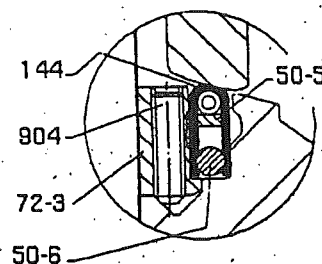
MAINTENANCE MANUAL  
DANAIS TBT II

R355-070036  
Date : 06/01

SHEET D - 1 - 4

KIT 1 : PTFE SEAT DISMANTLING

WAFER, LUG AND FLANGED BODIES CL150 : NPS : 2 TO 10"



- 1- Close the valve
- 2- Identify and disconnect the electric, hydraulic or pneumatic connections of the actuator
- 3- Sling the actuator
- 4- Remove the valve from the piping and lay it flat on a workstand with the seat facing up
- 5- Open the disc completely
- 6- Remove screws (904)
- 7- Remove the tightening flange (72-3)
- 8- Remove the seat (144)
- 9- Remove the tightening ring (50-6) out of the seat
- 10- Remove the reaction ring (50-5) out of the seat



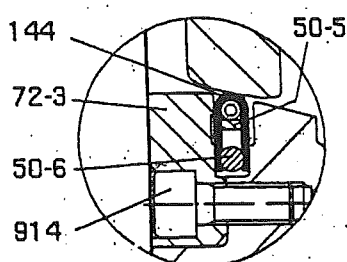
**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET D - 1 - 5**

**KIT 1 : PTFE SEAT DISMANTLING**

**WAFER AND LUG BODIES CL150 : NPS : 12" TO 24"**



- 1- Close the valve
- 2- Identify and disconnect the electric, hydraulic or pneumatic connections of the actuator
- 3- Sling the actuator
- 4- Remove the valve from the piping and lay it flat on a workstand with the seat facing up
- 5- Remove screws (914)
- 6- Remove the tightening flange (72-3)
- 7- Remove the seat (144)
- 8- Remove the tightening ring (50-6) out of the seat
- 9- Remove the reaction ring (50-5) out of the seat

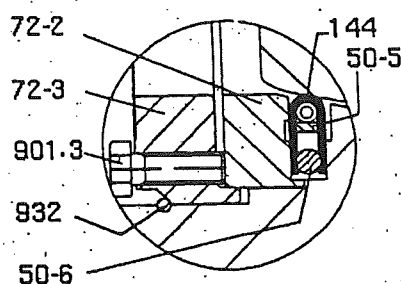
**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET D - 1 - 6**

**KIT 1 : PTFE SEAT DISMANTLING**

**FLANGED BODIES CL150 : NPS : 12 TO 24"**



- 1- Close the valve
- 2- Identify and disconnect the electric, hydraulic or pneumatic connections of the actuator
- 3- Sling the actuator
- 4- Remove the valve from the piping and lay it flat on a workstand with the seat facing up
- 5- Remove screws (901.3)
- 6- Remove the retaining ring (932) using a screwdriver into an extremity
- 7- Remove the tightening flange (72-3) and the centring flange (72-2)
- 8- Remove the seat (144)
- 9- Remove the tightening ring (50-6) out of the seat
- 10- Remove the reaction ring (50-5) out of the seat



**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET D - 2 - 1**

**KIT 2 : DISMANTLING OF THE VALVE**

**WAFFER AND LUG BODIES CL150 : NPS ≤ 250-10"  
WAFFER AND LUG BODIES CL300 : NPS ≤ 200-8"**

- 1- Remove the seat, using the sheet D - 1 - 1
- 2- Uncouple the actuator
- 3- Loosen and remove the nuts (920) and the adjusting rings (512) from the extension stud-bolts (902)
- 4- Remove the extension sub-unit (13-21) and then the lip seal ring (41-2)
- 5- Loosen and remove the screws (901-1) fitted with washers (554) of the gasket holder (559)
- 6- Remove the outer ring (932-2)
- 7- Remove the intermediate shaft (212) using a mallet by striking the driving square
- 8- Remove the lip seal ring (415-2 : In option) from the intermediate shaft (212)
- 9- Remove the gasket holder (559), the sealing packing (01-48), the thrust insert (553-3) and the lip seal ring (415-1). Only the thrust insert (553-3) is to be reinstalled
- 10- Remove the strip (310-1) and the O' rings (412) from the gasket holder (559)
- 11- Rotate the disc counter-clockwise by 90°
- 12- Drive out the pins (561-2 and 561-3) inside the shaft (a receptacle is provided)
- 13- Remove the spacer bush (543)
- 14- Drive out the drive shaft (213) by using a tie-rod
- 15- Remove the thrust inserts (553-1 and 553-2) from the shaft (213)
- 16- Remove the disc (550)
- 17- Extract the strips (310-2 and 310-3) pinching the collar and pulling up



**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET D - 2 - 2**

**KIT 2 : DISMANTLING OF THE VALVE**

**WAFFER AND LUG BODIES CL150 : NPS = 300-12"  
WAFFER, LUG AND FLANGED BODIES CL300 : 250-10" ≤ NPS ≤ 550-22"**

**1- Remove the seat, using the sheet :**

- D - 1 - 1 for wafer or lug bodies : CL300 → NPS = 250-10"
- D - 1 - 2 for wafer or lug bodies : CL150 → NPS = 300-12"  
CL300 → 300-12" ≤ NPS ≤ 550-22"
- D - 1 - 3 for flanged bodies

**2- Uncouple the actuator**

**3- Loosen and remove the nuts (920) and the adjusting rings (512) from the extension stud-bolts (902)**

**4- Remove the extension sub-unit (13-21) and then the lip seal ring (41-2)**

**5- Loosen and remove the screws (901-1) fitted with washers (554) of the gasket holder (559)**

**6- Remove the outer ring (932-2)**

**7- Remove the intermediate shaft (212) using a mallet by striking the driving square**

**8- Remove the lip seal ring (415-2 : In option) from the intermediate shaft (212)**

**9- Remove the gasket holder (559), the sealing packing (01-48), the thrust insert (553-3) and the lip seal ring (415-1). Only the thrust insert (553-3) is to be reinstalled**

**10- Remove the strip (310-1) and the O' rings (412) from the gasket holder (559)**

**11- Rotate the disc counter-clockwise by 180° (to a position symmetrically opposite to the closed position)**

**12- Drive out the pins (561-2 and 561-3) inside the shafts (a receptacle is provided)**

**13- Drive out the drive shaft (213) and the shaft (210) by using a tie-rod**

**14- Remove the disc (550) and retain the spacer bushes (543-1 and 543-2)**

**15- Extract the strips (310-2 and 310-3) pinching the collar and pulling up**

# **MAINTENANCE MANUAL DANAIS TBT II**

**R355-070036  
Date : 06/01**

## **SHEET D - 2 - 3**

### **KIT 2 : DISMANTLING OF THE VALVE**

**WAFFER AND LUG BODIES CL150 : 350-14" ≤ NPS ≤ 600-24"  
FLANGED BODIES CL150 : 300-12" ≤ NPS ≤ 600-24"**

- 1- Remove the seat, using the sheet :
  - D - 1 - 2 for wafer or lug bodies
  - D - 1 - 3 for flanged bodies
- 2- Uncouple the actuator
- 3- Loosen and remove the nuts (920) and the adjusting ring (512) from the extension stud-bolt (902)
- 4- Remove the extension sub-unit (13-21) and then the lip seal ring (41-2 or 41-2-1)
- 5- Loosen and remove the screws (901-1) fitted with washers (554) of the gasket holder (559)
- 6- Remove the gasket holder (559), the sealing packing (01-48), the thrust insert (553-3) and the lip seal ring (415-1). Only the thrust insert (553-3) is to be reinstalled
- 7- Remove the strip (310-1) and the O' rings (412) from the gasket holder (559)

#### **For wafer/lug bodies**

- 8- Drive out the pins (561-2 and 561-3) inside the shafts (a receptacle is provided)

#### **For flanged bodies**

- 8- Remove the retainers (930-3 and 930-4) and the screws (901-4 and 901-5)

- 9- Drive out the drive shaft (213) and the shaft (210) by using a tie-rod
- 10- Remove the lip seal ring (415-2 : In option) from the drive shaft (213)
- 11- Remove the disc (550) and retain the spacer bushes (543-1 and 543-2)
- 12- Extract the strips (310-2 and 310-3) pinching the collar and pulling up

**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET D - 2 - 4**

**KIT 2 : DISMANTLING OF THE VALVE**

**WAFER, LUG AND FLANGED BODIES CL150 : NPS ≥ 650-26"  
WAFER, LUG AND FLANGED BODIES CL300 : NPS ≥ 600-24"  
WAFER, LUG AND FLANGED BODIES CL600 : NPS ≥ 400-16"**

- 1- Remove the seat, using the sheet :
  - D - 1 - 2 for wafer or lug bodies
  - D - 1 - 3 for flanged bodies
- 2- Uncouple the actuator
- 3- Loosen and remove the nuts (920) and the adjusting rings (512) from the extension stud-bolts (902)
- 4- Remove the extension sub-unit (13-21) and then the lip seal ring (41-2 or 41-2-2)
- 5- Loosen and remove the screws (901-1) fitted with washers (554) of the gasket holder (559)
- 6- Remove the gasket holder (559), the sealing packing (01-48), the thrust insert (553-3) and the lip seal ring (415-1). Only the thrust insert (553-3) is to be reinstalled
- 7- Remove the strip (310-1) and the O' rings (412) from the gasket holder (559)
- 8- Rotate the disc counter-clockwise by 180° (to a position symmetrically opposite to the closed position)
- 9- Drive out the pins (561-2 and 561-3) inside the shafts (a receptacle is provided)
- 10- Loosen the screws (901-2), remove them with the washers (931)
- 11- Push the taper pin (56-2) in the bottom of their housing
- 12- Drive out the drive shaft (213) and the shaft (210) by using a tie-rod
- 13- Remove the lip seal ring (415-2 : In option) from the drive shaft (213)
- 14- Extract the taper pin (56-2) out of the operating shaft (213) and the pins (561-2 and 561-3) out of the shaft (213 and 210)
- 15- Remove the disc (550) and retain the spacer bushes (543-1 and 543-2)
- 16- Extract the strips (310-2 and 310-3) pinching the collar and pulling up



**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET D - 2 - 5**

**KIT 2 : DISMANTLING OF THE VALVE**

**FLANGED BODIES CL150 :  $200-8'' \leq \text{NPS} \leq 250-10''$   
WAFER, LUG AND FLANGED BODIES CL600 :  $\text{NPS} \leq 350-14''$**

**1- Remove the seat, using the sheet :**

- D - 1 - 1 for wafer or lug bodies : CL600  $\rightarrow \text{NPS} \leq 250-10''$   
for flanged bodies : CL600  $\rightarrow \text{NPS} \leq 80-3''$
- D - 1 - 2 for wafer or lug bodies : CL600  $\rightarrow 300-12'' \leq \text{NPS} \leq 350-14''$
- D - 1 - 3 for flanged bodies : CL150  $\rightarrow 200-8'' \leq \text{NPS} \leq 250-10''$   
: CL600  $\rightarrow 100-4'' \leq \text{NPS} \leq 350-14''$

**2- Uncouple the actuator**

**3- Loosen and remove the nuts (920) and the adjusting rings (512) from the extension stud-bolts (902)**

**4- Remove the extension sub-unit (13-21) and then the lip seal ring (41-2 or 41-2-1)**

**5- Loosen and remove the screws (901-1) fitted with washers (554) of the gasket holder (559)**

**6- Remove the gasket holder (559), the sealing packing (01-48), the thrust insert (553-3) and the lip seal ring (415-1). Only the thrust insert (553-3) is to be reinstalled**

**7- Remove the strip (310-1) and the O' rings (412) from the gasket holder (559)**

**8- Rotate the disc counter-clockwise by 90°**

**9- Remove the nuts (920-3 and 920-4), the screws (901-4 and 901-5) and the retainers (930-3 and 930-4)**

**10- Drive out the drive shaft (213)**

**11- Remove the lip seal ring (415-2 : In option) from the drive shaft (213)**

**12- Remove the disc (550) and retain the spacer bushes (543-1 and 543-2)**

**13- Extract the strips (310-2 and 310-3) pinching the collar and pulling up**



MAINTENANCE MANUAL  
DANAIS TBT II

R355-070036

Date : 06/01

SHEET D - 2 - 6

KIT 2 : DISMANTLING OF THE VALVE

FLANGED BODIES CL150 : NPS  $\leq$  150-6"  
FLANGED BODIES CL300 : NPS  $\leq$  200-8"

1- Remove the seat, using the sheet :

• D - 1 - 1 for flanged bodies :

CL150  $\rightarrow$  NPS = 50-2"

CL300  $\rightarrow$  NPS  $\leq$  80-3"

• D - 1 - 3 for flanged bodies.:

CL150  $\rightarrow$  65-2"1/2  $\leq$  NPS  $\leq$  150-6"

CL300  $\rightarrow$  100-4"  $\leq$  NPS  $\leq$  200-8"

2- Uncouple the actuator

3- Loosen and remove the nuts (920) and the adjusting rings (512) from the extension stud-bolts (902)

4- Remove the extension sub-unit (13-21) and then the lip seal ring (41-2)

5- Loosen and remove the screws (901-1) fitted with washers (554) of the gasket holder (559)

6- Remove the outer ring (932-2)

7- Remove the intermediate shaft (212) using a mallet by striking the driving square

8- Remove the lip seal ring (415-2 : In option) from the intermediate shaft (212)

9- Remove the gasket holder (559), the sealing packing (01-48), the thrust insert (553-3) and the lip seal ring (415-1). Only the thrust insert (553-3) is to be reinstalled

10- Remove the strip (310-1) and the O' rings (412) from the gasket holder (559)

11- Rotate the disc counter-clockwise by 90°

12- Drive out the pins (561-2 and 561-3) inside the shaft (a receptacle is provided)

13- Drive out the drive shaft (213) by using a tie-rod

14- Remove the disc (550) and retain the spacer bushes (543-1 and 543-2)

15- Extract the strips (310-2 and 310-3) pinching the collar and pulling up

**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 1 - 1**

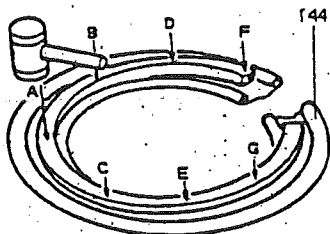
**KIT 1 : METAL SEAT ASSEMBLY**

**WAFER AND LUG BODIES CL150, CL300 AND CL600 : NPS ≤ 250-10"**

**FLANGED BODIES CL150 : NPS = 50-2"**

**FLANGED BODIES CL300 AND CL600 : NPS ≤ 80-3"**

- 1- Set the disc in open position
- 2- For a standard metal seat, install the reaction ring (50-5) on the new seat (144) if these two parts are supplied separately. Two procedures of assembly are possible :
  - Heat the reaction ring up to 200° C so that it can be inserted easily into the seat
  - Or, install the reaction ring as per the procedure described below :



Hold the ring engaged in A, then engage it progressively, either manually or using a mallet in (B,C), (D,E), (F,G). Perform these operations with the part lying flat on a workstand

- 3- Coat all the static and dynamic toroids of seat (144) with a thin and regular coat of PTFE or molybdenum disulphide

**For a standard metal seat**

- 4- Position manually the new flexible seat (144) fitted with its reaction ring (50-5) into the body (with reaction ring facing down)
- 5- Install the tightening ring (50-6), the external cylindric part of which being coated with a thin and regular coat of PTFE or molybdenum disulphide

**For a H.P. metal seat**

- 4- Position manually the static joint into the body
- 5- Install the seat (144), the external cylindric part of which being coated with a thin and regular coat of PTFE or molybdenum disulphide

- 6- Install the tightening flange (72-3)

- 7- The tightening flange (72-3) is placed under a press (see annex1-I) or using a flange attached to the valve flange by four tie-rods (see annex1-II), ensuring that the tightening flange remains parallel to the body flange face during the phase of engagement into the seat

- 8- Operate several times and check that there is a glossy and regular trace around the edge of the disc and on the flexible seat

MAINTENANCE MANUAL  
DANAIS TBT II

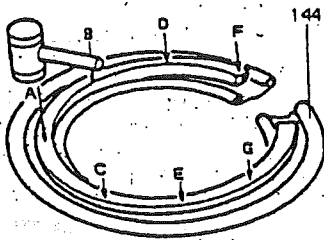
R355-070036  
Date : 06/01

SHEET A - 1 - 2

KIT 1 : METAL SEAT ASSEMBLY

WAFFER AND LUG BODIES CL150, CL300 AND CL600 : NPS  $\geq$  300-12"

- 1- Set the disc in closed position
- 2- For a standard metal seat, install the reaction ring (50-5) on the new seat (144) if these two parts are supplied separately. Two procedures of assembly are possible :
  - Heat the reaction ring up to 200° C so that it can be inserted easily into the seat
  - Or, install the reaction ring as per the procedure described below :



Hold the ring engaged in A, then engage it progressively, either manually or using a mallet in (B,C), (D,E), (F,G). Perform these operations with the part lying flat on a workstand

- 3- Coat all the static and dynamic toroids of seat (144) with a thin and regular coat of PTFE or molybdenum disulphide

For a standard metal seat

- 4- Position manually the new flexible seat (144) fitted with its reaction ring (50-5) into the body (with reaction ring facing down)
- 5- Install the tightening ring (50-6), the external cylindric part of which being coated with a thin and regular coat of PTFE or molybdenum disulphide
- 6- Install the tightening flange (72-3)
- 7- Place the screws (914) and tighten them slightly
- 8- Open the disc (550)
- 9- Tighten the screws (914) until the torque value defined in annex 3

For a H.P. metal seat

- 4- Position manually the static joint into the body
- 5- Install the seat (144), the external cylindric part of which being coated with a thin and regular coat of PTFE or molybdenum disulphide

- 10- Operate several times and check that there is a glossy and regular trace around the edge of the disc and on the flexible seat

**MAINTENANCE MANUAL  
DANAIS TBT II**

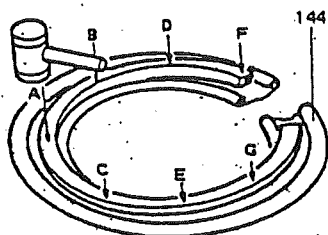
**R355-070036  
Date : 06/01**

**SHEET A - 1 - 3**

**KIT 1 : METAL SEAT ASSEMBLY**

**FLANGED BODIES CL150 : NPS  $\geq$  65-2"1/2  
FLANGED BODIES CL300 AND CL600 : NPS  $\geq$  100-4"**

- 1- Set the disc in closed position
- 2- For a standard metal seat, install the reaction ring (50-5) on the new seat (144) if these two parts are supplied separately. Two procedures of assembly are possible :
  - Heat the reaction ring up to 200° C so that it can be inserted easily into the seat
  - Or, install the reaction ring as per the procedure described below :



Hold the ring engaged in A, then engage it progressively, either manually or using a mallet in (B,C), (D,E), (F,G). Perform these operations with the part lying flat on a workstand

- 3- Coat all the static and dynamic toroids of seat (144) with a thin and regular coat of PTFE or molybdenum disulphide

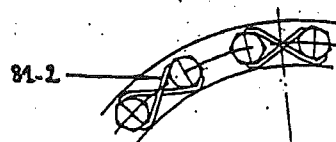
**For a standard metal seat**

- 4- Position manually the new flexible seat (144) fitted with its reaction ring (50-5) into the body (with reaction ring facing down)
- 5- Install the tightening ring (50-6), the external cylindric part of which being coated with a thin and regular coat of PTFE or molybdenum disulphide

**For a H.P. metal seat**

- 4- Position manually the static joint into the body
- 5- Install the seat (144), the external cylindric part of which being coated with a thin and regular coat of PTFE or molybdenum disulphide

- 6- Install the centering flange (72-2), the tightening flange (72-3) and the retaining ring (932)
- 7- Place the screws (901-3) and tighten them slightly
- 8- Open the disc (550)
- 9- Tighten the screws (901-3) until the torque value defined in annex 3
- 10- Install the wire (81-2) on the screws head (901-3) as shown below
- 11- Operate several times and check that there is a glossy and regular trace around the edge of the disc and on the flexible seat



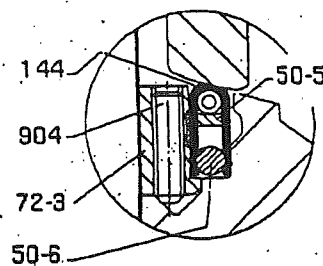
**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

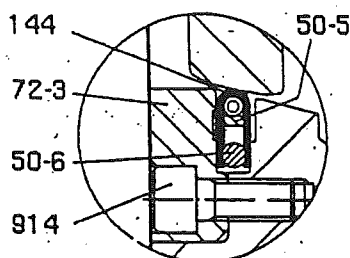
**SHEET A - 1 - 4**

**KIT 1 : PTFE SEAT ASSEMBLY**

**WAFER, LUG AND FLANGED BODIES CL150 : NPS : 2" TO 10"**



- 1- Set the disc in open position
- 2- Install the loading spring and the reaction ring (50-5) into the new seat (144)
- 3- Install the reaction ring (50-6)
  - To mount those parts into the seat, it is necessary to heat the plastomer seat between 80° C and 100°C in an oven or a boiling water tank.
- 4- Place the seat 144 into the body valve
- 5- Install the tightening flange (72-3) and the screws (904)
- 6- Tighten the screws (904) progressively in star-type tightening up to contact between the flange (72-3) into the body
- 7- Tighten the screws until the torque defined in annex 3

**MAINTENANCE MANUAL  
DANAIS TBT II****R355-070036  
Date : 06/01****SHEET A-1-5****KIT 1 : PTFE SEAT ASSEMBLY****WAFER AND LUG BODIES CL150 : NPS : 12" TO 24"**

- 1- Set the disc in closed position
- 2- Install the loading spring and the reaction ring (50-5) into the new seat (144)
- 3- Install the reaction ring (50-6)

- To mount those parts into the seat, it is necessary to heat the plastomer seat between 80° C and 100°C in an oven or a boiling water tank.

- 4- Place manually the seat (144) into the body valve
- 5- Install the tightening flange (72-3)
- 6- Place the screws (914) and tighten them lightly
- 7- Open the disc
- 8- Tighten the screws (914) until the torque defined in annex 3

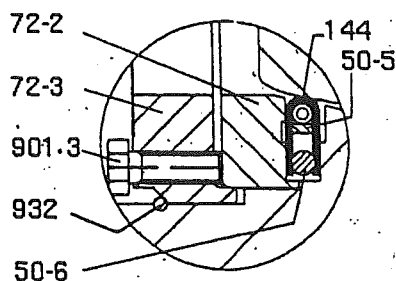
**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 1 - 6**

**KIT 1 : PTFE SEAT ASSEMBLY**

**FLANGED BODIES CL150 : NPS : 12" TO 24"**



- 1- Set the disc in closed position
- 2- Install the loading spring and the reaction ring (50-5) into the new seat (144)
- 3- Install the reaction ring (50-6)
  - To mount those parts into the seat, it is necessary to heat the plastomer seat between 80° C and 100°C in an oven or a boiling water tank.
- 4- Place manually the seat (144) into the body valve
- 5- Install the centring flange (72-2), the tightening flange (72-3) and the retaining ring (932)
- 6- Place the screws (901.3) and tighten them lightly
- 7- Open the disc
- 9- Tighten the screws (901.3) until the torque defined in annex 3



**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

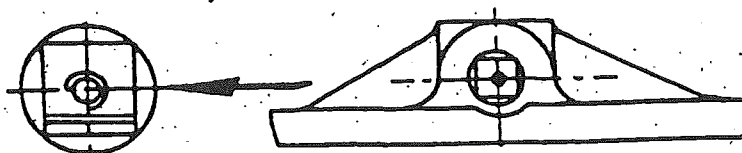
**SHEET A - 2 - 1 (Page 1/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**WAFER AND LUG BODIES CL150 : NPS ≤ 250-10"**

**WAFER AND LUG BODIES CL300 : NPS ≤ 200-8"**

- 1- Install the strips (310-2 and 310-3) checking that they are plated against the borings
- 2- Position the disc into the body in opened position and preventing the edge of the disc from possible shocks.
- 3- Install the thrust inserts (553-1 and 553-2) on the shaft (213)
- 4- Install the shaft (213) in the disc (550) making sure that the holes of the pins (561-2 and 561-3) are positionned in the same plan. And make sure that the locating groove of the square is positionned parallel and on the same side as the disc (as per diagram below)



- 5- Install the pin (561-2 and 561-3) and engage them in their final position using a mallet and a bronze drift
- 6- Install the spacer bush (543) into the body (100)
- 7- Coat the torus of the lip seal ring (415-2 : In option) with a thin and regular coating of PTFE or molybdenum disulphide and install it
- 8- Install the shaft (212), making sure that the locating pin is in the same position as the locating groove of the shaft (213)
- 9- Coat the torus of the static joint (41-2 or 41-2-1) with a thin and regular coating of PTFE or molybdenum disulphide
- 10- Coat the boring of the body (100) and the protrusion of the extension (13-21) with a thin and regular coating of PTFE or molybdenum disulphide
- 11- Position the static joint (41-2 or 41-2-1) manually into the body without forcing
- 12- Install the extension (13-21) and slide it down carefully along the intermediate shaft (212) until contact with the lip seal ring (41-2 or 41-2-1)
- 13- Install the studs (902), the adjusting rings (512) and the nuts (920) without tightening them

**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 2 - 1 (Page 2/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**WAFER AND LUG BODIES CL150 : NPS ≤ 250-10"**

**WAFER AND LUG BODIES CL300 : NPS ≤ 200-8"**

- 14- Insert the lip seal ring (415-1), the thrust insert (553-3) and the sealing packing (01-48) into the extension (13-21) using the installation tool shown in annex 4
- 15- Apply a thin coat of silicon grease on the O' rings (412) and install them on the gasket holder (559)
- 16- Install the strip (310-1) in the gasket holder (559), checking that it is plated against the boring
- 17- Insert the gasket holder (559) equipped into the extension (13-21)
- 18- Install the washers (554) and the screws (901-1) without tightening them
- 19- Torque the nuts (920) as per the procedure and the value defined in annex 3 making sure that the flange of the extension (13-21) and the flange of the body (100) remain parallel during the phase of fitting into the static joint (41-2 or 41-2-1)
- 20- Torque the screws (901-1) according to the value defined in annex 3
- 21- Install the outer ring (932-2)
- 22- Install the seat (144), proceeding as per KIT 1, using the sheet A - 1 - 1

**MAINTENANCE MANUAL  
DANAIS TBT II**

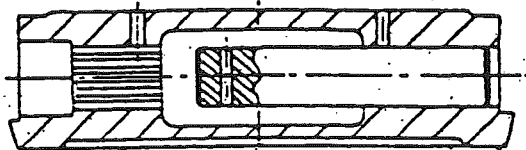
**R355-070036  
Date : 06/01**

**SHEET A - 2 - 2 (Page 1/2)**

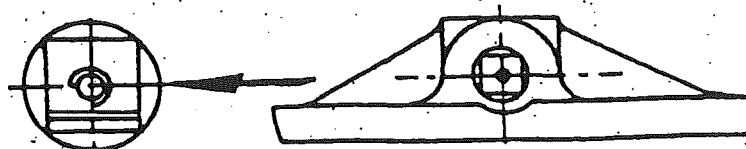
**KIT 2 : ASSEMBLY OF THE VALVE**

**WAFER AND LUG BODIES CL150 : NPS = 300-12"  
WAFER, LUG AND FLANGED BODIES CL300 : 250-10" ≤ NPS ≤ 550-22"**

- 1- Install the strips (310-2 and 310-3) checking that they are plated against the borings
- 2- Install and hold the spacer bushes (543-1 and 543-2) in place
- 3- Install the shaft (210) in the disc (550) without placing it to its final position, as per the diagram below, making sure that the holes of the pins (561-2 and 561-3) are positionned in the same plan of the shaft (210) and the disc (550)



- 4- Position the disc into the body in closed position (disc facing down) with the body in horizontal position (seat facing up) and preventing the edge of the disc from possible shocks
- 5- Engage the shaft (210) up to its final position
- 6- Install the pin (561-3)
- 7- Install the shaft (213) in the body (100) and the disc (550) making sure that the locating groove of the square is positionned parallel and on the same side as the disc (as per diagram below)



- 8- Install the pin (561-2) and engage both pins (561-2 and 561-3) in their final position using a mallet and a bronze drift
- 9- Coat the torus of the lip seal ring (415-2 : In option) with a thin and regular coating of PTFE or molybdenum disulphide and install it
- 10- Install the intermediate shaft (212) making sure that its locating pin is in the same position as the locating groove of the drive shaft (213)
- 11- Coat the torus of the static joint (41-2) with a thin and regular coating of PTFE or molybdenum disulphide

**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 2 - 2 (Page 2/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**WAFER AND LUG BODIES CL150 : NPS = 300-12"  
WAFER, LUG AND FLANGED BODIES CL300 : 250-10" ≤ NPS ≤ 550-22"**

- 12- Coat the boring of the body (100) and the protrusion of the extension (13-21) with a thin and regular coating of PTFE or molybdenum disulphide
- 13- Position the static joint (41-2) manually into the body without forcing
- 14- Install the extension (13-21) and slide it down carefully along the intermediate shaft (212) until contact with the lip seal ring (41-2)
- 15- Install the studs (902), the adjusting rings (512) and the nuts (920) without tightening them
- 16- Insert the lip seal ring (415-1), the thrust insert (553-3) and the sealing packing (01-48) into the extension (13-21) using the installation tool shown in annex 4
- 17- Apply a thin coat of silicon grease on the O' rings (412) and install them on the gasket holder (559)
- 18- Install the strip (310-1) in the gasket holder (559), checking that it is plated against the boring
- 19- Insert the gasket holder (559) equipped into the extension (13-21)
- 20- Install the washers (554) and the screws (901-1) without tightening them
- 21- Torque the nuts (920) as per the procedure and the value defined in annex 3 making sure that the flange of the extension (13-21) and the flange of the body (100) remain parallel during the phase of fitting into the static joint (41-2)
- 22- Torque the screws (901-1) according to the value defined in annex 3
- 23- Install the outer ring (932-2)
- 24- Install the seat (144), proceeding as per KIT 1, using the sheet :
  - D - 1 - 1 for wafer or lug bodies : CL300 → NPS = 250-10"
  - D - 1 - 2 for wafer or lug bodies : CL150 → NPS = 300-12"  
CL300 → 300-12" ≤ NPS ≤ 550-22"
  - D - 1 - 3 for flanged bodies

**MAINTENANCE MANUAL  
DANAIS TBT II**

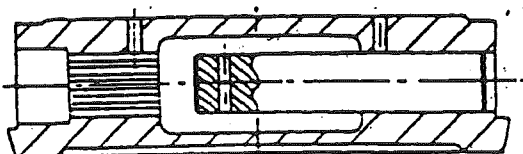
**R355-070036  
Date : 06/01**

**SHEET A - 2 - 3 (Page 1/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**WAFER AND LUG BODIES CL150 : 350-14" ≤ NPS ≤ 600-24"  
FLANGED BODIES CL150 : 300-12" ≤ NPS ≤ 600-24"**

- 1- Install the strips (310-2 and 310-3) checking that they are plated against the borings
- 2- Install and hold the spacer bushes (543-1 and 543-2) in place
- 3- Install the shaft (210) in the disc (550) without placing it to its final position, as per the diagram below, making sure that the holes of the shaft (210) and the disc (550) are positionned in the same plan



- 4- Position the disc into the body in closed position (disc facing down) with the body in horizontal position (seat facing down) and preventing the edge of the disc from possible shock
- 5- Engage the shaft (210) up to its final position

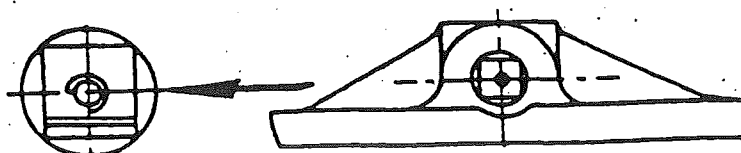
**For wafer and lug bodies**

- 6- Install the pin (561-3)

**For flanged bodies**

- 6- Install the retainers (930-4) and the screws (901-5) without tightening them

- 7- Coat the torus of the lip seal ring (415-2 : In option) with a thin and regular coating of PTFE or molybdenum disulphide and install it on the shaft (213)
- 8- Install the shaft (213) in the body (100) and the disc (550) making sure that the locating groove of the square is positionned parallel and on the same side as the disc (as per diagram below)



MAINTENANCE MANUAL  
DANAIS TBT II

R355-070036  
Date : 06/01

SHEET A - 2 - 3 (Page 2/2)

KIT 2 : ASSEMBLY OF THE VALVE

WAFFER AND LUG BODIES CL150 : 350-14"  $\leq$  NPS  $\leq$  600-24"

FLANGED BODIES CL150 : 300-12"  $\leq$  NPS  $\leq$  600-24"

For wafer/lug bodies

- 9- Install the pin (561-2) and engage both pins (561-2 and 561-3) in their final position using a mallet and a bronze drift

For flanged bodies

- 9- Install the retainers (930-3) and the screws (901-4) and tighten the screws (901-4 and 901-5) according to the annex 3

- 10- Coat the torus of the static joint (41-2 or 41-2-1) with a thin and regular coating of PTFE or molybdenum disulphide
- 11- Coat the boring of the body (100) and the protrusion of the extension (13-21) with a thin and regular coating of PTFE or molybdenum disulphide
- 12- Position the static joint (41-2 or 41-2-1) manually into the body without forcing
- 13- Install the extension (13-21) and slide it down carefully along the intermediate shaft (213) until contact with the lip seal ring (41-2 or 41-2-1)
- 14- Install the studs (902), the adjusting rings (512) and the nuts (920) without tightening them
- 15- Insert the lip seal ring (415-1), the thrust insert (553-3) and the sealing packing (01-48) into the extension (13-21) using the installation tool shown in annex 4
- 16- Apply a thin coat of silicon grease on the O' rings (412) and install them on the gasket holder (559)
- 17- Install the strip (310-1) in the gasket holder (559), checking that it is placed against the boring
- 18- Insert the gasket holder (559) equipped into the extension (13-21)
- 19- Install the washers (554) and the screws (901-1) without tightening them
- 20- Torque the nuts (920) as per the procedure and the value defined in annex 3 making sure that the flange of the extension (13-21) and the flange of the body (100) remain parallel during the phase of fitting into the static joint (41-2 or 41-2-1)
- 21- Torque the screws (901-1) according to the value defined in annex 3
- 22- Install the seat (144), proceeding as per KIT 1, using the sheet :

• A - 1 - 2 for wafer or lug bodies

• A - 1 - 3 for flanged bodies

**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 2 - 4 (Page 1/2)**

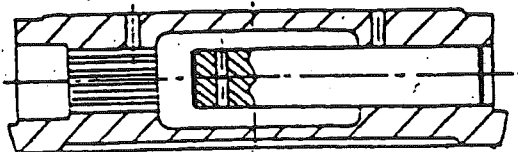
**KIT 2 : ASSEMBLY OF THE VALVE**

**WAFFER, LUG AND FLANGED BODIES CL150 : NPS  $\geq$  650-26"**

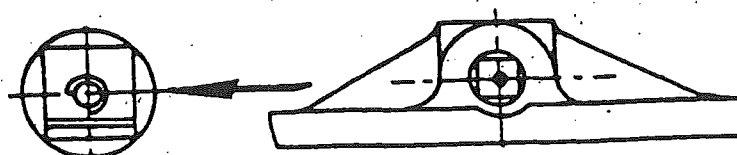
**WAFFER, LUG AND FLANGED BODIES CL300 : NPS  $\geq$  600-24"**

**WAFFER, LUG AND FLANGED BODIES CL600 : NPS  $\geq$  400-16"**

- 1- Install the strips (310-2 and 310-3) checking that they are plated against the borings
- 2- Install and hold the spacer bushes (543-1 and 543-2) in place
- 3- Install the shaft (210) in the disc (550) without placing it to its final position, as per the diagram below, making sure that the holes of the pins (561-3) are positionned in the same plan of the shaft (210) and the disc (550)



- 4- Position the disc into the body in closed position (disc facing down) with the body in horizontal position (seat facing down) and preventing the edge of the disc from possible shocks
- 5- Engage the shaft (210) up to its final position
- 6- Install the pin (561-3)
- 7- Engage the taper pins (56-2) in the bottom of their housing of the disc, the flats in the side of the operating shaft
- 8- Coat the torus of the lip seal ring (415-2 : In option) with a thin and regular coating of PTFE or molybdenum disulphide and install it
- 9- Install the shaft (213) in the body (100) and the disc (550) making sure that the locating groove of the square is positionned parallel and on the same side as the disc (as per diagram below)



- 10- Place the washers (931) and the screws (901-2). Tighten them until the torque value defined in annex 3



**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 2 - 4 (Page 2/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**WAFER, LUG AND FLANGED BODIES CL150 : NPS ≥ 650-26"**

**WAFER, LUG AND FLANGED BODIES CL300 : NPS ≥ 600-24"**

**WAFER, LUG AND FLANGED BODIES CL600 : NPS ≥ 400-16"**

- 11- Install the pin (561-2) and engage both pins (561-2 and 561-3) in their final position using a mallet and a bronze drift
- 12- Coat the torus of the static joint (41-2 or 41-2-2) with a thin and regular coating of PTFE or molybdenum disulphide
- 13- Coat the boring of the body (100) and the protrusion of the extension (13-21) with a thin and regular coating of PTFE or molybdenum disulphide
- 14- Position the static joint (41-2 or 41-2-2) manually into the body without forcing
- 15- Install the extension (13-21) and slide it down carefully along the shaft (213) until contact with the lip seal ring (41-2 or 41-2-2)
- 16- Install the studs (902), the adjusting rings (512) and the nuts (920) without tightening them
- 17- Insert the lip seal ring (415-1), the thrust insert (553-3) and the sealing packing (01-48) into the extension (13-21) using the installation tool shown in annex 4
- 18- Apply a thin coat of silicon grease on the O' rings (412) and install them on the gasket holder (559)
- 19- Install the strip (310-1) in the gasket holder (559), checking that it is plated against the boring
- 20- Insert the gasket holder (559) equipped into the extension (13-21)
- 21- Install the washers (554) and the screws (901-1) without tightening them
- 22- Torque the nuts (920) as per the procedure and the value defined in annex 3 making sure that the flange of the extension (13-21) and the flange of the body (100) remain parallel during the phase of fitting into the static joint (41-2)
- 23- Torque the screws (901-1) according to the value defined in annex 3
- 24- Install the seat (144), proceeding as per KIT 1, using the sheet :
  - A - 1 - 2 for wafer or lug bodies
  - A - 1 - 3 for flanged bodies

**MAINTENANCE MANUAL  
DANAIS TBT II**

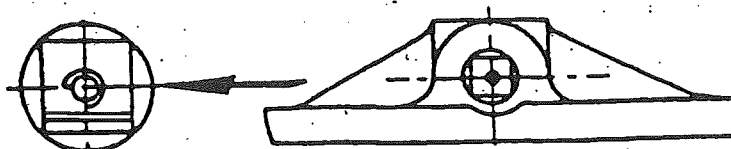
**R355-070036  
Date : 06/01**

**SHEET A - 2 - 5 (Page 1/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**FLANGED BODIES CL150 : 200-8"  $\leq$  NPS  $\leq$  250-10"  
WAFFER, LUG AND FLANGED BODIES CL600 : NPS  $\leq$  350-14"**

- 1- Install the strips (310-2 and 310-3) checking that they are plated against the borings
- 2- Install and hold the spacer bushes (543-1 and 543-2) in place
- 3- Position the disc into the body in closed position and preventing the edge of the disc from possible shocks
- 4- Coat the torus of the lip seal ring (415-2 : In option) with a thin and regular coating of PTFE or molybdenum disulphide and install it on the shaft (213)
- 5- Install the shaft (213) in the disc (550) making sure that the holes of the screws (901-4 and 901-5) are positionned in the same plan. And make sure that the locating groove of the square is positionned parallel and on the same side as the disc (as per diagram below)



- 6- Rotate the disc (550) and the operating shaft in open position
- 7- Align the two screws holes between the shaft (213) and the disc (550)
- 8- Install the nuts (920-3 and 920-4), the screws (901-4 and 901-5) and the retainers (930-3 and 930-4)
- 9- Coat the torus of the static joint (41-2 or 41-2-1) with a thin and regular coating of PTFE or molybdenum disulphide
- 10- Coat the boring of the body (100) and the protrusion of the extension (13-21) with a thin and regular coating of PTFE or molybdenum disulphide
- 11- Position the static joint (41-2 or 41-2-1) manually into the body without forcing
- 12- Install the extension (13-21) and slide it down carefully along the shaft (213) until contact with the static joint (41-2 or 41-2-1)
- 13- Install the studs (902), the adjusting rings (512) and the nuts (920) without tightening them
- 14- Insert the lip seal ring (415-1), the thrust insert (553-3) and the sealing packing (01-48) into the extension (13-21) using the installation tool shown in annex 4

**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 2 - 5 (Page 2/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**FLANGED BODIES CL150 :  $200-8'' \leq NPS \leq 250-10''$   
WAFFER, LUG AND FLANGED BODIES CL600 :  $NPS \leq 350-14''$**

- 15- Apply a thin coat of silicon grease on the O' rings (412) and install them on the gasket holder (559)
- 16- Install the strip (310-1) in the gasket holder (559), checking that it is plated against the boring
- 17- Insert the gasket holder (559) equipped into the extension (13-21)
- 18- Install the washers (554) and the screws (901-1) without tightening them
- 19- Torque the nuts (920) as per the procedure and the value defined in annex 3 making sure that the flange of the extension (13-21) and the flange of the body (100) remain parallel during the phase of fitting into the static joint (41-2 or 41-2-1)
- 20- Torque the screws (901-1) according to the value defined in annex 3
- 21- Install the seat (144), proceeding as per KIT 1, using the sheet :
  - A - 1 - 1 for wafer or lug bodies : CL600  $\rightarrow NPS \leq 250-10''$   
for flanged bodies : CL600  $\rightarrow NPS \leq 80-3''$
  - A - 1 - 2 for wafer or lug bodies : CL600  $\rightarrow 300-12'' \leq NPS \leq 350-14''$
  - A - 1 - 3 for flanged bodies : CL150  $\rightarrow 200-8'' \leq NPS \leq 250-10''$   
: CL600  $\rightarrow 100-4'' \leq NPS \leq 350-14''$

**MAINTENANCE MANUAL  
DANAIS TBT II**

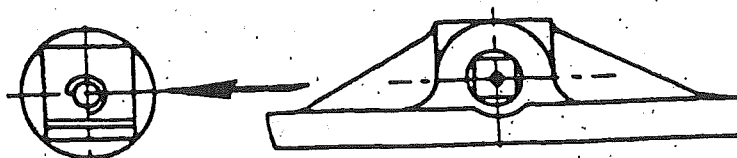
**R355-070036  
Date : 06/01**

**SHEET A - 2 - 6 (Page 1/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**FLANGED BODIES CL150 : NPS ≤ 150-6"  
FLANGED BODIES CL300 : NPS ≤ 200-8"**

- 1- Install the strips (310-2 and 310-3) checking that they are plated against the borings
- 2- Install and hold the spacer bushes (543-1 and 543-2) in place
- 3- Position the disc into the body in open position and preventing the edge of the disc from possible shocks
- 4- Install the shaft (213) in the disc (550) making sure that the holes of the pins (561-2 and 561-3) are positionned in the same plan. And make sure that the locating groove of the square is positionned parallel and on the same side as the disc (as per diagram below)



- 5- Install the pin (561-2 and 561-3) and engage them in their final position using a mallet and a bronze drift
- 6- Coat the torus of the lip seal ring (415-2 : In option) with a thin and regular coating of PTFE or molybdenum disulphide and install it
- 7- Install the shaft (212), making sure that the locating pin is in the same position as the locating groove of the shaft (213)
- 8- Coat the torus of the static joint (41-2) with a thin and regular coating of PTFE or molybdenum disulphide
- 9- Coat the boring of the body (100) and the protrusion of the extension (13-21) with a thin and regular coating of PTFE or molybdenum disulphide
- 10- Position the static joint (41-2) manually into the body without
- 11- Install the extension (13-21) and slide it down carefully along the intermediate shaft (212) until contact with the lip seal ring (41-2)
- 12- Install the studs (902), the adjusting rings (512) and the nuts (920) without tightening them
- 13- Insert the lip seal ring (415-1), the thrust insert (553-3) and the sealing packing (01-48) into the extension (13-21) using the installation tool shown in annex 4

**MAINTENANCE MANUAL  
DANAIS TBT II**

**R355-070036  
Date : 06/01**

**SHEET A - 2 - 6 (Page 2/2)**

**KIT 2 : ASSEMBLY OF THE VALVE**

**FLANGED BODIES CL150 : NPS  $\leq$  150-6"  
FLANGED BODIES CL300 : NPS  $\leq$  200-8"**

- 14- Apply a thin coat of silicon grease on the O' rings (412) and install them on the gasket holder (559)
- 15- Install the strip (310-1) in the gasket holder (559), checking that it is placed against the boring
- 16- Insert the gasket holder (559) equipped into the extension (13-21)
- 17- Install the washers (554) and the screws (901-1) without tightening them
- 18- Torque the nuts (920) as per the procedure and the value defined in annex 3 making sure that the flange of the extension (13-21) and the flange of the body (100) remain parallel during the phase of fitting into the static joint (41-2)
- 19- Torque the screws (901-1) according to the value defined in annex 3
- 20- Install the outer ring (932-2)
- 21- Install the seat (144), proceeding as per KIT 1, using the sheet :
  - A - 1 - 1 for flanged bodies :
    - CL150  $\rightarrow$  NPS = 50-2"
    - CL300  $\rightarrow$  NPS  $\leq$  80-3"
  - A - 1 - 3 for flanged bodies :
    - CL150  $\rightarrow$  65-2"1/2  $\leq$  NPS  $\leq$  150-6"
    - CL300  $\rightarrow$  100-4"  $\leq$  NPS  $\leq$  200-8"

# MAINTENANCE MANUAL DANAIS TBT II

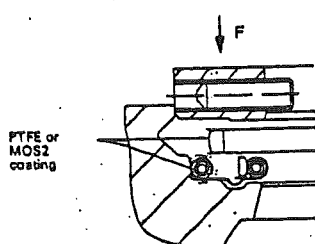
R355-070036  
Date : 06/01

## ANNEX 1

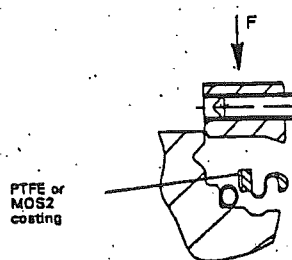
### TIGHTENING FLANGE ASSEMBLY

#### I - PRESS ASSEMBLY

Standard metal seat

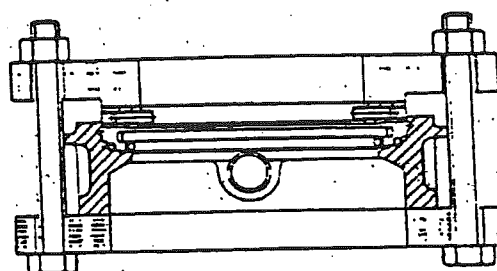


H.P. metal seat



DN	Minimum strenght values F in daN
50-2" to 100-4"	3000
125-5"	3500
150-6"	4000
200-8"	6500
250-10"	8000

#### II - ASSEMBLY WITH 2 FLANGES AND 4 SCREWS + NUTS



See annex 2 for flange dimensions

**NOTE :** - For this operation, ensuring that the tightening ring engages into the seat (for a standard metal seat) or the seat engages into the static joint (for a H.P. metal seat). Use the defined flange in annex 2, the raised face  $\phi B$  is used to tight the flange into the body.

- Tightening ring in place into the body, place the screws (904) and tighten them with F strenght on the flange. Tighten them until the torque value (see annex 3).
- Operate several times and check that there is a glossy and regular trace around the edge of the disc and on the flexible seat.

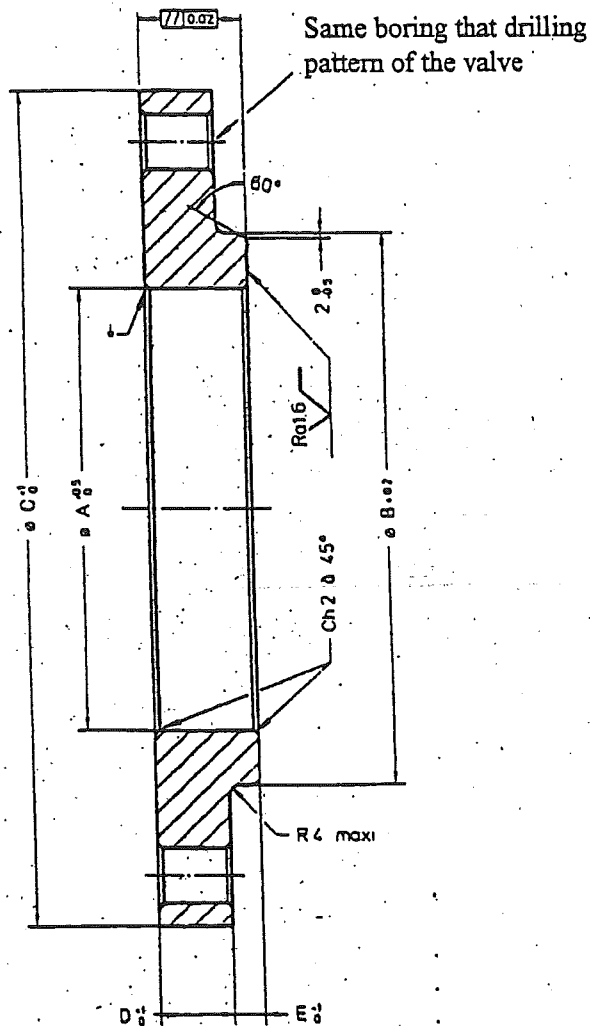
# MAINTENANCE MANUAL

## DANAIS TBT II

**R355-070036**  
**Date : 06/01**

ANNEX 2

## TOOL FOR FLANGE



Chamfer not defined : 1 to 2.5 to 45°

\* For NPS 2" and 2" 1/2, it is necessary to realize a chamfer 10 mm to 45°

			CL150	CL300		
DN	A	B	C		D	E
50-2"	44	72	152	165	10	12
65-2"1/2	57	90	178	190	15	12
80-3"	70	105	190	210	24	12
100-4"	90	127	229	254	24	12
125-5"	110	147	254	279	24	12
150-6"	135	172	279	318	25	12
200-8"	180	228	343	381	28	12
250-10"	228	273	406	444	30	12

# MAINTENANCE MANUAL DANAIS TBT II

R355-070036  
Date : 06/01

## ANNEX 3

### TIGHTENING TORQUE OF THE BOLTING

#### ASSEMBLY CONDITION

**LUBRICATION :** All torques defined in this annex are for lubricated bolting with a basis molybdenum disulphide product (sliding varnish or paste).

**TIGHTENING MODE :** The tightening mode on all parts is realized in "star-type". This tightening mode avoids an eventually sliding of the joints and ensures a good homogeneity strenght.  
The completely tightening requires four to six rotations according to the defined torque.

#### TIGHTENING TORQUE OF THE SCREWS (in m.daN)

Apply the allowance 0 to + 5 % at torque values defined the table below :

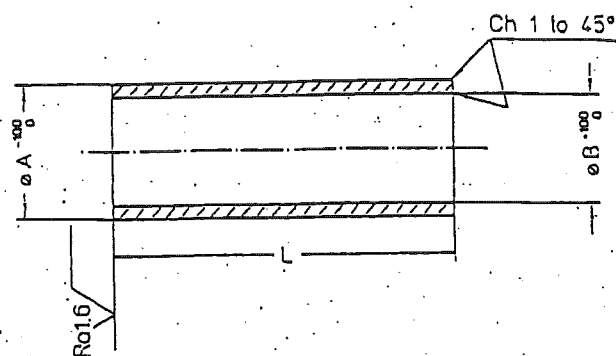
	Screws of the tightening flange		Screws of the gasket holder	Screws of the extension or of the shaft	Screws of the taper pin
	Wafer and lug bodies	Flanged bodies			
	904-1; 914	901-3			
			901-1	920; 920-1; 920-2; 920-3; 920-4	901-2
M5	0,50		0,50	0,60	
M6	0,75	0,20	0,75	1,00	
M8	1,80	0,40	1,80	2,30	
M10	3,50	3,00	3,50	4,60	
M12	6,00	4,50	6,00	8,00	
M14	9,50	6,50	9,50	13,00	
M16	14,50	10,00	14,50	19,00	
M18	20,00		20,00	26,00	12,50
M20	28,50		28,50	37,50	18,00
M22	37,50		37,50	50,00	23,50
M24	48,00		48,00	60,00	30,00
M27				60,00	44,00
M30				60,00	55,00
M33				60,00	60,00
M36				60,00	60,00



MAINTENANCE MANUAL  
DANAIS TBT II

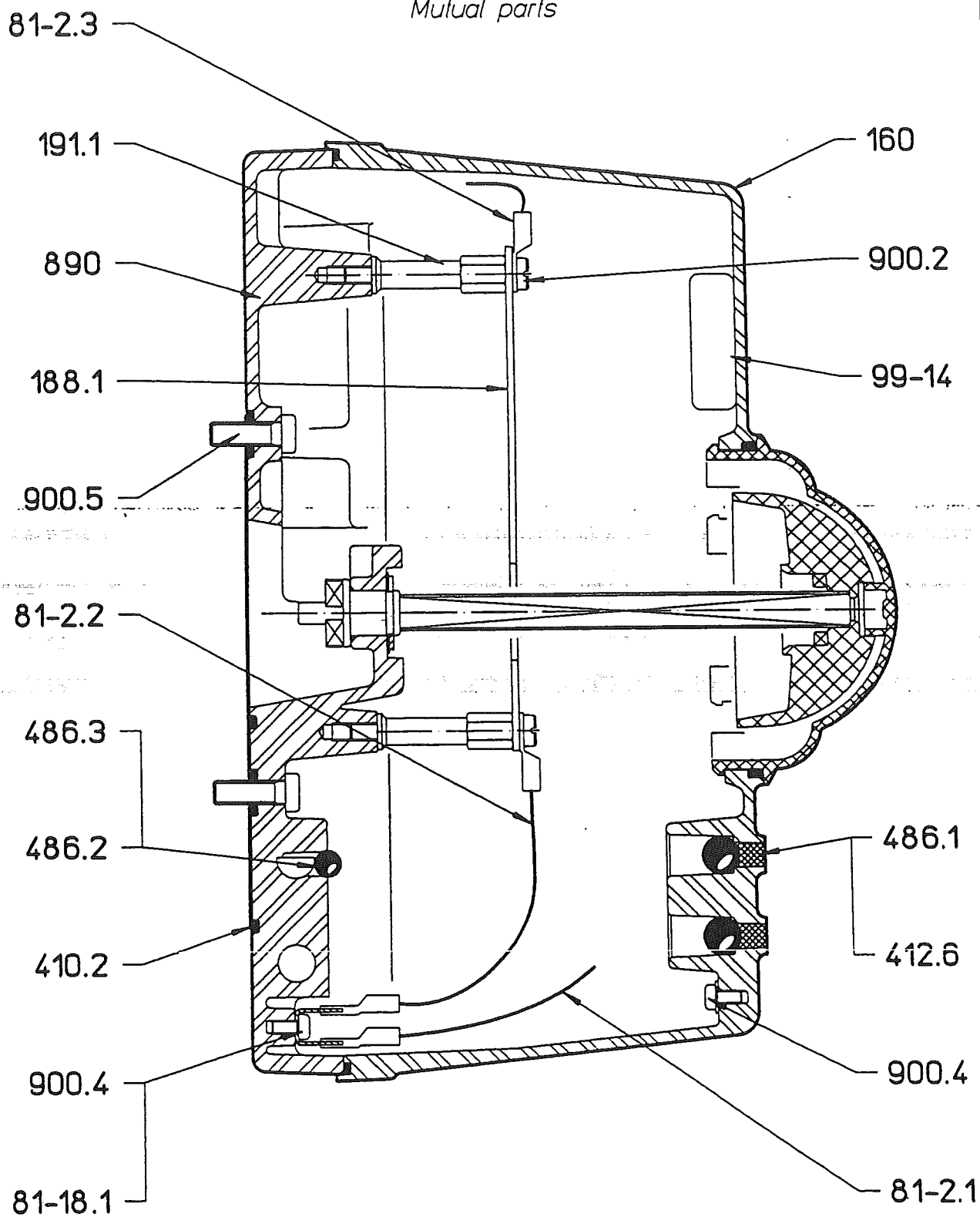
R355-070036  
Date : 06/01

ANNEX 4



NPS	WAFER / LUG BODIES									FLANGED BODIES								
	CL150			CL300			CL600			CL150			CL300			CL600		
	φ A	φ B	L	φ A	φ B	L	φ A	φ B	L	φ A	φ B	L	φ A	φ B	L	φ A	φ B	L
3"										44	30	110						
4"										44	30	110						
6"										61	41	120						
8"	66	46	130	74	54	130				66	46	130	74	54	130			
10"	74	54	130	80	60	130				66	46	130	80	60	130	80	60	150
12"	80	60	130	96	76	130				74	54	130	96	76	130			
14"	74	54	130	96	76	130				74	54	130	96	76	130	96	76	150
16"	80	60	130	125	105	150				80	60	130	125	105	150			
18"	80	60	130	140	120	150				80	60	130	140	120	150	125	105	150
20"	96	76	130	155	135	150				96	76	130	155	135	150	125	105	175
22"	96	76	130							125	105	130						
24"	96	76	130	125	105	150				96	76	150	125	105	150	145	125	175
26"	125	105	150							125	105	150						
28"	155	135	150							155	135	150						
30"	125	105	150	145	125	175				125	105	150	145	125	175			
32"				155	135	175							155	135	175			
34"				165	145	175							165	145	175			
36"	145	125	175							145	125	175						
38"																		
40"																		
42"	145	125	175							145	125	175						
44"																		
48"	165	145	175							165	145	175						
52"																		
54"																		
56"																		
60"																		
64"																		
66"																		

Pièces communes  
Mutual parts

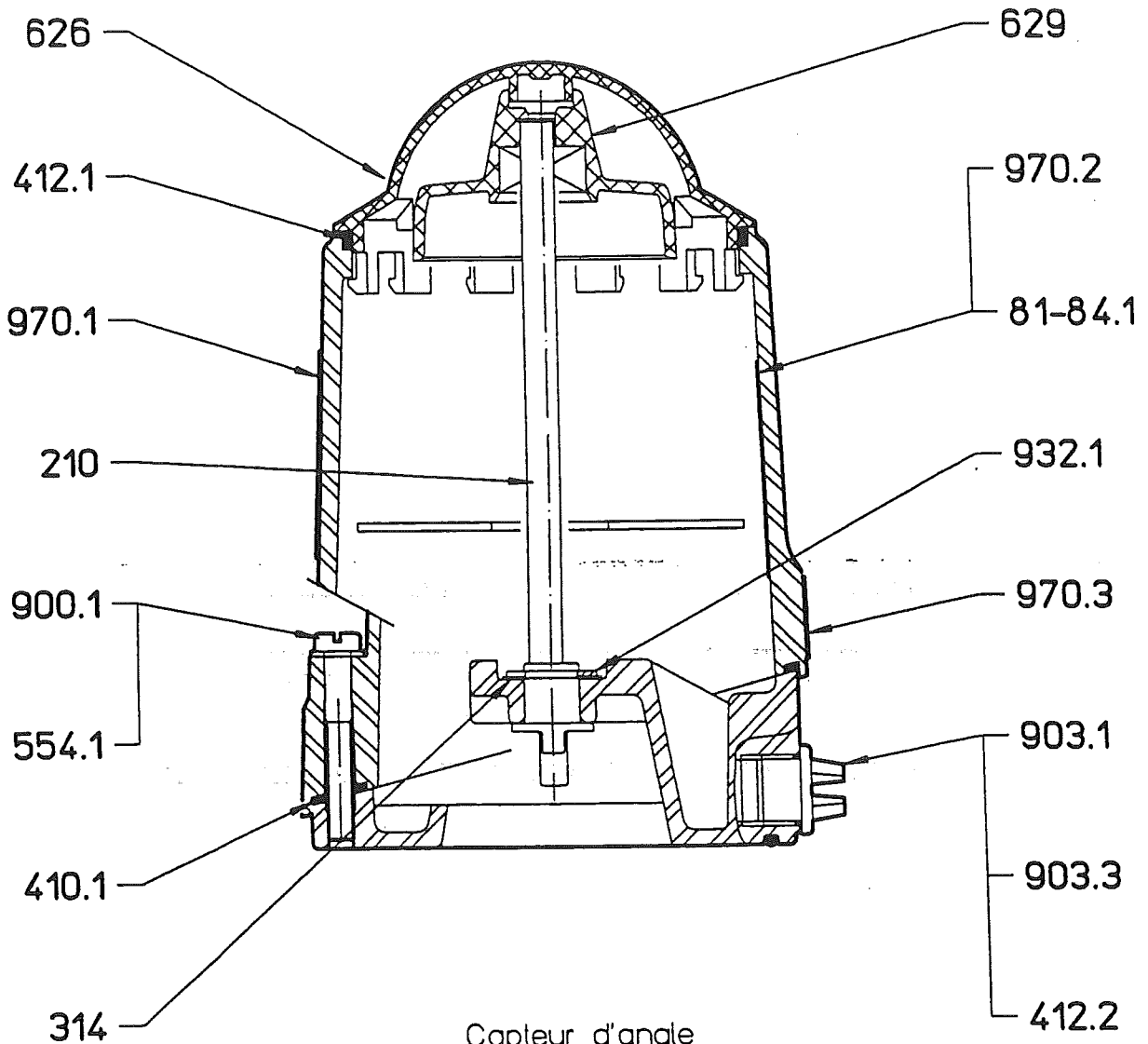


A	23-02-99	First issue	CB

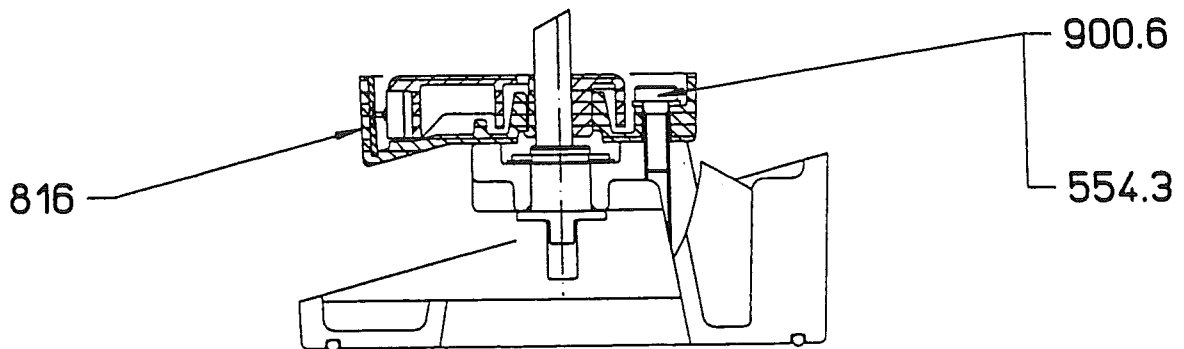
DRAWN BY : *gwy* CB 23-Feb-1999  
CHECKED BY : *LB* LB 3-Mar-1999

L-J28-046-A-1

Pièces communes  
Mutual parts



Capteur d'angle  
Angle sensor



A	23-02-99	First issue	CB

DRAWN BY : *aw* CB 23-Feb-1999  
CHECKED BY : *LB* LB 3-Mar-1999

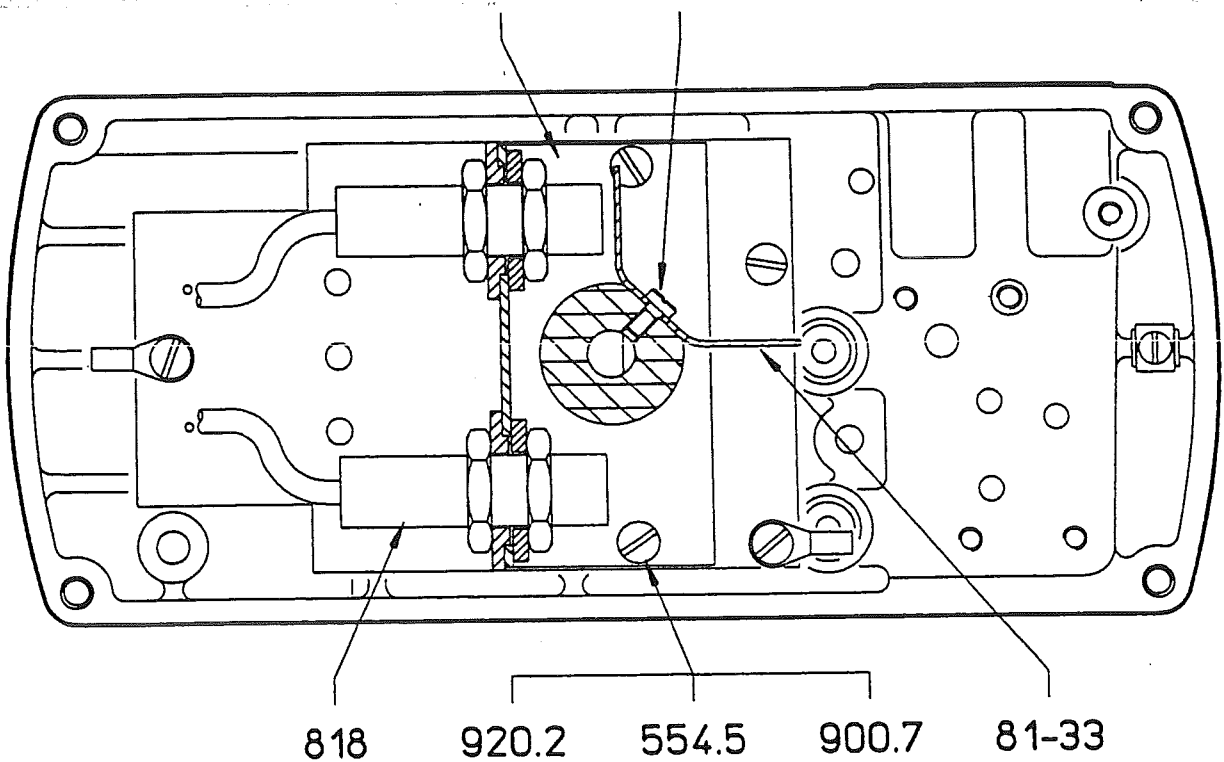
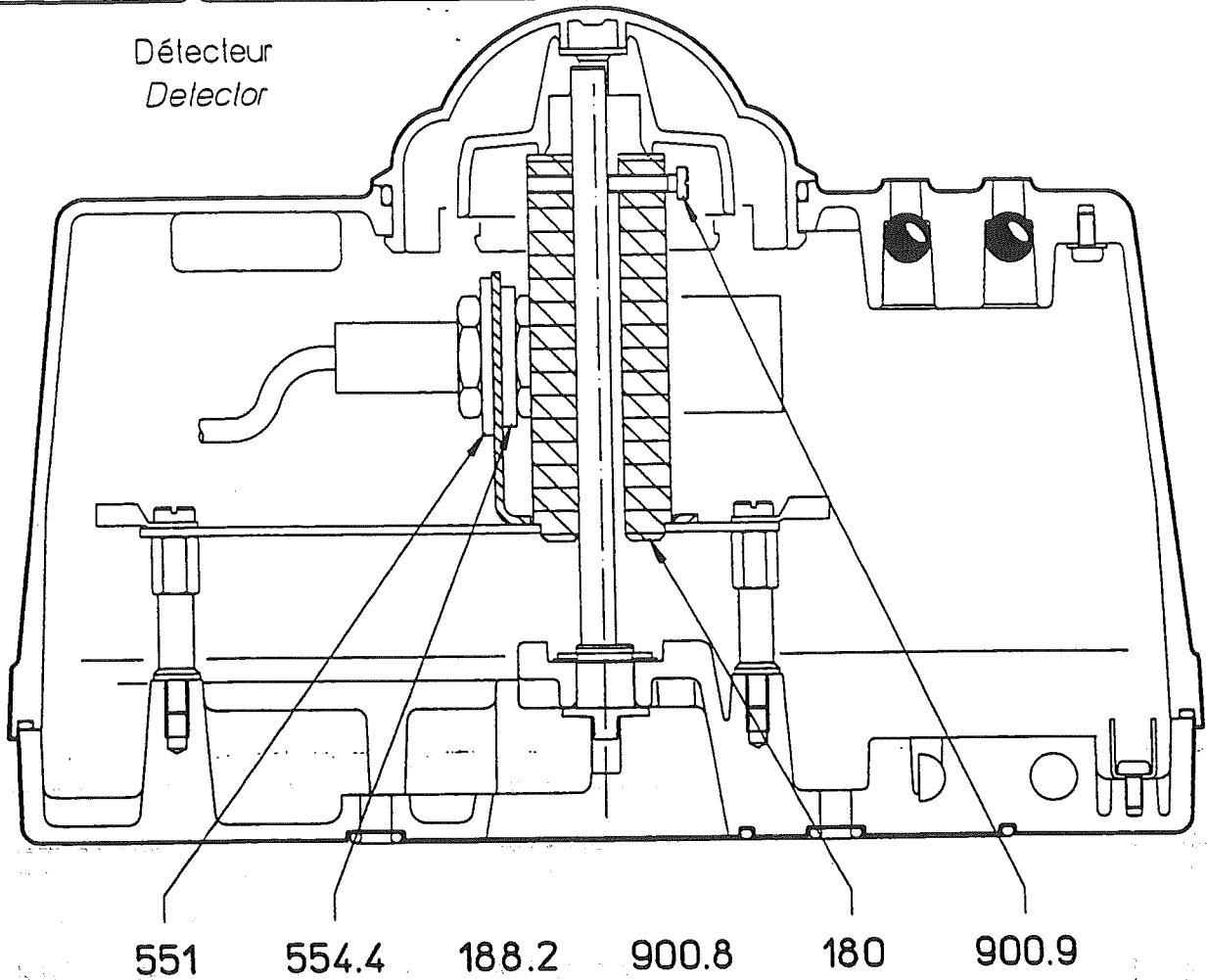
L-J28-046-A-2

ami.KSB

Proximity switches  
type ø12 lg.35 to 80

AMTRONIC  
RA.1141

Décteur  
Delector



A	23-02-99	First issue	CB

DRAWN BY : *sw* CB 23-Feb-1999  
CHECKED BY : *LB* LB 3-Mar-1999

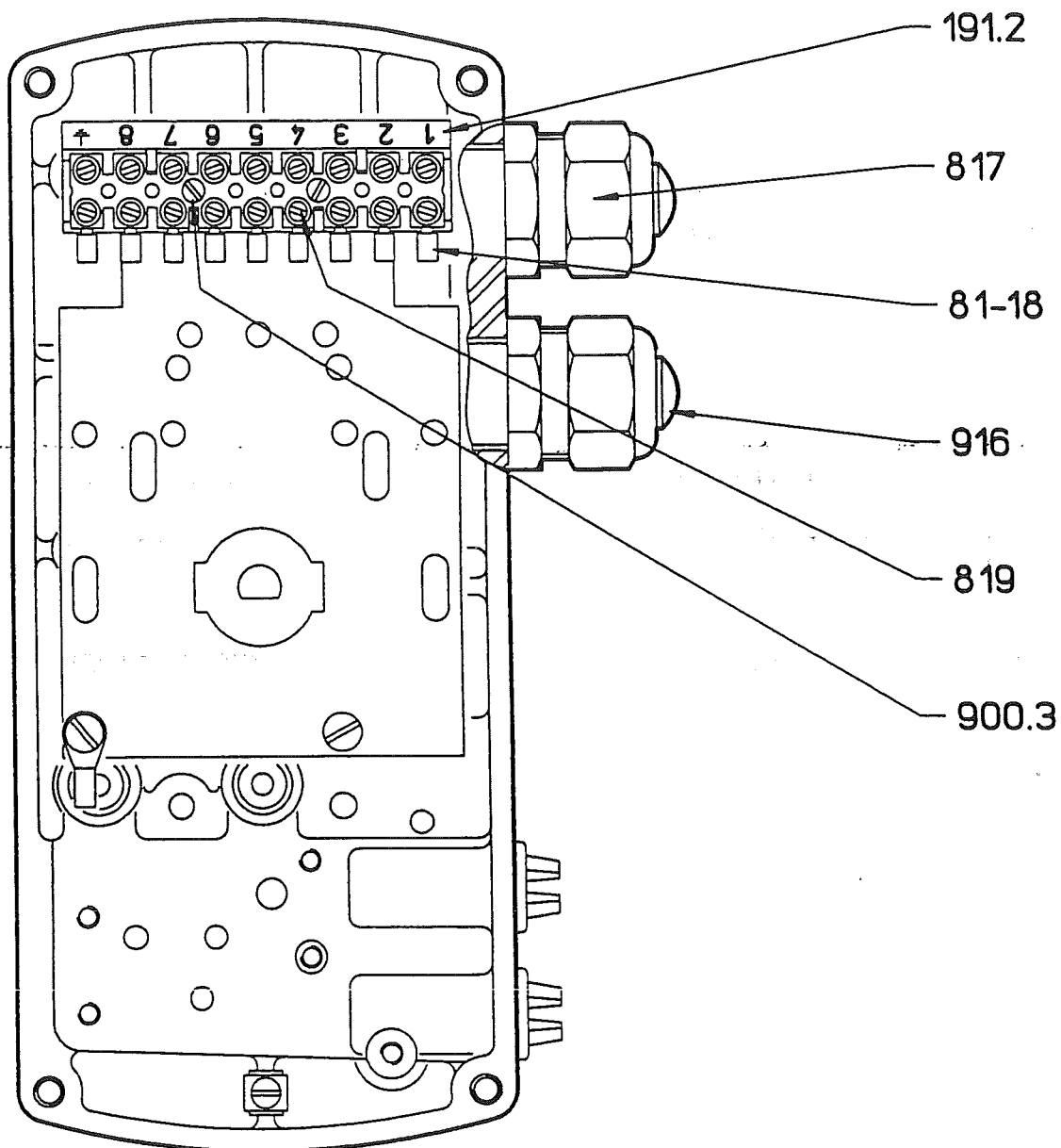
L-J28-046-A-3

ammi.KSB

Proximity switches  
type ø12 lg.35 to 80

AMTRONIC  
RA.1141

Sortie par presse étoupe  
Outlet by packing gland



A	23-02-99	First issue	CB

DRAWN BY : *am* CB 23-Feb-1999  
CHECKED BY : *LB* LB 3-Mar-1999

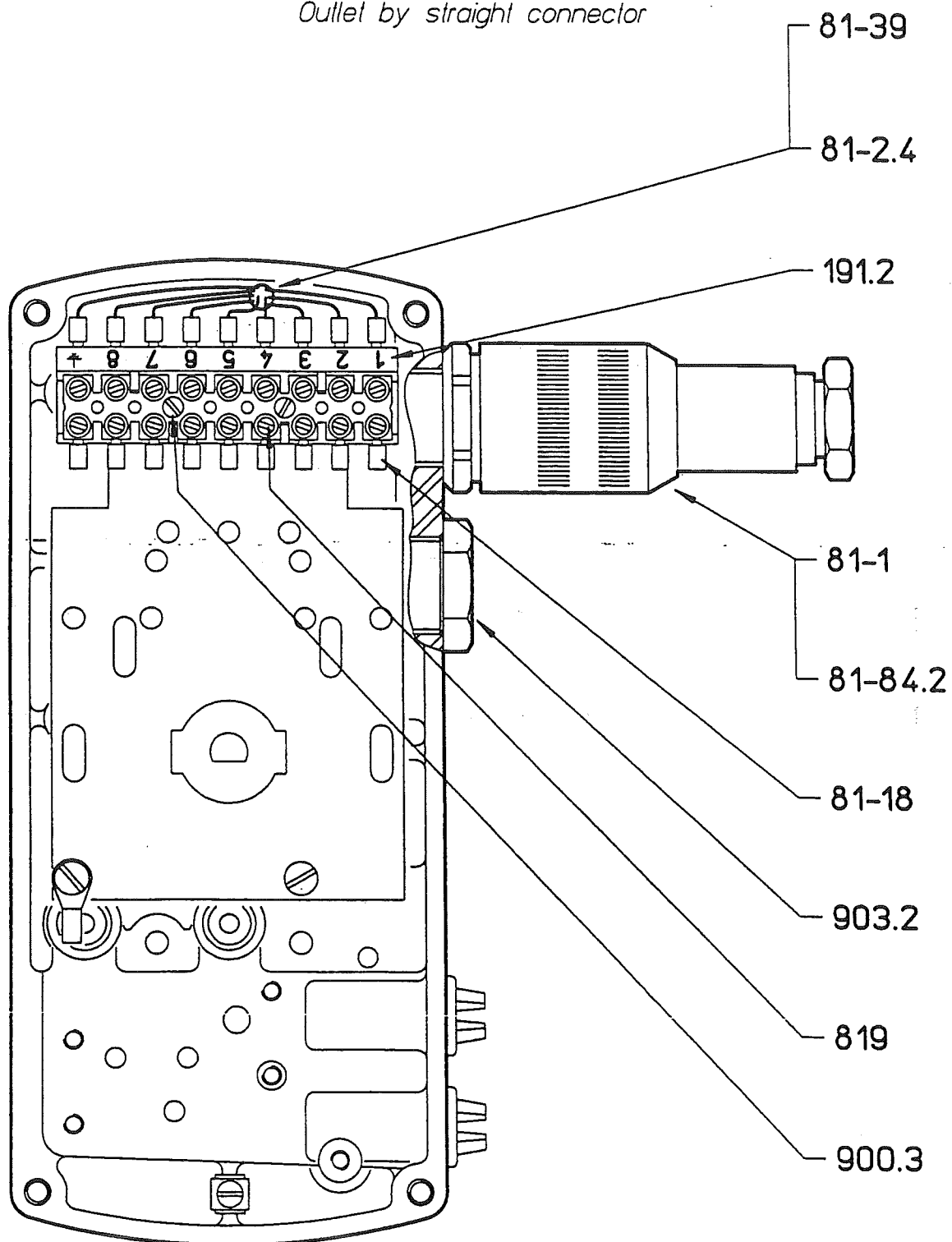
L-J28-046-A-4

ammi.KSB



Proximity switches  
type ø12 lg.35 to 80

AMTRONIC  
RA.1141

Sortie par connecteur droit  
Outlet by straight connector



A	23-02-99	First issue	CB
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DRAWN BY :  CB 23-Feb-1999  
CHECKED BY :  LB 3-Mar-1999

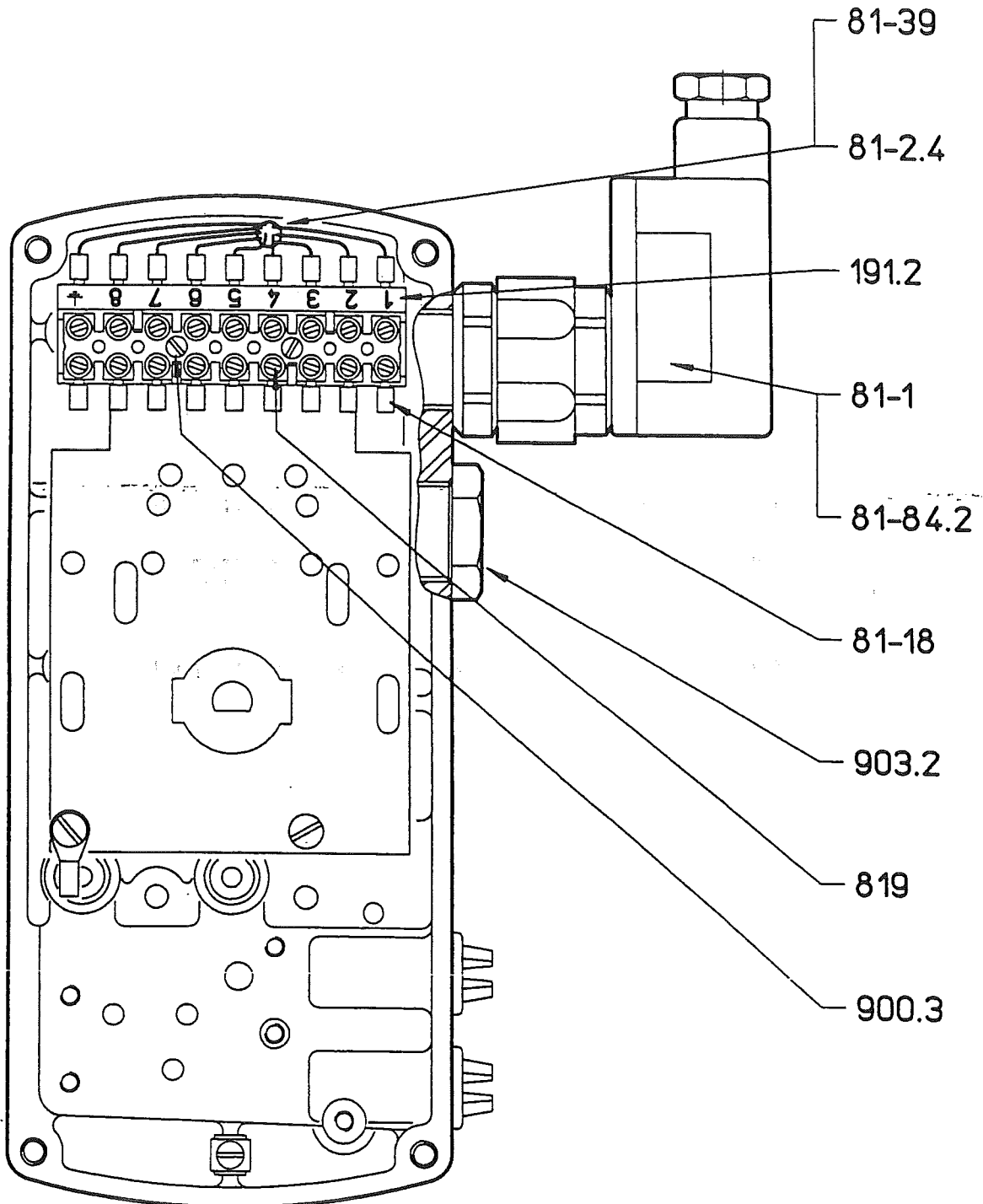
L-J28-046-A-5

amri.KSB

Proximity switches  
type ø12 lg.35 to 80

AMTRONIC  
RA.1141

Sortie par connecteur coudé  
Outlet by bend connector



A	23-02-99	First issue	CB
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DRAWN BY : *am* CB 23-Feb-1999  
CHECKED BY : *LB* LB 3-Mar-1999

L-J28-046-A-6

Zeichen	Qt	N° mécano	Désignation/Description/Bezeichnung	Matière/Material/Werkstoff
<b>Pièces communes</b> <b>Common parts</b> <b>Gemeinsame Teile</b>				
160	1		Couvercle Cover Deckel	Alliage léger Light alloy Leichtmetall-Legierung
188.1	1		Tôle de fixation Mounting plate Befestigungsplatte	Acier Steel Stahl
191.1	3		Support C.I. réf. 1380250 Support Träger	Polyamide Polyamide Polyamid
210	1		Axe d'entraînement Shaft Antriebsachse	Acétal Acetal Acetal
314	1		Rondelle butée Thrust washer Druckscheibe	Inox Stainless steel Rostfreier Stahl
410.1	1		Joint du couvercle Cover gasket Deckeldichtung	Nitrile Nitrile Nitril
410.2	1		Joint d'embase Distribution gasket Sockeldichtung	Nitrile Nitrile Nitril
412.1	1		Joint torique Ø 68 Ø 3 O'ring O-Ring-Dichtung	Nitrile Nitrile Nitril
412.2	2		Joint torique Ø 12 Ø 1.5 O'ring O-Ring-Dichtung	Nitrile Nitrile Nitril
412.6	2		Corde Ø 5.33 O'ring Dichtungsschnur	Nitrile Nitrile Nitril
486.1	2		Bille Ø 8.5 Ball Kugel	Inox Stainless steel Rostfreier Stahl
486.2	1		Bille Ø 5 Ball Kugel	Inox Stainless steel Rostfreier Stahl
486.3	1		Bille Ø 6 Ball Kugel	Inox Stainless steel Rostfreier Stahl
554.1	4		Rondelle Z 5 N Washer Unterlegscheibe	Inox Stainless steel Rostfreier Stahl
626	1		Voyant Sight glass Beobachtungsfenster	Polycarbonate Polycarbonate Polycarbonat
629	1		Index Pointer Anzeiger	Polyamide Polyamide Polyamid
81-18.1	1		Langue faston 6.3 141818-1 Clip Faston-Stecker	AMP
81-2.1	1		S/E fil de masse Ground wire subunit Erdanschlußdraht	Cuivre Copper Kupfer
81-2.2	1		S/E fil de masse Ground wire subunit Erdanschlußdraht	Cuivre Copper Kupfer
81-2.3	1		S/E fil de masse Ground wire subunit Erdanschlußdraht	Cuivre Copper Kupfer
81-84.1	1		Schéma de couplage Coupling diagram Kopplungsschaltbild	Aluminium adhésif Adhesive aluminium Aluminium, selbstklebend

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Zeichen	Qt	N° mécano	Désignation/Description/Bezeichnung	Matière/Material/Werkstoff
890	1		Embase Base plate Sockel	Alliage léger Light alloy Leichtmetall-Legierung
900.1	4		Vis CBLX M5 lg.35x20 Screw Schraube	Inox Stainless steel Rostfreier Stahl
900.2	3		Vis CBLX M4 lg.8 Screw Schraube	Inox Stainless steel Rostfreier Stahl
900.4	2		Vis autotaraudeuse M3 lg6 Cutting screw Schraube	Acier Steel Stahl
900.5	4		Vis CBLX M5 lg.16 Screw Schraube	Inox Stainless steel Rostfreier Stahl
903.1	1		Bouchon 1/4"G - 730 G 1/4 Plug Stopfen	Polyamide Polyamide Polyamid
903.3	1		Bouchon percé 1/4"G SR 1630 RÉF.12313 Plug Stopfen	Polyamide Polyamide Polyamid
932.1	1		Circlips ext. Ø 10x1 DIN 471 Circlip for shaft Außensicherungsring	Acier Steel Stahl
970.1	1		Plaque d'identité Identity plate Namenschild	Polyester adhésif Adhesive polyester Polyester, selbstklebend
970.2	1		Notice d'instruction Operating instructions Betriebsanweisungen	Papier indéchirable Paper Papier, unzerreißbar
970.3	1		Etiquette "No air" Label Zettel	Polyester adhésif Adhesive polyester Polyester, selbstklebend
99-14	1		Sachet déshydratant Dessicant bag Trockenmittelbeutel	
.....	.....	.....	.....	.....
<p align="center"><b>Capteur d'angle</b> Angle sensor Winkelgeber</p>				
554.3	1		Rondelle plate Z 4 N Washer Unterlegscheibe	Inox Stainless steel Rostfreier Stahl
816	1		S/E capteur d'angle Angle sensor subunit Winkelgeber-Baugruppe	Acétal Acetal Acetal
900.6	1		Vis CBLX M4 lg.12 Screw Schraube	Inox Stainless steel Rostfreier Stahl
.....	.....	.....	.....	.....
<p align="center"><b>Détecteur de proximité Ø 12 lg.35 à 80</b> Proximity switch Ø 12 lg.35 to 80 Näherungsschalter Ø 12 L. 35 bis 80</p>				
180	1		Colonne Column Distanzsäule	Technyl Technyl Technyl
188.2	1		Tôle de fixation Mounting plate Befestigungsplatte	Acier Steel Stahl
551	2		Rondelle entretoise Spacer washer Distanzscheibe	Acier Steel Stahl

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Zeichen	Qt	N° mécano	Désignation/Description/Bezeichnung	Matière/Material/Werkstoff
554.4	2		Rondelle Z Ø 12 Washer Unterlegscheibe	Acier Steel Stahl
554.5	2		Rondelle Z Ø 4 Washer Unterlegscheibe	Acier Steel Stahl
818	2		Détecteur Ø 12 lg. 35 à 80 Proximity switch Näherungsschalter	Suivant commande According to order Je nach Bestellung
81-33	1		Tôle de détection Activation plate Schaltblech	Acier Steel Stahl
900.7	2		Vis CBLX M4 lg.12 Screw Schraube	Inox Stainless steel Rostfreier Stahl
900.8	2		Vis CS M3 lg.6 Screw Schraube	Acier Steel Stahl
900.9	1		Vis CS M3 lg.12 Screw Schraube	Acier Steel Stahl
920.2	2		Ecrou H M4 Nut Sechskantmutter	Acier Steel Stahl
.....	.....	.....	.....	.....
Sortie par presse étoupe plastique IP67 Outlet through plastic packing gland IP67 Ausgang durch Kunststoff-Stopfbuchse IP67				
191.2	1		Support de barrette Connecting strip bracket Anschlußleistenträger	Polystyrène Polystyrene Polystyrol
817	2		Presse étoupe PG13,5 IP67 pour câble Ø 6 à Ø 12 Packing gland Stopfbuchse	Polyamide Polyamide Polyamid
819	1		Barrette de raccordement 9 éléments réf.342-21 Connecting strip Anschlußleiste	LEGRAND
81-18	9		Embout de câble code 22-16 réf. 165143 Cable ferrule Kabelpreßring	A.M.P.
900.3	2		Vis à tôle TCL n°2 lg.16 Screw Schraube	Acier Steel Stahl
916	2		Bouchon réf. 15-145 Plug Stöpsel	Caoutchouc Rubber Gummi
.....	.....	.....	.....	.....
Sortie par presse étoupe métallique IP67 Outlet through metal packing gland IP67 Ausgang durch Metallstopfbuchse IP67				
191.2	1		Support de barrette Connecting strip bracket Anschlußleistenträger	Polystyrène Polystyrene Polystyrol
817	2		Presse étoupe PG13,5 IP67 pour câble Ø 6 à Ø 12 Packing gland Stopfbuchse	Laiton Brass Messing
819	1		Barrette de raccordement 9 éléments réf.342-21 Connecting strip Anschlußleiste	LEGRAND

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Zeichen	Qt	N° mécano	Désignation/Description/Bezeichnung	Matière/Material/Werkstoff
81-18	9		Embout de câble code 22-16 réf. 165143 <i>Cable ferrule</i> Kabelpreßring	A.M.P.
900.3	2		Vis à tête TCL n°2 lg.16 <i>Screw</i> Schraube	Acier Steel Stahl
916	2		Bouchon réf. 15-145 <i>Plug</i> Stöpsel	TRAPY
.....	.....	.....	.....	.....

## Sortie par connecteur droit 7 broches

Outlet via 7-pin straight connector

Ausgang durch 7-pol. geraden Stecker

191.2	1		Support de barrette <i>Connecting strip bracket</i> Anschlußleistenträger	Polystyrène Polystyrene Polystyrol
819	1		Barrette de raccordement 9 éléments réf.342-21 <i>Connecting strip</i> Anschlußleiste	LEGRAND
81-1	1		Connecteur droit 7 broches IP65 DIN 43651 <i>Connector</i> Stecker	SOURIAU
81-18	14		Embout de câble code 22-16 réf. 165143 <i>Cable ferrule</i> Kabelpreßring	A.M.P.
81-2.4	1		Fil de raccordement connecteur <i>Connecting wire</i> Steckeranschlußdraht	Cuivre Copper Kupfer
81-39	3		Collier colring réf.320-32 lg180 <i>Cable clamp</i> Kabelschelle	LEGRAND
81-84.2	1		Tableau schéma de couplage <i>Coupling diagram</i> Kopplungsschaltbild	
900.3	2		Vis à tête TCL n°2 lg.16 <i>Screw</i> Schraube	Acier Steel Stahl
903.2	1		Bouchon fileté réf. 3503 <i>Plug</i> Gewindestopfen	TRAPY
.....	.....	.....	.....	.....

## Sortie par connecteur coudé 7 broches

Outlet via 7-pin elbowed connector

Ausgang durch 7-pol. Winkelstecker

191.2	1		Support de barrette <i>Connecting strip bracket</i> Anschlußleistenträger	Polystyrène Polystyrene Polystyrol
819	1		Barrette de raccordement 9 éléments réf.342-21 <i>Connecting strip</i> Anschlußleiste	LEGRAND
81-1	1		Connecteur coudé 7 broches IP65 DIN 43651 <i>Connector</i> Stecker	HIRSCHMANN
81-18	14		Embout de câble code 22-16 réf. 165143 <i>Cable ferrule</i> Kabelpreßring	A.M.P.

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Date : 23-02-99 C.B. VERIF : LB 03/03/1999

N° Nomenclature : L-J28-046-A

Zeichen	Qt	N° mécano	Désignation/Description/Bezeichnung	Matière/Material/Werkstoff
81-2.4	1		Fil de raccordement connecteur <i>Connecting wire</i> Steckeranschlußdraht	Cuivre <i>Copper</i> Kupfer
81-39	3		Collier colring réf.320-32 lg180 <i>Cable clamp</i> Kabelschelle	LEGRAND
81-84.2	1		Tableau schéma de couplage <i>Coupling diagram</i> Kopplungsschaltbild	
900.3	2		Vis à tôle TCL n°2 lg.16 <i>Screw</i> Schraube	Acier <i>Steel</i> Stahl
903.2	1		Bouchon fileté réf. 3503 <i>Plug</i> Gewindestopfen	TRAPY
.....	.....	.....	.....	.....

## Sortie par connecteur droit 12 broches

Outlet via 12-pin straight connector

Ausgang durch 12-pol. geraden Stecker

191.2	1		Support de barrette <i>Connecting strip bracket</i> Anschlußleistenträger	Polystyrène <i>Polystyrene</i> Polystyrol
819	1		Barrette de raccordement 9 éléments réf.342-21 <i>Connecting strip</i> Anschlußleiste	LEGRAND
81-1	1		Connecteur droit 12 broches IP65 DIN 43651 <i>Connector</i> Stecker	HIRSCHMANN
81-18	16		Embout de câble code 22-16 réf. 165143 <i>Cable ferrule</i> Kabelpreßring	A.M.P.
81-2.4	1		Fil de raccordement connecteur <i>Connecting wire</i> Steckeranschlußdraht	Cuivre <i>Copper</i> Kupfer
81-39	3		Collier colring réf.320-32 lg180 <i>Cable clamp</i> Kabelschelle	LEGRAND
81-84.2	1		Tableau schéma de couplage <i>Coupling diagram</i> Kopplungsschaltbild	
900.3	2		Vis à tôle TCL n°2 lg.16 <i>Screw</i> Schraube	Acier <i>Steel</i> Stahl
903.2	1		Bouchon fileté réf. 3503 <i>Plug</i> Gewindestopfen	TRAPY
.....	.....	.....	.....	.....

## Sortie par connecteurs coudés 12 broches

Outlet via 12-pin elbowed connector

Ausgang durch 12-pol. Winkelstecker

191.2	1		Support de barrette <i>Connecting strip bracket</i> Anschlußleistenträger	Polystyrène <i>Polystyrene</i> Polystyrol
819	1		Barrette de raccordement 9 éléments réf.342-21 <i>Connecting strip</i> Anschlußleiste	LEGRAND
81-1	1		Connecteur coudé 12 broches IP65 DIN 43651 <i>Connector</i> Stecker	HIRSCHMANN

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Zeichen	Qt	N° mécano	Désignation/Description/Bezeichnung	Matière/Material/Werkstoff
81-18	14		Embout de câble code 22-16 réf. 165143 Cable ferrule Kabelpreßring	A.M.P.
81-2.4	1		Fil de raccordement connecteur Connecting wire Steckeranschlußdraht	Cuivre Copper Kupfer
81-39	3		Collier colring réf.320-32 lg180 Cable clamp Kabelschelle	LEGRAND
81-84.2	1		Tableau schéma de couplage Coupling diagram Kopplungsschaltbild	
900.3	2		Vis à tôle TCL n°2 lg.16 Screw Schraube	Acier Steel Stahl
903.2	1		Bouchon fileté réf. 3503 Plug Gewindestopfen	TRAPY

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**SAFETY VALVE FOR INNER VESSEL  
ANDERSON GREENWOOD  
9390 C06 ALTA**

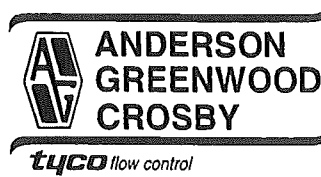
**Items Z62036 and Z62037 for 1800MT LOX TANK**

**Items Z72036 and Z72037 for 1000MT LIN TANK**

**SUPPLIER :**

TYCO Flow Control  
Parc d'Activité du Vert Galan  
4, rue des Oziers  
BP 688 Saint-Ouen-l'Aumône  
95004 Cergy Pointoise  
FRANCE  
Mr Frédéric PEREZ  
Tel: 01 39 09 37 31  
Fax: 01 39 09 37 27





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APPR			PAGE 1 OF 58		



ANDERSON, GREENWOOD & CO.

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Page 2

See Revision  
Status Below

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## INSTRUCTIONS – MAINTENANCE

### SERIES 9300 PILOT OPERATED SAFETY RELIEF VALVES

The intent of these instructions is to acquaint the user with the storage, installation and operation of this product. **Please read these instructions carefully before installation.**

#### **WARNING**

Removal of the seal wires in an attempt to adjust and/or repair this product by unauthorized or unqualified persons voids the product warranty and may cause damage to equipment and serious injury or death to persons.

The product is a safety related component intended for use in critical applications. The improper application, installation or maintenance of the product or the use of parts or components not manufactured by Anderson Greenwood Crosby may result in a failure of the product.

Any installation, maintenance, adjustment, test, etc. performed on the Product must be done in accordance with the requirements of all applicable Anderson Greenwood Crosby Procedures and Instructions as well as applicable National and International Codes and Standards.

#### **SAFETY PRECAUTIONS**

When the pressure/vacuum relief valve is under pressure never place any part of your body near the pilot exhaust nor the outlet of the main valve.

The main valve outlet should be piped or vented to a safe location.

Always wear proper safety gear to protect head, eyes, ears, etc. anytime you are near pressurized valves.

Never attempt to remove the pressure/vacuum relief valve from a system that is pressurized.

Never make adjustments to or perform maintenance on the pressure/vacuum relief valve while in service unless the valve is isolated from the system pressure. If not properly isolated from the system pressure, the pressure/vacuum relief valve may inadvertently open resulting in serious injury.

Remove the pressure/vacuum relief valve prior to performing any pressure testing of the system.

The safety of lives and property often depends on the proper operation of the pressure/vacuum relief valve. The valve must be maintained according to appropriate instructions and must be periodically tested and reconditioned to ensure correct function.

#### **STORAGE AND HANDLING**

Pressure/vacuum relief valve performance may be adversely affected if the valve is stored for an extended period without proper protection. Rough handling and dirt may damage, deform, or cause misalignment of valve parts and may alter the pressure setting and adversely affect valve performance and seat tightness. It is recommended that the valve be stored in the original shipping container in a warehouse or as a minimum on a dry surface with a protective covering until installation. Inlet and outlet protectors should remain in place until the valve is ready to be installed in the system.

TABLE OF CONTENTS

	<u>Page</u>
1.0 DISCLAIMER.....	6
2.0 INTRODUCTION.....	6
2.1 Description of Valve.....	6
2.2 Service Applicability.....	8
2.3 Code Applicability.....	8
2.4 Conversion.....	8
2.5 Size/Pressure Ranges of Series 9300 Pressure/Vacuum Relief valves.....	9
2.6 Basic Pilot Types for the Series 9300 Main Valve.....	9
3.0 MAIN VALVE.....	10
3.1 General Main Valve Maintenance.....	10
3.2 Main Valve Single Diaphragm Disassembly.....	10
3.3 Main Valve Dual Diaphragm Disassembly.....	13
3.4 Main Valve Seat Disassembly and Replacement (Bolted).....	17
3.5 Main Valve Seat Disassembly and Replacement (Banded).....	22
3.6 Main Diaphragm Disassembly and Replacement.....	23
3.7 Auxiliary Diaphragm Disassembly and Replacement.....	24
3.8 Main Valve Nozzle Replacement.....	24
3.9 Reassembly of Main Valve Single Diaphragm.....	26
3.10 Reassembly of Main Valve Dual Diaphragm.....	26
4.0 PILOT MAINTENANCE.....	28
4.1 Pilot Disassembly for Non-Flowing Modulating Pilots (Type 400B).....	28
4.2 Pilot Assembly for Non-Flowing Modulating Pilots (Type 400B).....	31
4.3 Pilot Disassembly for Flowing Modulating or Snap Action Pilots (Types 91, 93, and 93T).....	32
4.4 Pilot Assembly for Flowing Modulating or Snap Action Pilots (Types 91, 93, and 93T).....	39
4.5 Pilot Adjustment for Non-Flowing Modulating Pilots (Type 400B).....	40
4.6 Pilot Adjustment for Flowing Modulating or Snap Action Pilots (Types 91, 93, and 93T).....	43
5.0 FUNCTIONAL TESTING OF COMPLETE ASSEMBLY.....	46
5.1 General.....	46
5.2 Field Test Procedure for Non-Flowing Modulating Positive Pressure Pilot (400B).....	46
5.3 Field Test Instructions for Flowing Modulating or Snap Action Pilots (Types 91, 93 and 93T).....	49
6.0 STORAGE AND HANDLING.....	50
7.0 TROUBLE SHOOTING.....	52
8.0 MAIN VALVE SPARE PARTS AND REPAIR KITS.....	53
8.1 Type 9300 Main Valve Single Chamber Repair Kit.....	53
8.2 Type 9300 Main Valve Dual Chamber Repair Kit.....	53

9.0	PILOT SPARE PARTS AND REPAIR KITS.....	54
9.1	91 Pilot Repair Kit.....	54
9.2	93 Pilot Repair Kit.....	54
9.3	93T Pilot Repair Kit.....	55
9.4	400A/B Pilot Repair Kit.....	55
9.5	400A Pilot Repair Kit.....	55
10.0	ACCESSORIES, OPTIONS, AND ACCESSORY REPAIR KIT.....	56
10.1	Accessories.....	56
10.2	Options.....	56
10.3	Accessory Repair Kit.....	57
11.0	LUBRICANTS AND SEALANTS FOR SERIES 9300.....	57
11.1	Lubricants and Sealants Used on Pilot Parts.....	57
11.2	Lubricants and Sealants Used on Main Valve Parts.....	58

## 1.0 Disclaimer

The proper protection and safety of equipment, property and personnel depends on the proper operation of the pressure relief valves described in this manual. All Anderson, Greenwood pressure relief valves should be kept in proper working condition in accordance with the manufacturer's written instructions. Periodic testing and maintenance by the user of this equipment is essential for continued, reliable, and safe function of the pressure relief valve.

All installation, maintenance, adjustment, repair and testing performed on pressure relief valves should be done by qualified technicians having the necessary skills and training adequate to perform such work. All applicable Codes and Standards, governing regulations and authorities should be adhered to when performing pressure relief valve repair. No repair, assembly, adjustment, or testing performed by persons other than Anderson, Greenwood personnel shall be covered by the warranty extended by Anderson, Greenwood to its customers. The user should use only original, factory supplied OEM parts in any maintenance or repair activity involving this product.

This Maintenance Manual is provided as a general guide for the repair and maintenance of the pressure relief valves described herein. It is not possible to describe all configurations or variations with such equipment. The user is advised to contact Anderson, Greenwood or its authorized assemblers and representatives for assistance in situations which are not adequately covered or described in this Manual.

## 2.0 Introduction

### 2.1 Description of Valve

The Type 9300 employs the highly successful pressurized Teflon® film seat, as well as protected FEP diaphragms. The design allows these valves to be used in the pilot operated pressure relief mode and simultaneously provide vacuum relief, either via weight loads of the internals, or with a specific pilot control of the vacuum opening. The Type 9300 was designed with a special studded inlet connection to reduce the inlet profile, and coupled with larger orifice areas, these valves provide flow capacities as much as 45% greater than the Series 90 valves. The Type 9300 is a full body valve to pipe away the discharge if required.

#### 2.1.1 Pilot Operated Safety Relief Vent With Non-Flowing Modulating Pilot

?	9340P	-- Positive Pressure Relief Valve
?	9340C	-- Positive and Negative Pressure Relief Valve
?	9304V	-- Negative Pressure Relief Valve

Pilot operated valves use a pilot to control pressure over a large unbalanced member in the main valve, such as a diaphragm piston. The large overbalance means a much larger force on top of the seat compared to process forces pushing up on the seat. At set pressure, the pilot relieves the pressure quickly, permitting the main valve seat to open rapidly. All of the pilots have the same construction, except for the location of the connections to the main valve diaphragm actuators, or the connections for the pressure sense. For either the 9340P or the 9340C, the pilot controls only the positive pressure relief. The negative pressure relief is controlled by the weight of the parts that move in the main valve when it opens. In the 9304V, the pilot controls the negative pressure relief.

#### **2.1.2 Pilot Operated Safety Relief Vent With Flowing Modulating or Snap Action**

##### **Pilot**

- ? 9390P -- Positive Pressure Relief Valve
- ? 9390C -- Positive and Negative Pressure Relief Valve
- ? 9309V -- Negative Pressure Relief Valve

Weighted-loaded and spring operated valves open as process forces overcome downward forces, with little flexibility to overcome problem applications. Anderson, Greenwood pilot operated valves can be adjusted to open with a rapid 'snap' action or modulating action. Most applications are well served by the snap action mode, with full opening at set pressure and full reseating after a short blowdown. However, some systems might best be served by a proportional opening, whereby the valve opens just enough to satisfy small upsets and maintain constant system pressure, yet still have the capability to reach full capacity within 10% overpressure. The 9390C and 9309V pilots have the same construction except for the location of the connections for the pressure sense. For either the 9390P or 9390C, the pilot controls only the positive pressure relief. In the 9309V, pressure relief is controlled by the weight of the parts that move in the main valve when it opens. The pilot controls the negative pressure relief on the negative pressure relief valve. The Anderson, Greenwood 9390 Series can be set for a snap acting or modulating mode with a simple adjustment of the external blowdown screw. No part changes are necessary to change the operating mode.

## 2.2 Service Applicability

Refrigerated or cryogenic storage tanks (accurate low-pressure protection), natural gas transmission and distribution, blanketed vessels in the petrochemical, food, and electronics industries, ammonia, air blowers in the waste water treatment plants and marine (LNG and LPG).

## 2.3 Code Applicability

The Series 9300 are designed to meet the requirements of ASME UV Code Stamp, NB certified capacity 15 psig and above, and API 2000.

## 2.4 Conversion

Valve conversions are defined as any change which affects critical parts and/or valve nameplate data, from that which was originally supplied by the manufacturer such as a change in set pressure. Conversions, when required by the owner/user, shall only be performed by the manufacturer, their Appointed/Authorized Assembler or Repair Center in strict accordance with written instructions provided by the manufacturer. Communication with the manufacturer is critical when making any conversion to ensure the converted valve(s) provides the same safe, reliable performance as the original valve supplied by the Manufacturer.

For conversion information on the Series 9300 Pressure Relief Valves, contact the Service Department at:

Anderson, Greenwood  
Phone: (281) 274-4476  
Fax: (281) 274-6916  
International:  
Phone: 1 (281) 274-4476  
Fax: 1 (281) 274-6916

**2.5 Size/Pressure Ranges of Type 9300 Pressure/Vacuum Relief Valves**

Materials	AL, CS, SS
Main Valve Soft Goods	Teflon® Diaphragm Seat and Seals
Pilot Soft Goods	Elastomer or All Teflon® Soft Goods
Set Pressure range	4" wc to 50 psig [9.9 mbarg to 3.45 barg]
Vacuum Range	-1.73" wc to -14.7 psig [-4.3 mbarg to -1.01 barg]
Process Temperature	-320°F to 200°F <sup>2</sup> [-196°C to 93°C]
Size	2" to 12"
Blowdown - (fixed or variable)	

**2.6 Basic Pilot Types for the 9300 Main Valve****2.6.1 Type 91 Pilot**

The Type 91 was designed for specific applications where FEP diaphragms alone were not rugged enough and premium sealing was required for super cryogenic fluids. Type 91 design includes stainless steel (SS), and Teflon® diaphragms which provide extraordinary performance for hard to hold cryogenic fluids.

**2.6.2 Type 93 Pilot**

The Type 93 is a pilot operated pressure relief valve designed with elastomer seats and seals, and construction materials in aluminum, carbon steel (CS), and stainless steel (SS). These construction materials satisfy the majority of gas piping and chemical tank applications. The Type 93 pilot can be used on any Series 9000 valve except a combination 9000 larger than 6".



### 2.6.3 Type 93T Pilot

The Type 93T was an offshoot of the Type 93, designed specifically for cryogenic and chemical applications where an elastomer seal is not satisfactory.

### 2.6.4 Type 400B

The Type 400B is used with 8", 10", and 12" combination weight-loaded vacuums and pressure valves where quick relieving of dual diaphragm chambers is required to open the main valve.

## 3.0 Main Valve

### 3.1 GENERAL MAIN VALVE MAINTENANCE

Since the Type 9300 valve can be either a pressure only, vacuum only, or pressure/vacuum relieving device, it is built in a modular fashion. The standard single diaphragm unit will function on pressure and vacuum, however, opening under very low vacuum requires use of the auxiliary diaphragm chamber. The valve can also be repaired in a modular fashion. The seat can be replaced without complete disassembly of the diaphragm cases. Selective repair can be performed as required.

Prior to disassembly of the main valve or pilot, it is recommended to stamp or mark the location of the pilot, and the orientation of the diaphragm cases, studs, and column supports to the main valve body. This practice will ensure proper alignment and location of parts during reassembly.

To prevent mixing up parts it is recommended to repair the main valve and pilot in stages. For this reason, the diaphragm, nozzle, and seat maintenance and/or replacement instructions are separate from the pilot instructions.

### 3.2 Main Valve Single Diaphragm Disassembly

Refer to Figure 1.

1. Remove the pilot (as a unit) and the tubing from the diaphragm case. Set them aside.  
Note: Match mark orientation of tubing and case assembly to the body. This will assist in reassembly.
2. Unscrew the case bolts and remove the upper main diaphragm case.

3. On valve sizes 2" through 4", remove the diaphragm assembly, lower case, shaft and seat plate assembly from the main valve body.
4. On valve sizes 6" and larger, remove seat plate assembly from shaft prior to removing diaphragm assembly, lower case, and shaft. To remove, spin diaphragm plate assembly counterclockwise while holding seat plate assembly stationary until shaft is free of seat hub. The seat plate assembly should then rest on nozzle.
5. On valve sizes 6" and larger, remove diaphragm assembly and shaft from lower case. Then remove lower case from the body.
6. On valve sizes 6" and larger, Lift seat plate assembly from the body. Caution: When removing seat plate assembly, be careful not to damage the nozzle.
7. Unscrew counterclockwise the seat plate assembly from the main shaft. This is normally a hand operation, however, a 9/16" (14.3 mm) wrenching flat is provided on the seat hub. The connecting thread will run free, then tighten, and run free again as it disengages from a locking helicoil in the vertical shaft. This will allow the seat plate assembly, diaphragm assembly and lower case to be separated.
8. Holding the shaft stationary, remove the jam nut from the diaphragm assembly. Remove the diaphragms, washers, gaskets, plates, and lower case (as a unit) from the shaft.

ITEM	DESCRIPTION
14	CASE, UPPER MAIN DIAPHRAGM
15	DIAPHRAGM, MAIN
16	GASKET, DIAPHRAGM CASE
18	SHAFT, SEAT PLATE ASSEMBLY
19	PLATE, MAIN VACUUM
20	SCREEN, LOWER MAIN CASE
21	PLATE, MAIN PRESSURE
23	CASE, LOWER MAIN DIAPHRAGM
24	SLEEVE, GUIDE
32	GASKET, NOZZLE UPPER
33	NOZZLE
34	BODY
35	GASKET, NOZZLE LOWER
36	SCREW, NOZZLE RETAINER
38	STUD, INLET
39	NUT, INLET
40	BUSHING, SPLIT
41	BOLT, CASE
48	BUSHING, GUIDE
60	SLIPPER, DIAPHRAGM OUTER
61	SLIPPER, DIAPHRAGM INNER
62	DIAPHRAGM, REINFORCEMENT MAIN (LOW PRESSURE 2" & 3" VALVE SIZE)

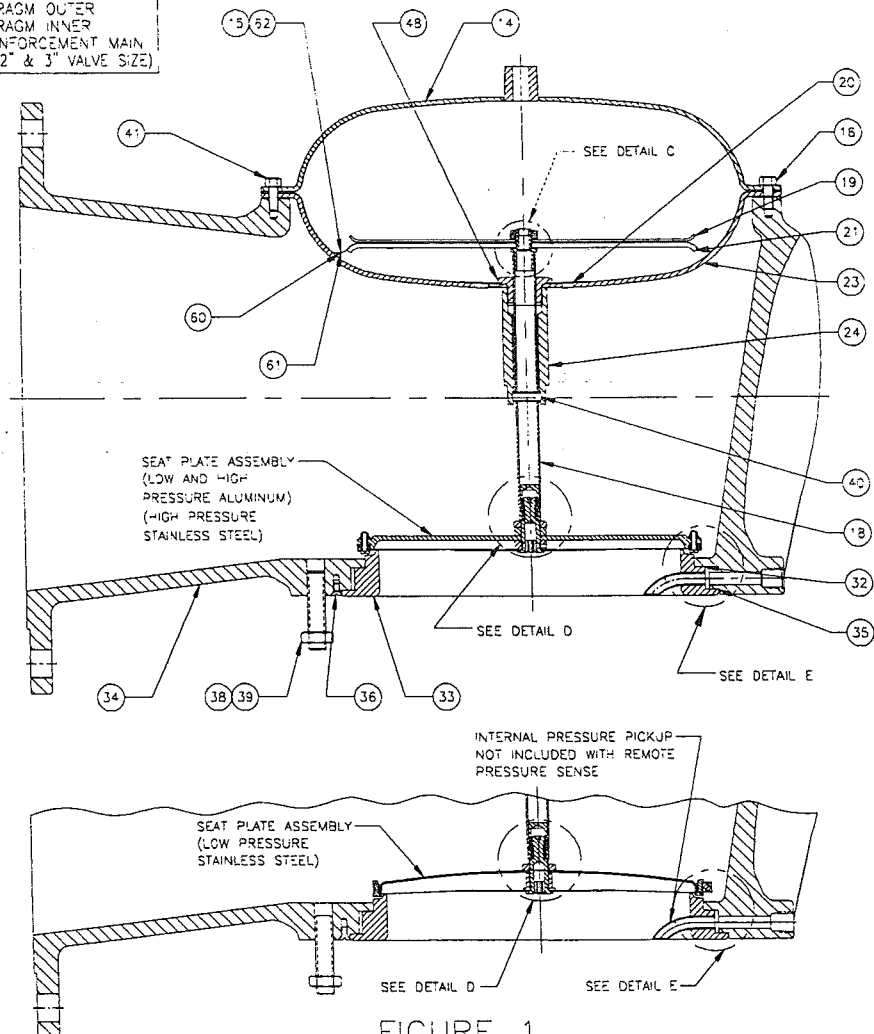


FIGURE 1

9390P VALVE ASSEMBLY  
(3" THRU 12" INLET SIZE  
WITH INTERNAL SENSE SHOWN)

### 3.3 Main Valve Dual Diaphragm Disassembly

Refer to Figure 2.

1. Remove the pilot and tubing from the auxiliary diaphragm case. **Note: Match mark orientation of tubing and case assembly with the body. This will assist in reassembly.**
2. Unscrew the upper auxiliary case bolts and nuts, and remove the upper auxiliary diaphragm case.
3. Install a 6" to 8" long braided wire through the hole at the top of the lift rod to retain the lift rod. (See Fig. 3, Detail C)
4. Lift the auxiliary and main diaphragm assemblies to the full open position using the auxiliary vacuum plate. The open dome port can be temporarily capped to hold the main diaphragm assembly open.
5. Remove the lift rod jam nut and Teflon<sup>®</sup> O-Ring. (See Fig. 6, Detail A).
6. The lift rod is attached to the auxiliary plate bushing with threads. Unscrew the lift rod from the bushing by turning the rod clockwise until it drops down into the main valve shaft bore.
7. Remove the main diaphragm case bolts. Remove the studs from the body. Remove the lower auxiliary diaphragm case and the upper main diaphragm case as a unit, which is assembled to the diaphragm case adapter. Allow the lift rod to slip from the center hole and lift the lower auxiliary diaphragm case, upper main diaphragm case, and adapter upwards as one unit.  
**Caution: Be careful not to bend the lift rod during case assembly removal.**
8. On valve sizes 2" through 4", remove the diaphragm assembly, lower case, shaft and seat plate assembly from the main valve body.
9. On valve sizes 6" and larger, remove seat plate assembly from shaft prior to removing diaphragm assembly, lower case, and shaft. To remove, spin diaphragm plates assembly counterclockwise while holding seat plate assembly stationary until shaft is free of seat hub. The seat plate assembly should then rest on nozzle.
10. On valve sizes 6" and larger, remove diaphragm assembly and shaft from lower case. Then remove lower case from the body.

11. On valve sizes 6" and larger, Lift seat plate assembly from the body. Caution: When removing seat plate assembly, be careful not to damage the nozzle.
12. Unscrew counterclockwise the seat plate assembly from the main shaft. This is normally a hand operation, however, a 9/16" (14.3 mm) wrenching flat is provided on the seat hub. The connecting thread will run free, then tighten, and run free again as it disengages from a locking helicoil in the vertical shaft. This will allow the seat plate assembly, diaphragm assembly and lower case to be separated.
13. Holding the shaft stationary, remove the jam nut from the diaphragm assembly. Remove the diaphragms, washers, gaskets, plates, and lower case (as a unit) from the shaft. (See Fig. 6, Detail C)

With the main valve disassembled, you are now ready to disassemble, inspect, and replace soft goods starting with the seat plate assembly.

ITEM	DESCRIPTION
1	CASE, UPPER AUXILIARY DIAPHRAGM
2	NUT, UPPER AUXILIARY DIAPHRAGM CASE
3	PLATE, AUXILIARY VACUUM
6	DIAPHRAGM, AUXILIARY
7	PLATE, AUXILIARY PRESSURE
12	CASE, LOWER AUXILIARY PRESSURE
13	STUD, SUPPORT ROD
14	CASE, UPPER MAIN DIAPHRAGM
15	DIAPHRAGM, MAIN
16	GASKET, DIAPHRAGM CASE
17	ROD, LIFT
18	SHAFT, SEAT PLATE ASSEMBLY
19	PLATE, MAIN VACUUM
20	SCREEN, LOWER MAIN CASE
21	PLATE, MAIN PRESSURE
23	CASE, LOWER MAIN DIAPHRAGM
24	SLEEVE, GUIDE
40	BUSHING, SPLIT
41	BOLT, CASE
48	BUSHING, GUIDE
63	DIAPHRAGM, REINFORCEMENT AUXILIARY (LOW PRESSURE 2" & 3" VALVE SIZE)

9390C MAIN VALVE ASSEMBLY  
(3" THRU 12" INLET SIZE WITH  
REMOTE PRESSURE SENSE SHOWN)

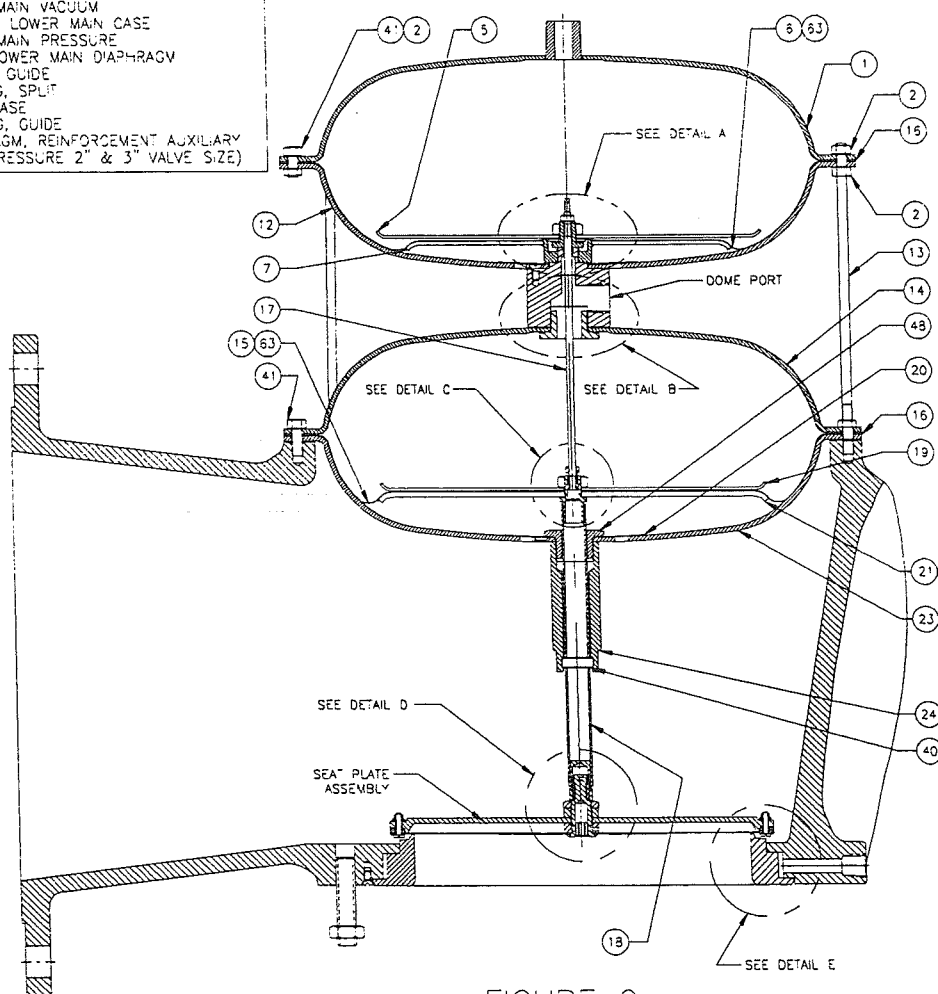
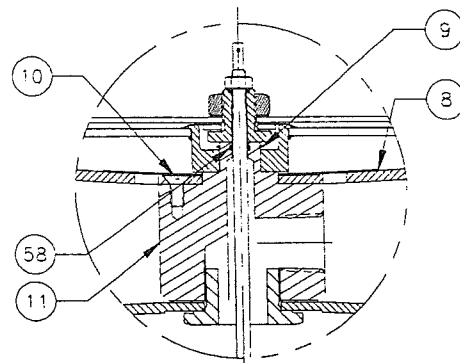
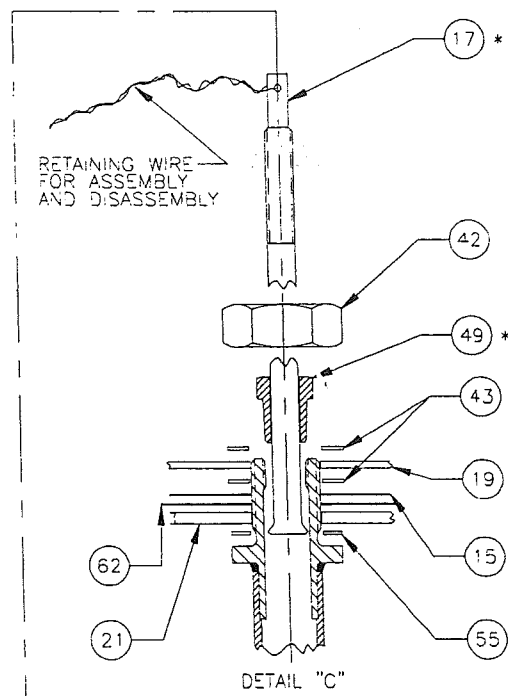
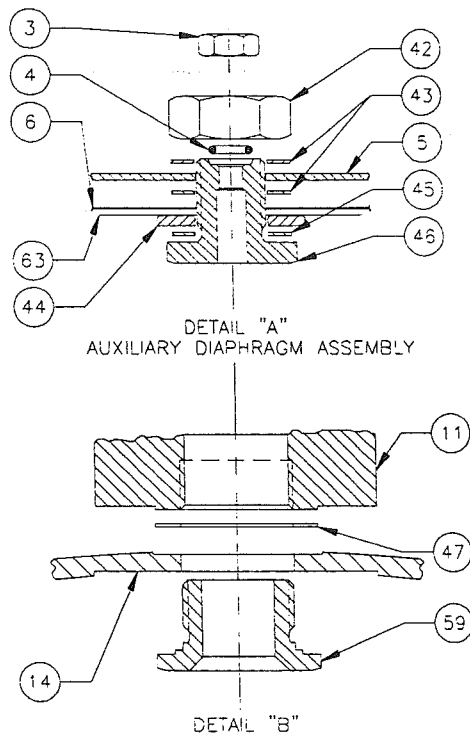


FIGURE 2  
HIGH AND LOW PRESSURE ALUMINUM  
SEAT PLATE ASSEMBLY SHOWN

REV	DESCRIPTION
3	NUT
4	O-RING/TEFLON
5	PLATE-AUXILIARY DIAPHRAGM
6	DIAPHRAGM-AUXILIARY
8	SCREEN-LOWER AUXILIARY CASE
9	RING-SNAP
10	SCREW
11	ADAPTER
14	CASE-UPPER, MAIN DIAPHRAGM
15	DIAPHRAGM-MAIN
17	ROD, LIFT
19	PLATE-MAIN VACUUM
21	PLATE-MAIN PRESSURE
42	NUT-JAM
43	WASHER
44	WASHER
45	GASKET-PLATE
46	BUSHING-AUXILIARY DIAPHRAGM
47	GASKET-ADAPTER
49	BUSHING-ROD RETAINING
55	GASKET-PLATE
58	O-RING, LIFT ROD
59	BUSHING, ADAPTER
61	SUPPER-DIAPHRAGM, INNER (HIGH PRESSURE SS INTERNALS)
62	DIAPHRAGM, REINFORCEMENT, AUXILIARY (LOW PRESSURE 2" & 3" VALVE SIZE)
63	DIAPHRAGM, REINFORCEMENT, DIAPHRAGM (LOW PRESSURE 2" & 3" VALVE SIZE)

DETAIL "A" & "B"  
ASSEMBLED

\* USED ONLY WITH DUAL DIAPHRAGM MODEL  
MAIN DIAPHRAGM ASSEMBLY

FIGURE 3

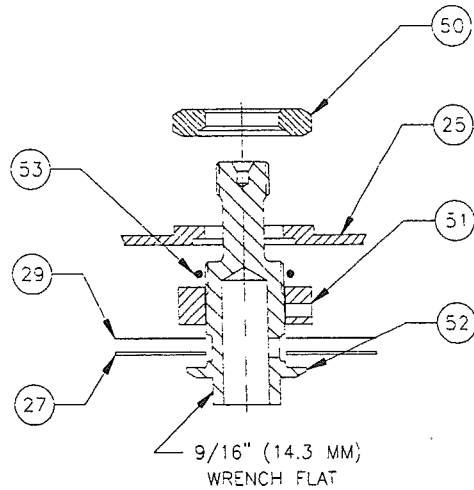
### 3.4 Main Valve Seat Disassembly and Replacement (Bolted)

Refer to Figures 4 and 5, Details D and E.

1. To assist in seat plate disassembly, partially thread the seat plate assembly into the fixture which consists of a 6" long hexagon bar with a  $\frac{1}{2}$ "x13x1" deep threaded hole in one end, and a 5/16" 18x1" deep threaded hole in the other end. **Note: The 5/16" hole is for valves sizes 2" through 6" and the  $\frac{1}{2}$ " hole is for 8" through 12".**
2. With the seat plate assembly threaded into the fixture, secure the fixture into a vise and remove the seat screws by holding the lock nut and turning the screws counter-clockwise. Then remove the seat retainer plate.
3. Holding the 9/16" wrench flat (located at the top end of the seat hub) secure, loosen the seat plate jam nut by turning it clockwise. Then remove the seat hub from the fixture and disassemble the remaining parts of the seat plate assembly. **Note: Secondary Teflon<sup>®</sup> seat used only in high pressure stainless steel options.**
4. Inspect seat plate radius for damage. Minor nicks and scratches may be removed by polishing radius with 320 grit or finer sand paper maintaining seat shape. **Warning: No lapping or machining of seat plate allowed.**
5. Inspect threaded parts and sealing surfaces and if damaged replace. Otherwise, clean all metal parts with oil free solvent and dry with lint free towel.
6. The new seat film is supplied as a square sheet of Teflon<sup>®</sup> without screw holes for the screws. To install, secure the larger end of the seat hub with the 9/16" wrenching flat into a vise and install in this order: protector plate, Teflon<sup>®</sup> seat film, seat bushing, seat o-ring (on outside of seat plate on seat plate on 6" sizes, seat plate (radius side down) and jam nut. Then tighten by turning the jam nut clockwise.
7. Remove the seat hub from the vise and install it into the fixture. To complete the assembly, install the secondary seat (high pressure stainless steel only) and then the retainer plate (bevel side down) onto the seat film. Then using a scribe punch out a hole in the film starting with the four threaded indicator holes (only threaded holes in retainer plate). Then install the 4 long retainer screws through those holes and tighten in a criss cross pattern. **Note: Lubricate retainer screws with Fluorolube to reduce the chances of galling.**

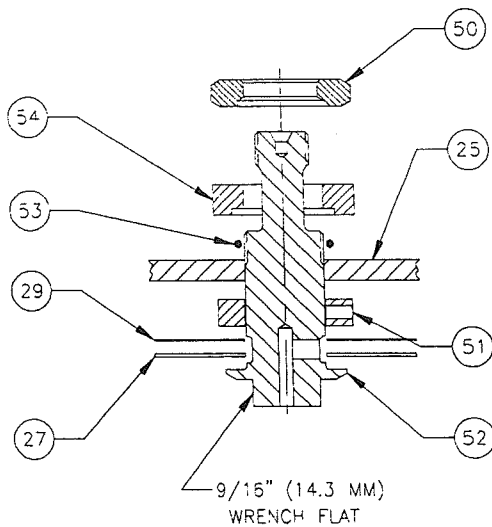


8. Punch out the remaining seat screw holes and install the screws and nuts and tighten. Caution: Be careful not to puncture or scratch the seat during this operation.
9. Trim off the excess film from the outside diameter of the seat plate to complete the replacement process.

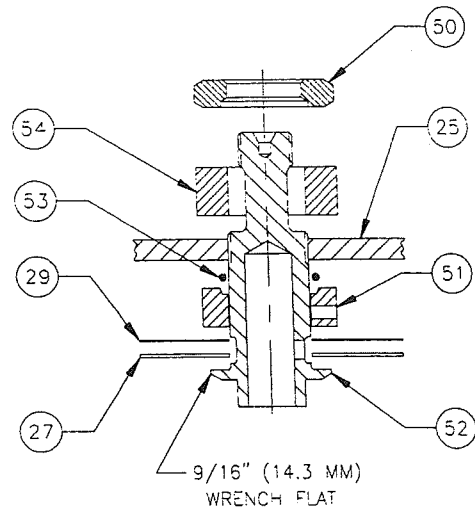


2" THRU 4" VALVE INLET SIZE

ITEM	DESCRIPTION
25	PLATE, SEAT
27	PLATE, PROTECTOR
29	FILM, SEAT
50	NUT, SEAT JAM
51	BUSHING, SEAT
52	HUB, SEAT
53	O-RING, SEAT
54	SPACER, SEAT



6" VALVE INLET SIZE



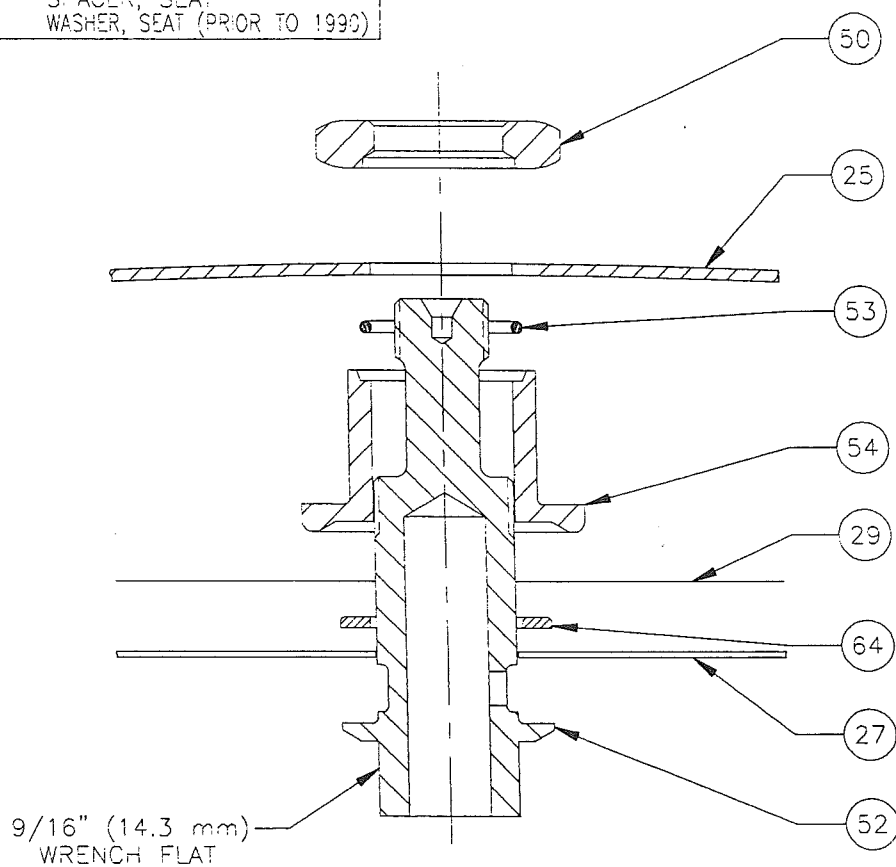
8" THRU 12" VALVE INLET SIZE

MAIN VALVE SEAT PLATE HUB ASSEMBLY  
(LOW AND HIGH PRESSURE ALUMINUM)  
(HIGH PRESSURE STAINLESS STEEL)

DETAIL D

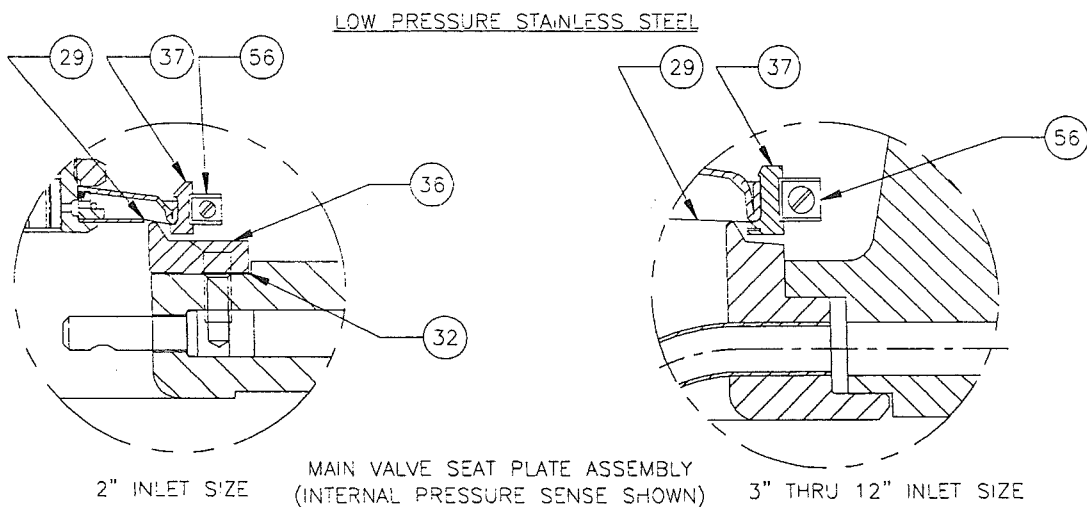
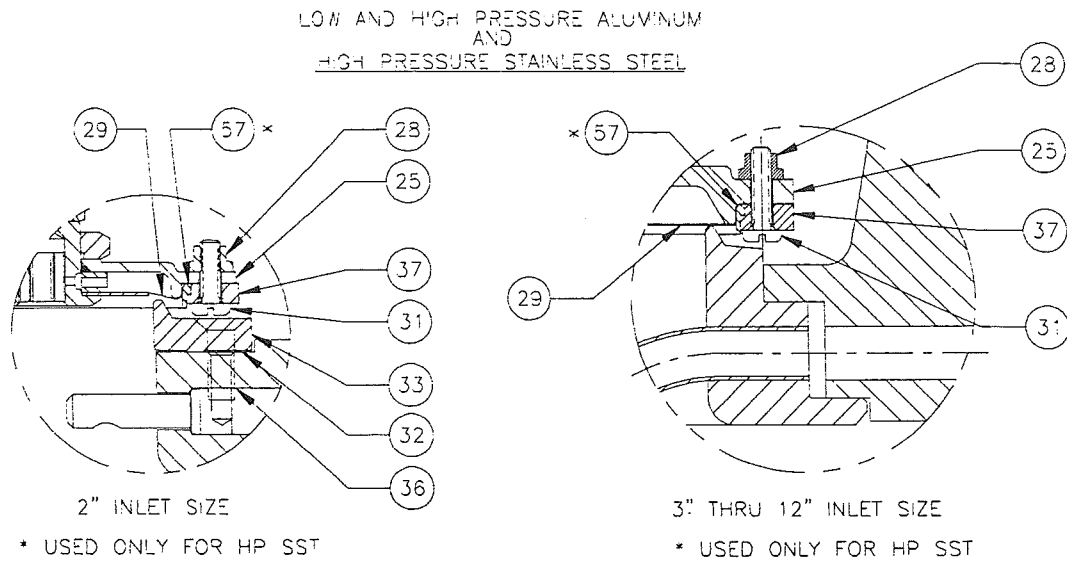
FIGURE 4

ITEM	DESCRIPTION
25	PLATE, SEAT
27	PLATE, PROTECTOR
29	FILM, SEAT
50	NUT, SEAT JAM
52	HUB, SEAT
53	O-RING, SEAT
54	SPACER, SEAT
64	WASHER, SEAT (PRIOR TO 1990)



MAIN VALVE SEAT PLATE HUB ASSEMBLY  
(LOW PRESSURE STAINLESS STEEL)

DETAIL D  
FIGURE 4A



DETAIL E

FIGURE 5

ITEM	DESCRIPTION
25	PLATE, SEAT
28	NUT, LOCK
29	FILM, SEAT
31	SCREW, SEAT
32	GASKET, NOZZLE UPPER
33	NOZZLE
36	SCREW, NOZZLE RETAINER
37	RETAINER, SEAT
56	CLAMP, BAND SEAT
57	SEAT, SECONDARY

### 3.5 Main Valve Seat Disassembly and Replacement (Banded)

Refer to Figure 4A Detailed and Figure 5 Detail E.

1. To assist in seat plate disassembly, partially thread the seat plate assembly into the fixture which consists of a 6" long hexagon bar with a  $\frac{1}{2}$ "x13x1" deep threaded hole in one end, and a 5/16"x18x1" deep threaded hole in the other end.  
**Note: The 5/16" hole is for valves sizes 2" through 6" and the  $\frac{1}{2}$ " hole is for 8" through 12".**
2. With the seat plate assembly threaded into the fixture and it secured in a vise, remove the band clamp. Then holding the 9/16 wrench flat on the seat hub stationery remove the seat plate jam nut.
3. Remove the seat hub from the fixture and disassemble the remaining parts from the seat plate assembly.
4. Inspect seat plate radius for damage. Minor nicks and scratches may be removed by polishing radius with 320 grit or finer sand paper maintaining seat shape. **Warning: No lapping or machining of seat plate allowed.**
5. Inspect threaded parts and sealing surfaces and if damaged replace. Otherwise, clean all metal parts with oil free solvent and dry with lint free towel.
6. The new seat film is pre-molded. To install, secure the wrenching flat of the seat hub into a vise and install the protector plate, Teflon<sup>®</sup> seat film (radius side down), seat bushing, seat o-ring, seat plate (radius side up, and install the jam nut **HAND TIGHT**. **Caution: Tightening the jam nut prior to stretching the film will cause ripples in the film. (See Detail E, figure 5)**
7. Remove the seat hub from the vise and install it into the fixture. Then install the glass-filled seat retainer (beveled side down) onto the seat film, and then install the band clamp and tighten.
8. Using a heat gun, apply heat to the seat film in a circular motion approximately 2" to 3" above surface until all ripples and creases are gone. This usually takes less than 1 minute. Now tighten jam nut wrench tight.
9. Trim excess film from back side of seat plate to complete reassembly process.

### 3.6 Main Diaphragm Disassembly and Replacement (Single/Dual Diaphragms)

(See Figure 3, Detail C)

1. Secure the main valve shaft wrenching surface in a soft jaw vise. Caution should be taken when securing aluminum shaft to prevent destroying the part.
2. Remove jam nut by turning it counterclockwise.
3. Note: mark plates as top and bottom prior to disassembly. Remove the following parts in this order: flat washer, vacuum plate, flat washer, diaphragm, slipper, pressure plate, and Teflon washer. Note: On single chamber valves with high pressure stainless steel internals, an outer and inner diaphragm slipper is used to protect the diaphragm from wear. The outer slipper is between the diaphragm and lower case. The inner slipper is between the diaphragm and the pressure plate.
4. Inspect plates for cracks, warpage. Clean all metal parts with oil free solvent, and dry with clean towel.
5. Proceed with this step only on disassembly of main valve dual diaphragms. Inspect lift rod straightness and ensure small diameter tip is not damaged. Also raise the lift rod up and check the surface for damage.
6. Proceed with this step only on disassembly of main valve dual diaphragms. Install 6" to 8" of braided stiff wire through the hole at the top of the lift rod. This will aid in reassembly of auxiliary diaphragm.
7. Install new Teflon<sup>®</sup> washer, lower plate (radius side up), reinforcement diaphragm (radius side down), metal washer (smooth side down), top plate, metal washer, and jam nut. Note: On 2" and 3" single and dual chamber valves with low pressure aluminum or low pressure stainless steel internals, use a reinforcement diaphragm between the main diaphragm and lower main case. The reinforcement diaphragm is recognized by a small offset hole at the center of the diaphragm. Caution: Installing the reinforcement diaphragm in the wrong location will cause damage to the diaphragm assembly.
8. Tighten jam nut wrench tight.

**3.7 Auxiliary Diaphragm Disassembly and Replacement (Dual Diaphragms)**

Refer to Figure 3, Detail A

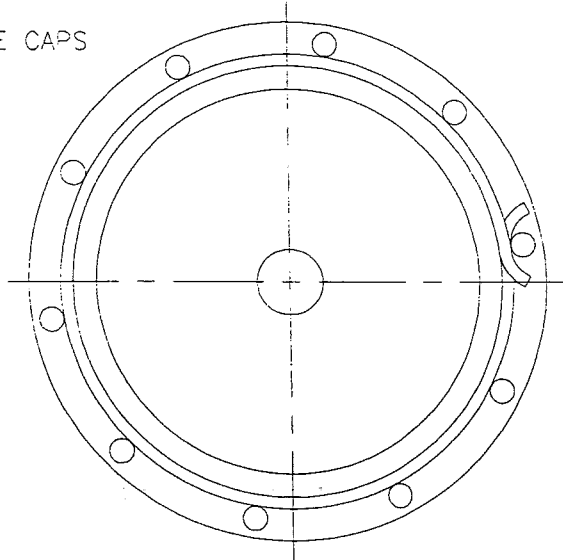
1. Secure auxiliary diaphragm bushing into soft jaw vise, and remove jam nut by turning it counterclockwise.
2. Remove flat washer, auxiliary plate, flat washer, reinforcement diaphragm, thick flat washer, and Teflon<sup>®</sup> washer.
3. Inspect threads on bushing and general condition of metal washers including sealing surface where Teflon washers seat. Clean metal parts with oil free solvent, and dry with clean towel.
4. Install Teflon<sup>®</sup> washer, thick washer (smooth side up), reinforcement diaphragm (radius side down), flat washer (smooth side down), auxiliary plate (bevel side down), flat washer, jam nut, and tighten by turning the jam nut clockwise. Caution: When tightening jam nut be careful not to damage diaphragm. Note: On 2" and 3" single and dual chamber valves with low pressure aluminum or low pressure stainless steel internals, use a reinforcement diaphragm between the main diaphragm and lower main case. The reinforcement diaphragm is recognized by a small offset hole at the center of the diaphragm. (See Detail A)

**3.8 Main Valve Nozzle Replacement**

1. Remove nozzle retaining screws and gently tap nozzle with soft face mallet.
2. Inspect nozzle seating surface for nicks or scratches. If they cannot be removed with a crocus cloth or finer sandpaper, the nozzle must be replaced.
3. If the upper and lower nozzle gaskets are to be replaced, install Teflon gasketing. (See Fig. 6, Section AA, the nozzle part only)
4. Reattach nozzle and retaining screws.

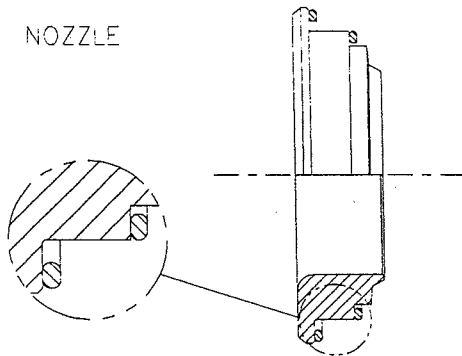
1. THE CONTACT SURFACES MUST BE CLEAN, FREE FROM GREASE, AND DRY.
2. REMOVE THE PROTECTIVE STRIP ON THE ADHESIVE TAPE.
3. LIGHTLY PRESS IN PLACE AS SHOWN BELOW.

UPPER MAIN VALVE CAPS

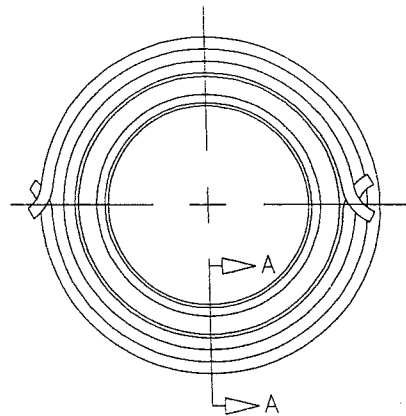


PUT TAPE JUST INSIDE OF BOLT HOLES, OVERLAPING ENDS AT A BOLT HOLE  
PUT TAPE ON TOP CAP ONLY. DO NOT PUT ON LOWER CAP OF MATING PAIR.

NOZZLE



SECTION A-A



PLACE TAPE TOWARD OUTER EDGE OF EACH GASKET LEDGE. PUT OVERLAPS ON  
OPPOSITE SIDES. USE 1/8" TAPE ON 3" AND 4" NOZZLES. 3/16" TAPE ON  
ALL CAPS AND LARGER NOZZLES.

TEFLON TAPE MOUNTING INSTRUCTIONS

FIGURE 6



**3.9 Reassembly of Main Valve Single Diaphragm**

1. Ensure nozzle maintenance is complete and nozzle is reinstalled.
2. Secure seat hub into soft jaw vise.
3. Install lower main valve case on top of seat plate.
4. Lower shaft and diaphragm assembly through center hole of case.
5. Holding shaft stationary, screw the seat plate assembly onto the main valve shaft. The connecting thread will run free, tighten, and free again as it engages with the locking helicoil.
6. Apply Teflon<sup>®</sup> gasketing to top of the main valve body. (See Fig. 6 main valve cap description)
7. Lower seat plate, shaft assembly, and lower diaphragm case into main valve body. Align bolt hole with diaphragm, case, and body.
8. Install Teflon<sup>®</sup> gasket material to upper main valve case. (See Fig. 6)
9. Reattach the upper main diaphragm case and seat plate assembly to the body.
10. Align match marks of case with body, and install cap bolts and tighten in a crisscross pattern.
11. Reattach the pilot and tubing.

**3.10 Reassembly of Main Valve Dual Diaphragm**

1. Ensure nozzle maintenance is complete and nozzle is reinstalled.
2. Secure seat hub into soft jaw vise.
3. Install lower main valve case on top of seat plate.
4. Lower shaft and diaphragm assembly through center hole of case.
5. Holding shaft stationary, screw the seat plate assembly onto the main valve shaft. The connecting thread will run free, tighten, and free again as it engages with the locking helicoil. Caution: Do not tighten the seat hub against the shoulder of the shaft.

6. Apply Teflon<sup>®</sup> gasketing to top of the main valve body .  
(See Fig. 6)
7. Lower seat plate, shaft assembly, and lower diaphragm case into main valve body. Align bolt hole with diaphragm, case, and body.
8. Replace the -10 o-ring in the upper end of the adapter bore lubricating it with Dow Corning FS3451 or equivalent when the new one is installed. (See Fig. 2)
9. Install Teflon<sup>®</sup> gasket material to upper main valve case and lower auxiliary case assembly spool. (See Fig. 6)
10. Lubricate threads and shaft of lift rod and lower spool assembly onto the main valve while lifting rod wire through the center hole of the adapter.
11. Align match marks of case with body, and install cap bolts and tighten in a crisscross pattern.
12. Lower auxiliary diaphragm assembly onto lower auxiliary case lifting rod wire through the center of diaphragm bushing. Holding the wire, spin diaphragm assembly 2 full turns clockwise.
13. Now bend the wire in half and spin the lift rod counterclockwise approximately 20 turns. This is the starting position for setting the lift of the auxiliary diaphragm.
14. To set lift position, position the edge of the ruler at the top edge of the auxiliary diaphragm vacuum plate and lift the rod up. Normal lift is 1/8" to 3/16". To increase lift, spin lift rod clockwise. To decrease lift, turn lift rod counterclockwise.
15. To lock setting insert Teflon<sup>®</sup> o-ring onto lift rod and install jam nut. To tighten, hold diaphragm jam nut and lift rod stationery and turn lift rod jam nut clockwise until wrench tight. **Note: Re-check Lift to ensure adjustment did not change during tightening.**
16. Uncap the dome port and close the auxiliary and main diaphragm assemblies.
17. Replace the upper auxiliary diaphragm case. Install case bolts and nuts and tighten.
18. Replace the pilot and tubing.

#### 4.0 Pilot Maintenance

##### 4.1 Pilot Disassembly for Non-Flowing Modulating Pilots (Type 400B)

Refer to Figure 7.

1. Remove bonnet cap, loosen adjustment screw lock nut, back out adjusting screw to relieve spring tension. Remove bonnet nuts, bonnet assembly, spring, washers, and ball.
2. Push down on spool retaining nut with a Phillips screw driver engaging the spool anti-rotation pin, and remove nut with a ½" open end wrench turning counterclockwise.
3. Remove spindle spring, case bolts, nuts, and upper case.  
**Note: Internals are now accessible for removal.**
4. Remove -14 o-ring, plate sense gasket, diaphragm sense, gasket, ring lantern, feedback diaphragm, gasket, metal slipper, and feedback diaphragm plate.
5. Remove spool and spindle assembly.
6. Remove the lower spindle, -13 o-ring, outlet seat, -14 o-ring from the spindle. Now the spindle may be removed from the spool. Remove the top inlet seat o-ring from the spindle.
7. Remove the lower diaphragm case from the body by removing the 4 inner case bolts.
8. Remove the inlet connector and inlet screen by removing the 2 bolts on the side of the pilot body.
9. Clean all metal parts, and throw away all gaskets, diaphragms, and seals. **Note: Pay particular attention to all port holes and polished areas.**

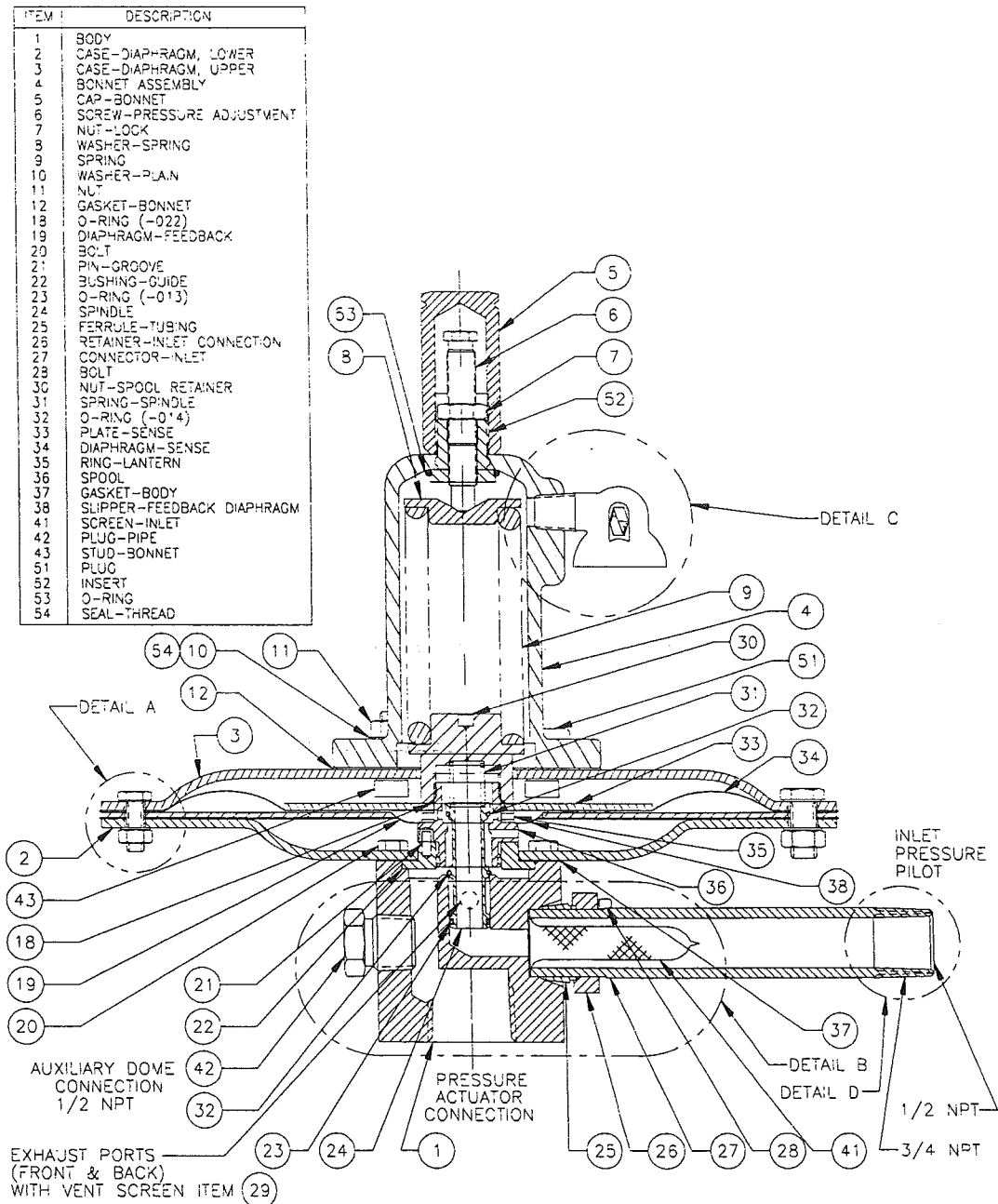
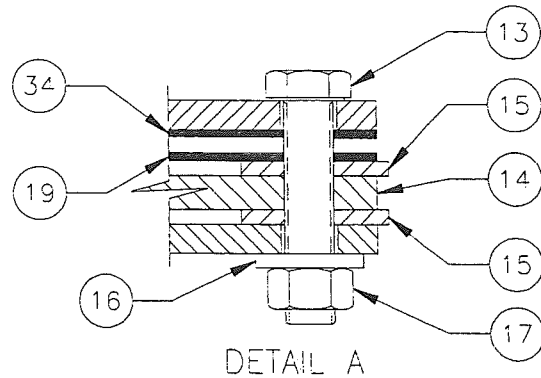
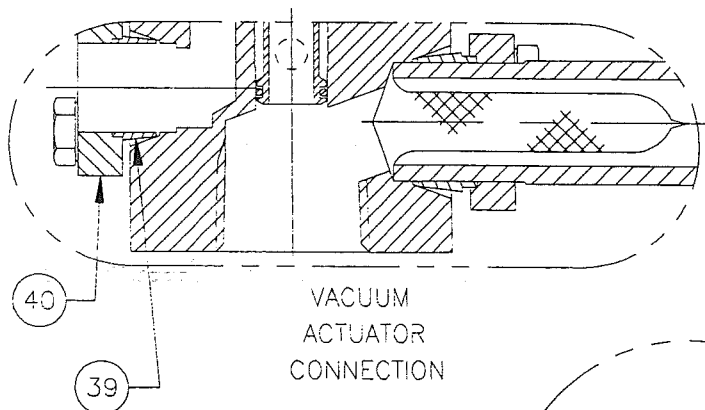
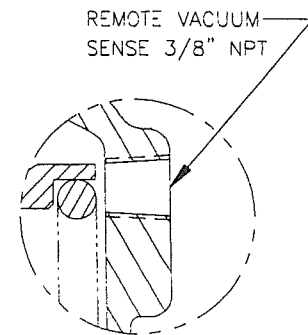


FIGURE 7

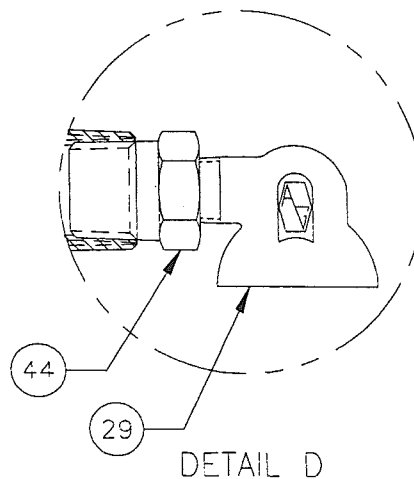
ITEM	DESCRIPTION
13	BOLT
14	PLATE, DIAPHRAGM SUPPORT
15	GASKET, DIAPHRAGM CASE
16	WASHER, LOCK
17	NUT
19	DIAPHRAGM, FEEDBACK
29	VENT SCREEN
34	DIAPHRAGM, SENSE
39	FERRULE, TUBING
40	RETAINER, DOME TUBING
44	BUSHING



DETAIL A

VACUUM  
ACTUATOR  
CONNECTION  
DETAIL B

DETAIL C



DETAIL D

FIGURE 8

**4.2 Pilot Assembly for Non-Flowing Modulating Pilots (Type 400B)**

1. Lubricate all O-Rings, sliding surfaces, screw threads and spring washer pivot points with Dow Corning No. 33 silicone grease or equivalent. **Note: For oxygen service valves use only lubricants suitable for this service, such as Krytox 240AC.**
2. The spindle O-Ring and bearing surface should be lubricated with Dow Corning FS 3451 or equivalent. **Note: Do not lubricate inlet or outlet seat o-rings**
3. Assemble the diaphragm lower case to the body. **Note: For Pilots with Kalrez O-Rings, use two Teflon<sup>®</sup> gaskets between the lower diaphragm case and the body.**
4. Assemble the inlet screen to the inlet connector and the inlet connector to the body.
5. Assemble the inlet seat (upper O-Ring [-014]) and the spindle O-Ring to the spindle.
6. Assemble the spindle to the spool and install the outlet seat (lower o-ring [-014]) to the spindle.
7. Install the spool with spindle in the body. Position the spool to engage the anti-rotation groove pin.
8. Install a diaphragm case gasket on the lower diaphragm case and the feedback diaphragm support plate. **Note: Install the support plate with the rounded edge up towards the feedback diaphragm**
9. Install the following parts in the order listed on the spool:
  1. Feedback diaphragm support plate
  2. Gasket
  3. Feedback diaphragm
  4. Lantern ring
  5. Sense diaphragm
  6. Gasket
  7. Sense plate. **Note: Install the sense plate with the round edge towards the sense diaphragm.**
  8. Install o-ring (-22) around the spindle. On the sense, add plenty of lubricant to the o-ring.
10. Install the upper diaphragm case, case bolts, washers, and nuts.

11. Install the spindle spring and spool retainer nut. Lube nut with Dow Corning 33 on bevel and use Fluorolube on the threads. Push down on the spool retainer nut with a Phillips screw driver engaging the anti-rotation pin and tighten the nut to 10 foot pounds using ½ open end wrench. **Note: Do not over tighten, the diaphragms may be damaged.**
12. Pretest pilot function by depressing spindle/diaphragm assembly stack downward. The spindle spring should return the stack assembly to the upward position. If it doesn't return to upward position, disassemble pilot and re-check assembly.
13. Install spring, spring washer and bonnet onto pilot body. Install bonnet gasket, bonnet, bonnet washers, and nuts and tighten.
14. Install pressure adjustment screw, lock nut and cap.

This Pilot is now ready for testing.

#### 4.3 Pilot Disassembly for Flowing Modulating or Snap Action Pilots (Types 91, 93, and 93T)

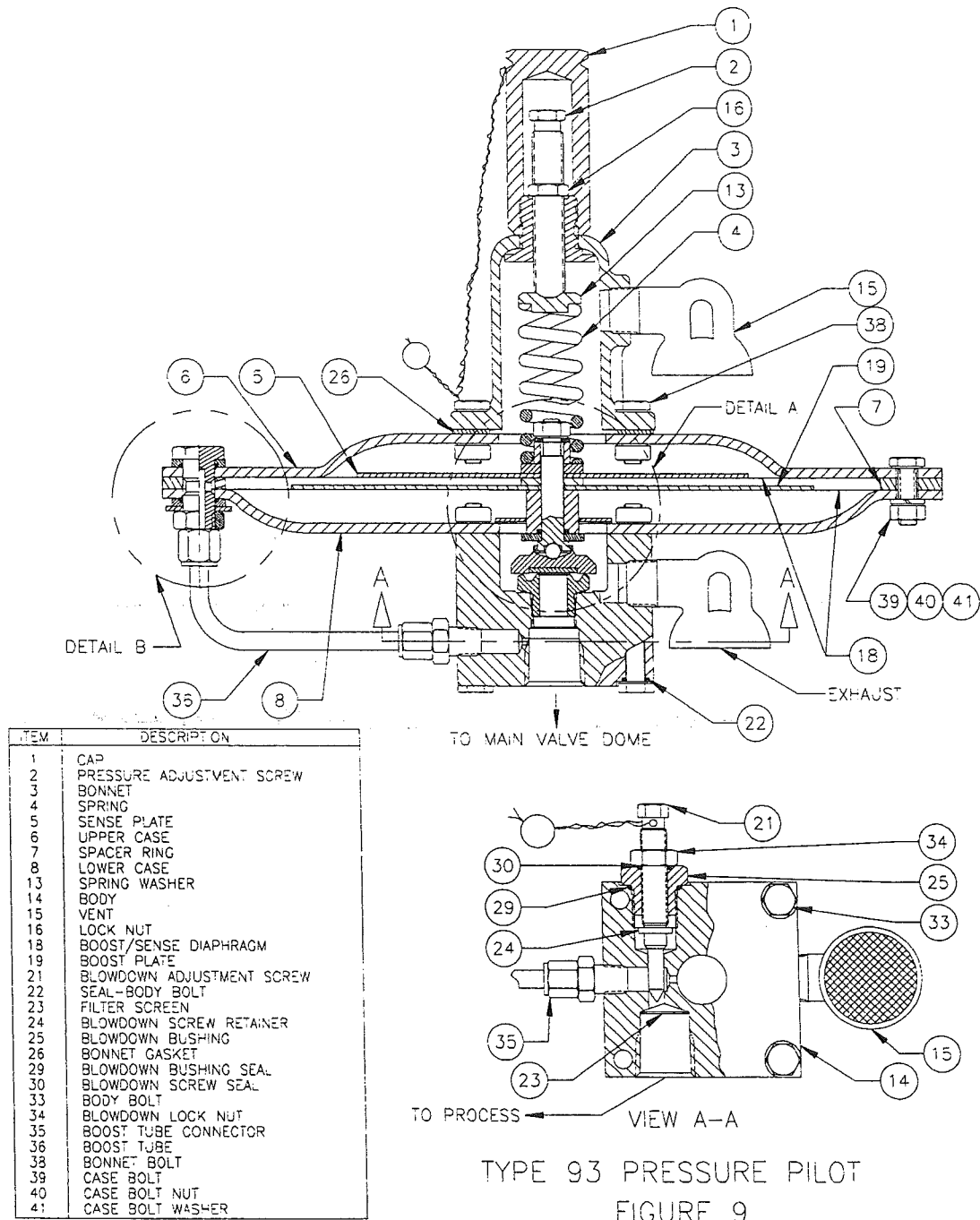
Refer to Figures 9 thru 13.

The pilot disassembly instructions and soft goods vary between pilot types. Pay particular attention to orientation of parts and materials. The 93T pilot has all Teflon<sup>®</sup> soft goods including diaphragms, and its maximum set pressure is 15 psig. The 91 pilot has Teflon<sup>®</sup> soft goods with stainless steel(SS), hasteloy, and Teflon<sup>®</sup> diaphragms, and its set pressure ranges from 16 psig to 50 psig. The 93 pilot is different from the 93T and 91 pilot in that it uses elastomer seat, seals, and diaphragms.

1. Remove cap, adjusting screw, adjusting screw lock nut, bonnet bolts and nuts from the pilot. Remove the bonnet, spring, and washer.
2. On Types 91 and 93T pilots, loosen boost tube fitting on boost tube at boost tube connector/bolt. Remove boost tube connector nut, washer, seal retainer, and lower boost tube seal. Let these parts slide down the boost tube. Remove boost tube connector bolt, upper boost tube seal, and seal retainer. (See Detail B, Figure 13)
3. On Type 93 pilot, Loosen boost tube fitting on boost tube at boost tube connector/bolt. Remove boost tube connector nut, washer, and lower boost tube seal. Let these 3 parts slide down the boost tube. Remove boost tube connector bolt and upper boost tube seal. (See Detail B)

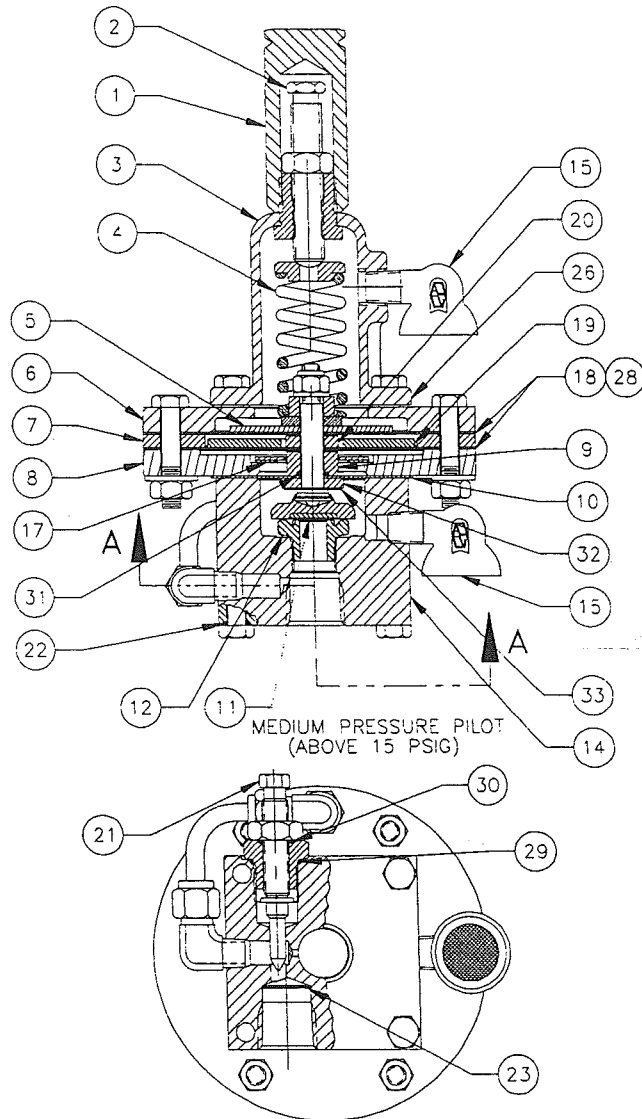
4. Remove case bolt nuts, lock washers, and case bolts. Remove the upper case.
5. **On Types 91 and 93T Pilots**, Hold hex spacer stationary with a shortwell 3/4 socket that has the ratchet area bored out and inserting another socket into the bored out hole loosen.  
  
Remove parts in the following order: hex washer, sense plate, upper case gasket, sense diaphragm case gasket, spindle gasket, sense spacer, boost plate, spacer ring, diaphragm gasket, boost diaphragm, diaphragm gasket, boost spacer, spindle seal, and spindle gasket. (See Detail A, Figure 12)
6. **On Type 93 Pilot**, Hold hex spacer stationary with a shortwell 3/4 socket that has the ratchet area bored out and inserting another socket into the bored out hole loosen.  
  
Remove parts in the following order; hex washer, sense plate, sense diaphragm, diaphragm gasket, sense spacer, boost plate, spacer ring, diaphragm gasket, boost diaphragm, boost spacer, check plate, and spindle seal.
7. Remove boost tube from the pilot body, and lower the boost tube seal from the boost tube.
8. Remove the bottom body bolts, case plate (on the 91 and 93T), and lower diaphragm case from the body.
9. Remove the spindle diaphragm and spindle/disk assembly from the body.
10. **On Types 91 and 93T only**, remove the retainer ring with snap ring pliers. Then remove the seat retainer from the spindle/disk assembly, and remove the Teflon seat.
11. Remove shim washer(s) from the spindle seat assembly. **Note: Shim washers may not always be used in assembly.**
12. Remove the blowdown bushing and blowdown bushing seal from the pilot body. **Note: The blowdown screw retainer c-ring is a loose fit on the blowdown adjustment screw. Be prepared to catch it when the bushing is removed from the body.**
13. Loosen the blowdown screw locknut and remove the blowdown adjusting screw and seal from the bushing.
14. Remove the vent from the body. **Note: It is not necessary to remove the filter screen or nozzle from the body.**
15. Discard all soft goods and spindle assembly (Type 93). Inspect metal parts for burrs, thoroughly clean all parts with oil free solvent, and dry with shop air. Pay particular attention to small passageways in the pilot, and check the tubing.





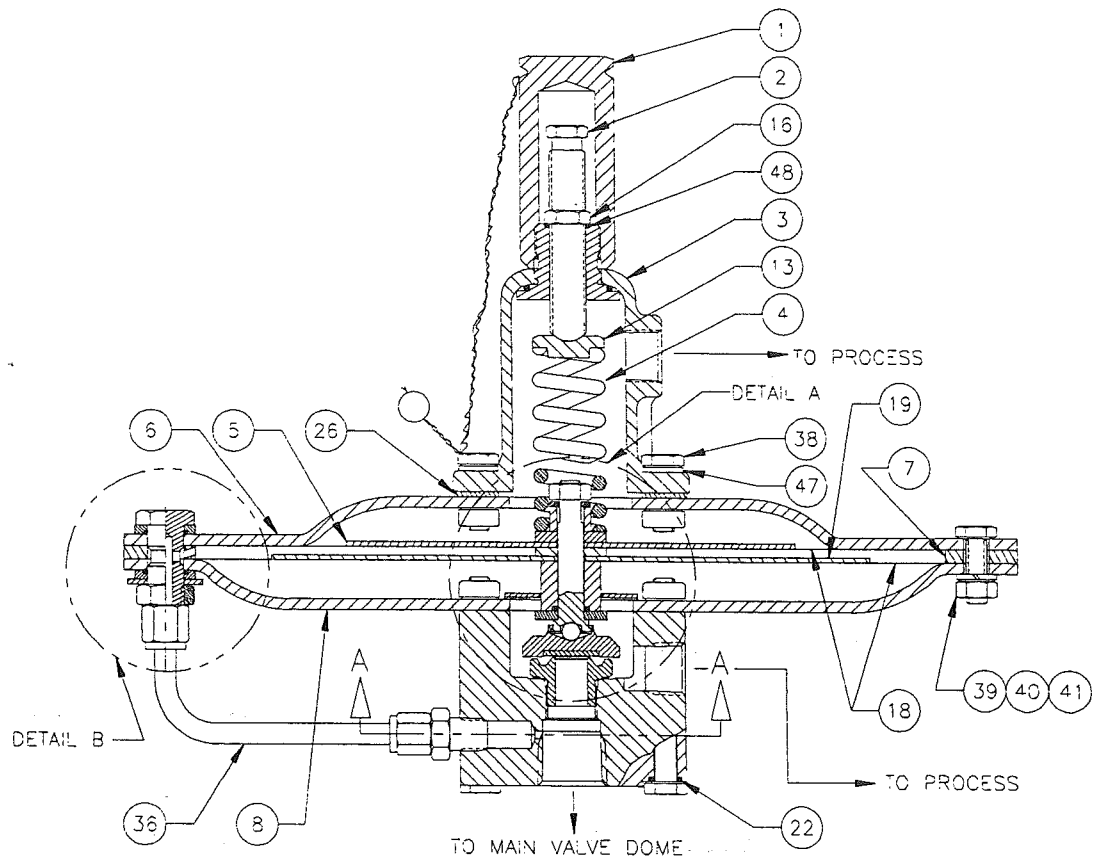
NO.	DESCRIPTION
1	CAP
2	PRESSURE ADJ. BOLT
3	BONNET
4	SPRING
5	SENSE PLATE
6	UPPER CASE
7	SPACER RING
8	LOWER CASE
9	BOOST SPACER
10	SPINDLE DIAPHRAGM *
11	SEAT/SPINDLE *
12	NOZZLE
14	BODY
15	VENT
17	CHECK PLATE
18	PILOT DIAPHRAGM *
19	BOOST PLATE
20	SENSE SPACER
21	BLOWDOWN NEEDLE
22	SEAL, BODY BOLT *
23	FILTER SCREEN
26	BONNET GASKET *
28	DIAPHRAGM GASKETS *
29	BUSHING SEAL *
30	BLOWDOWN SEAL *
31	SPINDLE SEAL *
33	SHIM WASHER

\*Recommended spare parts for repair.

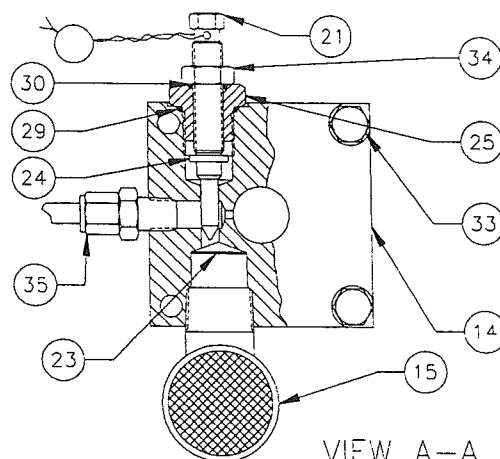


VIEW A-A

FIGURE 10

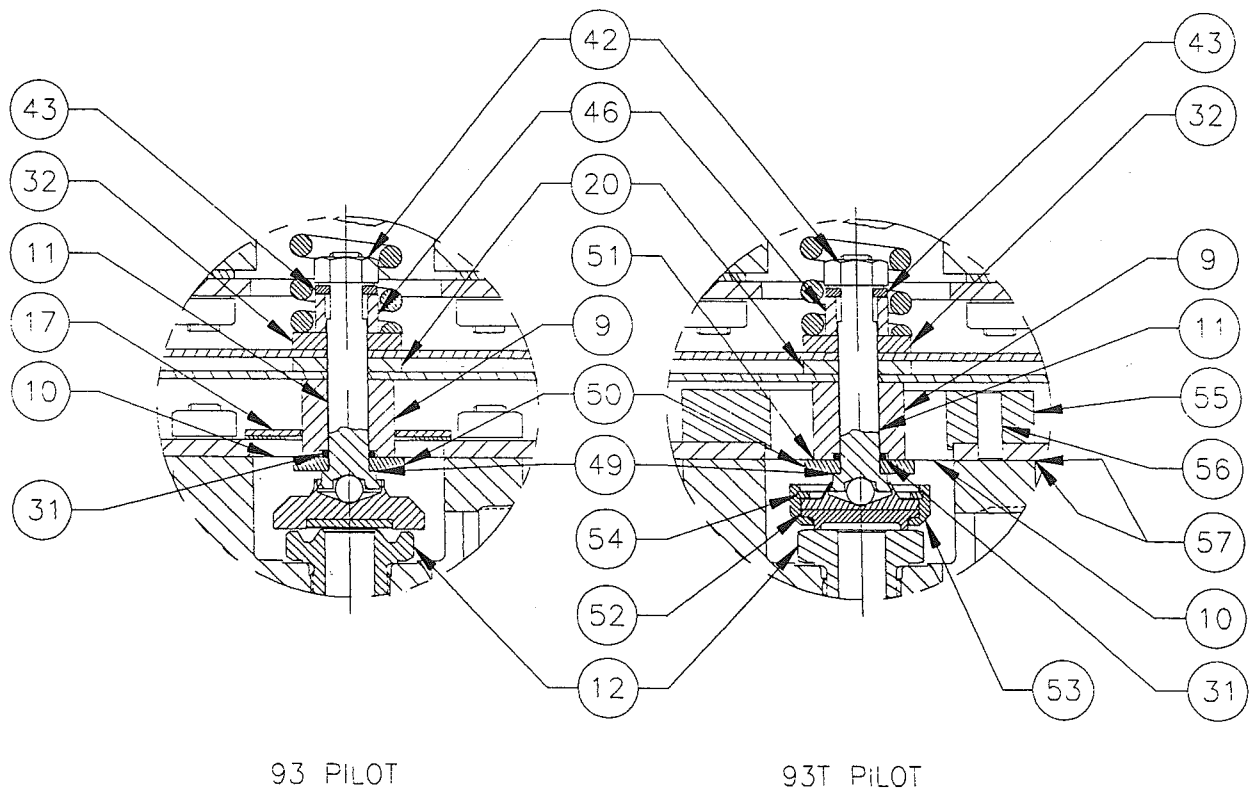


ITEM	DESCRIPTION
1	CAP
2	PRESSURE ADJUSTMENT SCREW
3	BONNET
4	SPRING
5	SENSE PLATE
6	UPPER CASE
7	SPACER RING
8	LOWER CASE
13	SPRING WASHER
14	BODY
15	VENT
16	LOCK NUT
18	BOOST/SENSE DIAPHRAGM
19	BOOST PLATE
21	BLOWDOWN ADJUSTMENT SCREW
22	SEAL-BODY BOLT
23	FILTER SCREEN
24	BLOWDOWN SCREW RETAINER
25	BLOWDOWN BUSHING
26	BONNET GASKET
29	BLOWDOWN BUSHING SEAL
30	BLOWDOWN SCREW SEAL
33	BODY BOLT
34	BLOWDOWN LOCK NUT
35	BOOST TUBE CONNECTOR
36	BOOST TUBE
38	BONNET BOLT
39	CASE BOLT
40	CASE BOLT NUT
41	CASE BOLT WASHER
47	BONNET BOLT SEAL
48	PRESSURE ADJUSTMENT SCREW SEAL



VIEW A-A  
TYPE 93 VACUUM PILOT  
FIGURE 11

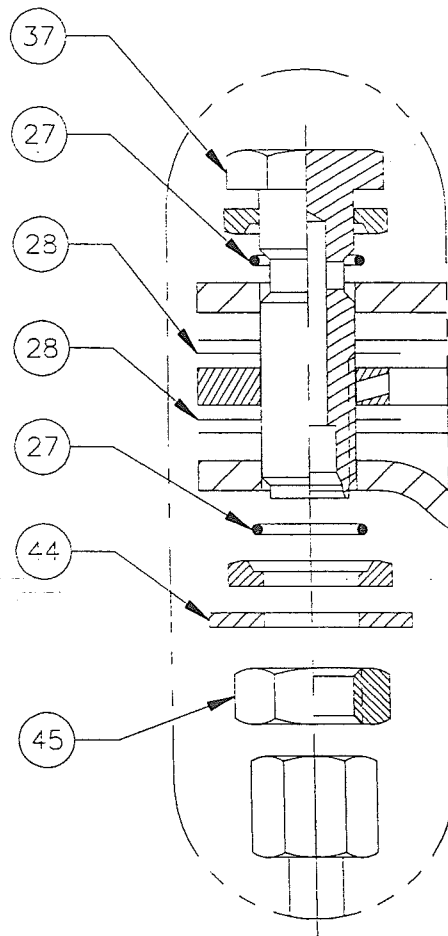
ITEM	DESCRIPTION
9	BOOST SPACER
10	SPINDLE DIAPHRAGM
11	SPINDLE/DISK ASSEMBLY
12	NOZZLE
17	CHECK PLATE
20	SENSE SPACER
31	SPINDLE SEAL
32	HEX SPACER
42	SPINDLE NUT
43	SPINDLE NUT WASHER
46	SPRING SPACER
49	SHIM WASHER
50	SPINDLE DIAPHRAGM PLATE
51	SPINDLE GASKET-93T
52	SEAT-93T
53	SEAT RETAINER-93T
54	RETAINER RING-93T
55	DIAPHRAGM CASE PLATE-93T
56	PIN-93T
57	CASE/BODY GASKET-93T



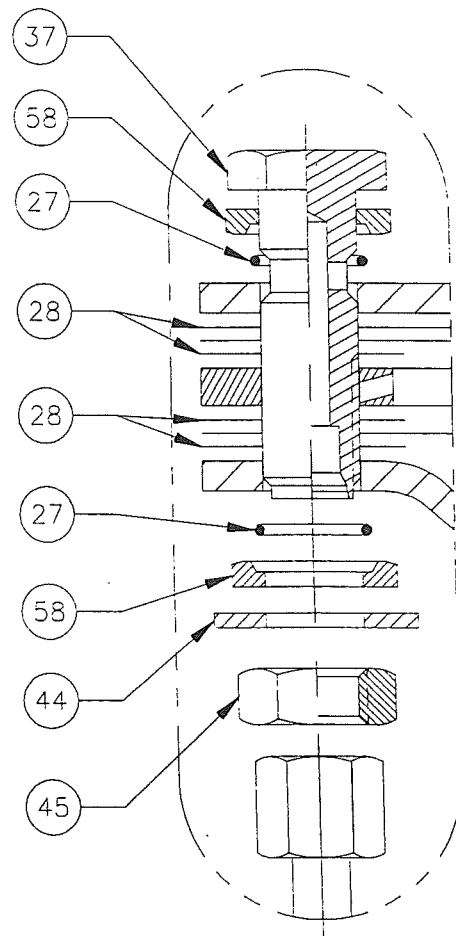
DETAIL A

FIGURE 12

ITEM	DESCRIPTION
27	BOOST TUBE SEAL
28	DIAPHRAGM GASKET
37	BOOST TUBE CONNECTOR/BOLT
44	BOOST TUBE CONNECTOR WASHER
45	BOOST TUBE CONNECTOR NUT
58	BOOST TUBE SEAL RETAINER-93T



93 PILOT



93T PILOT

DETAIL B  
FIGURE 13

**4.4 Pilot Assembly for Flowing Modulating or Snap Action Pilots**  
**(Types 91, 93, and 93T)**

1. On Type 93 and Teflon<sup>®</sup> seat Types 91 and 93T pilots, if you removed the nozzle, reattach the nozzle to the body, and replace the spindle seat assembly.
2. If you remove the filter screen, reattach the filter screen, and reattach the vent to the body.
3. Reattach the seal, and blowdown adjusting screw to the bushing, and tighten the screw locknut. **Note: Make sure the blowdown screw retainer is on the blowdown adjustment screw.**
4. Attach the blowdown bushing seal and the blowdown bushing to the body.
5. Place the shim washer(s) and spindle spacer on the spindle/seat assembly. Then place the spindle seat assembly in the body.
6. Lay a straight edge across the body and check the gap between the straight edge and the spindle spacer. Add or remove shims as required to make the top of the spindle diaphragm plate even with the top of the body.
7. Align the small hole in the lower diaphragm case with the hole in the spindle diaphragm. Then align the spindle diaphragm hole with the hole in the body. Install the lower case, body bolts, and bolt seals onto the body and tighten together. **Note: On the 91 and 93T Pilots, there are gaskets on each side of the spindle diaphragm and a diaphragm case plate that must be installed onto the lower case.**
8. On Types 91 and 93T Pilots, Reattach the hex jam nut, flat washer, seal retainer, and lower boost tube seal to the boost tube. Then attach the boost tube to the body.
9. On Types 91 and 93T pilots, install parts in the following order: spindle gasket, spindle seal, boost spacer, diaphragm gasket, boost diaphragm, diaphragm gasket (larger I. D. hole), spacer ring, boost plat, sense spacer, spindle gasket, diaphragm gasket, sense diaphragm, diaphragm gasket (smaller I.D. hole), sense plate, hex washer, spring disc, lock washer and jam nut. **Note: Be sure to align large hole in diaphragm and gaskets with the boost tube hole.**

10. On Type 93 Pilot, install parts in the following order: spindle seal, check plate (rubber side down), boost spacer, boost diaphragm, diaphragm gasket, spacer ring, boost plate, sense spacer, Diaphragm gasket, sense diaphragm, sense plate, hex washer, spring disc, lock washer, and jam nut. **Note: Be sure to align large hole in diaphragm and gaskets with the boost tube hole.**
11. To tighten spindle and diaphragm assembly, hold 3/4" socket tool onto hex washer stationary, and tighten the jam nut.
12. Install the upper boost tube seal (Type 93 Pilot), Teflon<sup>®</sup> seal and retainer seal (Types 91 and 93T Pilot), and boost tube connector into the large hole of the pilot body casing. Install the lower boost tube seal, washer, and boost tube connector nut to the bolt. Tighten boost tube fitting on the boost tube at the boost tube connector/bolt.
13. Install upper diaphragm case, case bolts, and nut, and tighten.
14. Install the spring washer, spring, bonnet, and bonnet bolts, adjusting screw locknut, and cap. **Note: For the vacuum pilot remember to replace seals and adjusting screw seal.**

#### 4.5 Pilot Adjustment for Non-Flowing Modulating Pilots (Type 400B)

The pilot may be set separate from the main valve provided there is access to a pilot test system similar to the one shown below in Figure 14.

##### 4.5.1 Adjustment of Set Pressure

1. Install the pilot valve onto the pilot test system and attach gage sensing lines to the supply and dome connections.
2. Remove cap.
3. Screw the set pressure adjustment screw clockwise until it is screwed in 80% to 90%.
4. Increase the supply pressure to nameplate setting and slowly back out the adjustment screw until flow through the pilot exhaust begins.

5. Continue to back the set pressure adjustment screw out until the dome pressure is 70% of the supply pressure. When the dome pressure reaches 70% of the supply pressure read the supply gage pressure. If it is below set pressure, you will need to tighten down on the pressure screw, or back off it if you are high. Tighten the locknut once the desired set pressure is achieved. Note: Adjust the set pressure for  $101\% \pm 1\%$  of the nameplate set pressure.
6. Cycle the pilot valve a minimum of 5 times to assure that the dome pressure reduction at set pressure is consistent. Increase the pressure very slowly in order to obtain an accurate reading of the cracking pressure and to expose any erratic performance. Note: Cracking pressure on vacuum pilots is that pressure at which the initial dome pressure change is noted.
7. Hold the pilot valve at set pressure to obtain the dome pressure reading. Note: The first 6 steps should be completed before this step is undertaken. In Modulating 400B Pilots, the dome pressure decreases proportional to increase in inlet pressure.  
  
Full dome reduction (dome pressure) occurs  $\leq 6\%$  over pressure.
8. Check the pilot exhaust for leakage when the pilot is in null position between crack and reseal. Note: Maximum leakage allowed is 60 bubbles per minute.



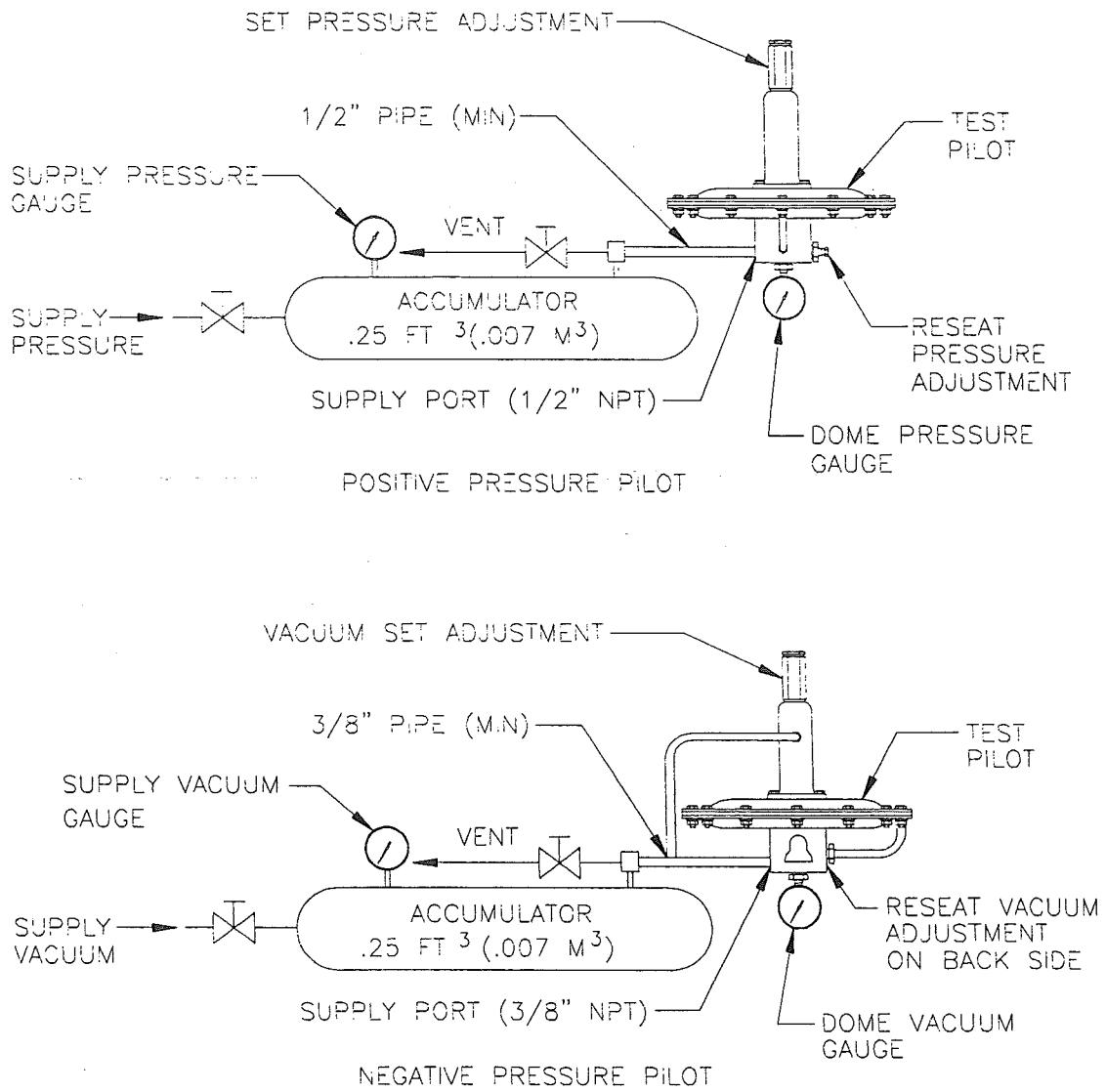


FIGURE 14

#### 4.5.2 Reseat Pressure

Reseat is defined as that supply pressure when the dome pressure is 75% of the supply pressure. Note: Blowdown adjustment is not required on Type 400B pilots.

#### 4.5.3 Adjustment Tolerances

Pressure	Tolerance
Set Pressure	+/- 3%
Crack Pressure	98% of set
Reseat Pressure	96% of set

#### 4.6 Pilot Adjustment for Flowing Modulating or Snap Action Pilots (Types 91, 93, and 93T Pilots)

The pilot may be set separate from the main valve provided there is access to a pilot test system similar to the one shown below in Figure 14.

##### 4.6.1 Adjustment of Set Pressure

1. Install the pilot valve onto the pilot test system, and attach gage sensing lines to the supply and dome connections.
2. Remove the cap.
3. Screw the set pressure adjustment screw clockwise until it is screwed in 80% to 90%.
4. Increase the supply pressure to nameplate setting and slowly back out the set pressure adjustment screw until flow through the pilot exhaust begins.
5. Continue to back the set pressure adjustment screw out until the dome pressure is 70% of the supply pressure. When the dome pressure reaches 70% of the supply pressure read the supply gage pressure. If it is below set pressure, you will need to tighten down on the pressure screw, or back off it if you are high. Tighten the locknut once the desired set pressure is achieved. Note: Set pressure on a vacuum pilot is evidenced by a rapid change of the dome pressure (0 gage) to the supply pressure. A slow ramp speed is recommended on low set valves in order to obtain true reading of set pressure.

6. Check the pilot exhaust vent for leakage. The pilot shall be bubble tight up to crack pressure shown in 4.6.3. Also, check upper pilot vent for leakage. There should be 0 leakage from the upper vent.

#### 4.6.2 Reseat Pressure

1. Turn the blowdown adjusting screw clockwise to decrease the reseat pressure or counterclockwise to increase the reseat pressure.
2. A small interaction between set pressure and reseat pressure adjustments will occur; therefore, it may be necessary to readjust the set pressure after setting reseat pressure.

**Note:** If the blowdown adjusting screw has been removed or turned to either extreme, positioning it midway will aid in obtaining the correct reseat pressure. There are approximately 7 to 8 turns to obtain full travel of the adjustment. Midway from either end should produce a blowdown for snap action.

For modulating pilot action, back the adjustment screw out counterclockwise.

3. Cycle the pilot valve a minimum of 5 times to assure that dome pressure reduction at set pressure is consistent. Increase the pressure very slowly in order to obtain an accurate reading of the cracking pressure and to expose any erratic performance. **Note:** Cracking pressure on vacuum pilots is that pressure at which the initial dome pressure change is noted.
4. Hold the pilot valve at set pressure to obtain the dome pressure reading. For modulating pilots, dome pressure shall be read with the inlet at 105% of set pressure. **Note:** The first 4 steps should be completed before this step is undertaken.

On Snap action pilots, the dome pressure decreases rapidly with a "snap" to 15% +/- 10% of set pressure.

On Modulating Action Pilots (Series 90), the dome pressure decreases slowly to 30% +/- 5% of set pressure and recovers to 60% +/- 10% of set pressure at set pressure.

5. After desired pilot action is set, verify pilot seat tightness. This is accomplished by checking the pilot exhaust vent for leakage. The pilot should be bubble tight up to crack pressure as shown in 4.6.3. Be aware of crack pressure changes between set pressure ranges.

4.6.3 Adjustment Tolerances

Pilot Action	Set Press.	Set Press. Tolerances	Crack Press. % Set	Reseat Press. % Set
Snap	4"WC to 7"WC	+/- .2"WC	75 %	90% +/- 1
	7"WC to 1.0 PSIG	+/- 3%	90%	90% +/- 1
	Above 1 PSIG	+/- 3%	95%	92% +/- 1
	4"WC to 7"WC	+/- .2"WC	75%	90% +/- 1
	-7"WC to -1.0 PSIG	+/- 3%	90%	90% +/- 1
	-1 PSI TO 14.7 PSIG	+/- 3%	95%	92% +/- 1
Modulating Action	4"WC to 7"WC	+/- .2"WC	75%	100%
	7"WC to 1.0PSIG	+/- 3%	90%	100%
	Above 1.0 PSIG	+/- 3%	95%	100%
	4"WC to - 7"WC	+/- .2"WC	75%	100%
	-7"WC to -1.0 PSIG	+/- 3%	90%	100%
	-1.0 PSI to - 14.7 PSIG	+/- 3%	95%	100%

## 5.0 FUNCTIONAL TESTING OF COMPLETE ASSEMBLY OF MAIN VALVE AND PILOT

### 5.1 General

Assemble the pilot to the main valve, and install remaining tubing and accessories. The complete valve assembly should be leak tested for internal and external leaks using a pressure equal to 30% and 90% of set.

#### 5.1.1 Leakage Check - Pressure Relief Valves

Apply pressure to the inlet equal to 30% of the set pressure. Check for leakage at the main valve seat, no visible leakage shall occur. Hold time is 1 minute.

Increase the inlet pressure to 90% of the set pressure. Check for leakage at the cap seal, casting, pilot support pipe and supply tube and other applicable connections using leak test solution and at the main valve seat. No visible leakage shall occur for a hold time of 1 minute.

#### 5.1.2 Leakage Check - Vacuum Relief Valves

Valves equipped with vacuum pilots shall be leak tested per 5.1.1 on positive pressure with the set pressure equal to the reciprocal of the vacuum set pressure. Valves with weighted diaphragms shall be tested for leakage at 50% of their weighted set.

#### 5.1.3 Back Flow Preventers and/or Field Test

The use of some field test connection or back flow preventers necessitates the use of check valves. These valves shall be installed per the applicable assembly drawings and in the free flow direction shall open at less than .5 inches W.C. The check valves may be tested for forward flow either before or after assembly at the shops option. The output check valve of back flow preventers shall be checked for zero leakage per 5.1.1 paragraph 2.

### 5.2 Field Test Procedure for Non-Flowing Modulating Positive Pressure Pilot (Type 400B Pilot)

1. Connect gas bottle as shown in Figure 15.
2. Close valve "C".
3. Open block valve "B" to supply regulator. Note: Regulator pressure should be set at 0.)

4. Connect bubble tester bottle to pilot exhaust vent and block the second pilot vent if the pilot is equipped with one.
5. Increase pressure at field test port to slightly above tank pressure by slowly increasing regulated pressure.
6. Open field test valve "A" and slowly increase regulator pressure until bubbles are seen in the bottle. That pressure will be within 3% of the set pressure.
7. To remove the test set-up, close valves "A" and "B" and open valve "C:".

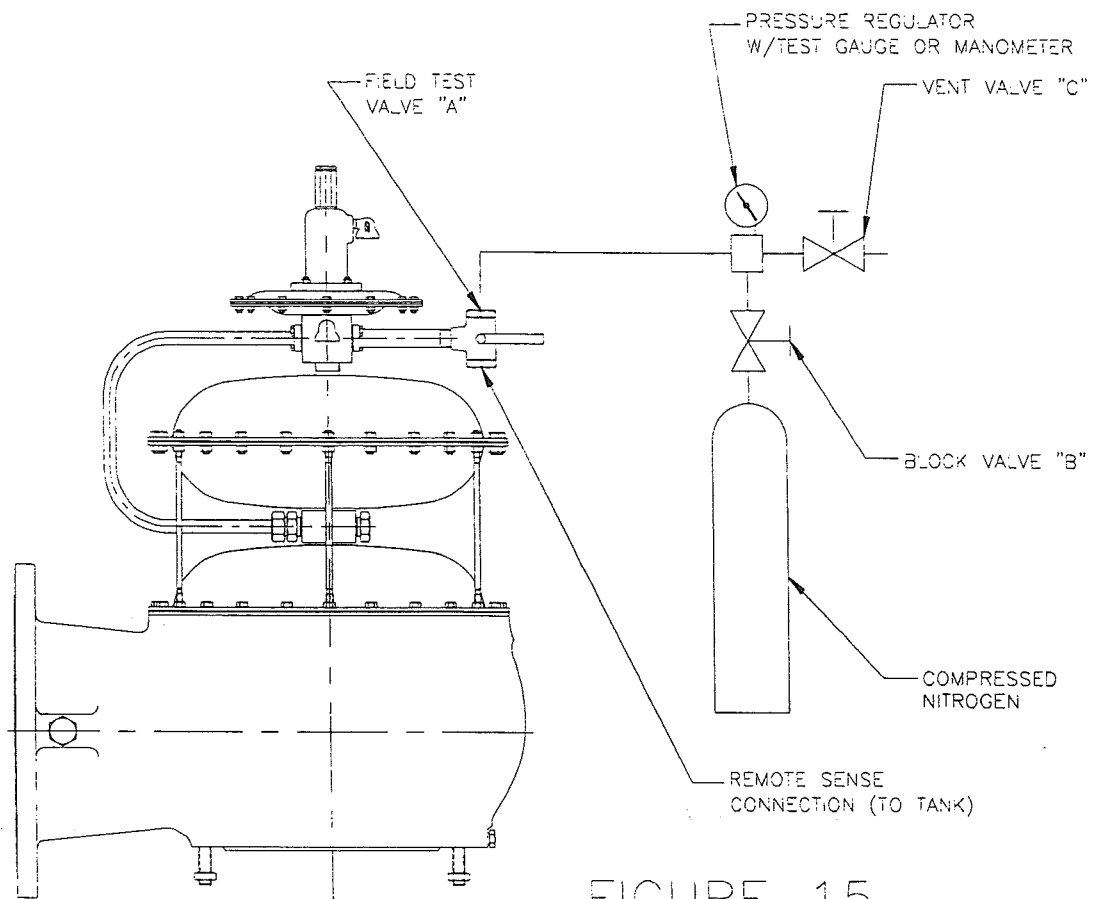


FIGURE 15

### 5.3 Field Test Instructions for Flowing Modulating or Snap Action Pilots

#### 5.3.1 General

An optional field test accessory is available for checking the positive set pressure without removing the valve from service. The field test accessory consists of a 3-way ball valve to allow the pilot to sense pressure from either the process or from the test gas source.

A standard bottle of nitrogen equipped with a pressure regulator, block valve, pressure gage, and convenient length of high pressure flexible hose is recommended for testing. A set up similar to that shown in Figure 13 should be used. Such a test kit is available from Anderson, Greenwood & Co. under the part number 04.4812.001 plus additional dash numbers for the pressure gages required.

#### 5.3.2 Field Test Procedure for Flowing Modulating or Snap Action Pilots

1. Connect the gas bottle as shown in Figure 16.
2. Close vent valve "C".
3. Open block valve "B" to supply regulator. **Note: Regulator pressure should be set at 0.**
4. Connect bubble tester bottle to pilot exhaust vent.
5. Increase pressure at field test port to slightly above tank pressure by slowly increasing regulated pressure.
6. Open field test valve "A" and slowly increase regulator pressure until bubbles are seen in the bottle. That pressure will be within 10% of the set pressure. **Note: For pilots adjusted for snap action, the main vent seat will open at set pressure if the tank pressure is present. If it is not, a sudden increase in pilot exhaust flow will be observed at set pressure.**
7. To remove the test set-up, close valves "A" and "B" and open valve "C".



**6.0 STORAGE AND HANDLING**

Because cleanliness is essential to the satisfactory operation and tightness of a 9000 Series Pilot Operated Relief Valve, precautions should be taken to keep out all foreign particles and materials. Valves should be closed off properly at both the valve inlet and outlet. Particular care should be taken to keep the valve inlet absolutely clean. Valves should preferably be stored indoors with the original factory installed protective measures left in place. This includes all desiccants, flange protectors, and factory seals. Valves should be placed on wooden pallets or other blocking materials to keep them off the floor or in a location where dirt and other forms of contamination are kept to a minimum. Valves should not be thrown in a pile or laid on the bare ground waiting for installation.

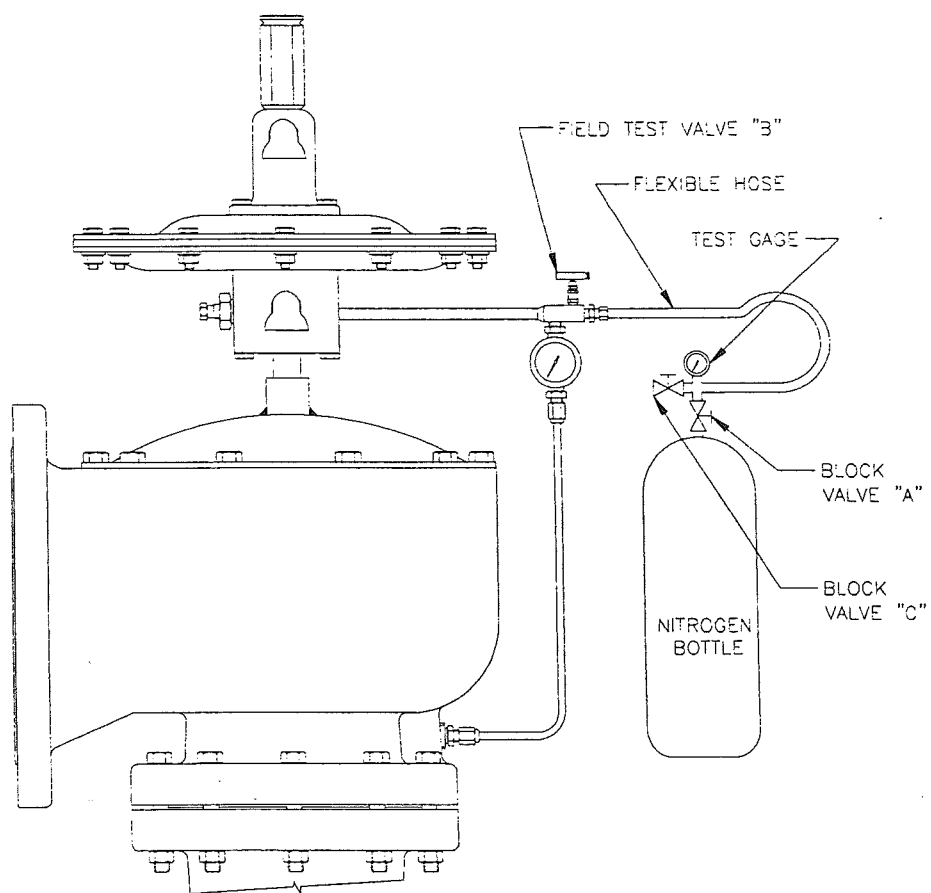


FIGURE 16

7.0 TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSE	RESOLUTION
1. Valve opens below set	1. Improper installation of sense line. 2. Plugged sense line. 3. Improper gauge accuracy and/or location.	1. Verify if sense line is installed properly. 2. Check sense line, inlet screen, and dipper tube for cleanliness. 3. Verify gauge accuracy for valve being tested and ensure location is at valve being tested.
2. Pilot leaks from upper vent.	1. Sense diaphragm failure. 2. Spindle lock nut loose.	1. Replace diaphragm. 2. Tighten spindle lock nut.
3. Pilot leaks from lower vent.	1. Pilot seat leakage. 2. Nozzle over tightened.	1. On the 93 pilot, replace spindle disc assembly. On the 93T and 91 pilots, replace seat. Inspect nozzle and relap if necessary. 2. Tighten nozzle per assembly instructions.
4. Main valve leaks.	1. Seat film damaged. 2. Nozzle damaged. 3. Nozzle seal damaged, missing, or out of place. 4. Seat plate assembly is loose. 5. Operating too close to set pressure. (Above 96%) 6. Main valve diaphragm failure. 7. Diaphragm assembly loose. 8. Seat plate not fully threaded on hub.	1. Replace seat film. 2. Inspect nozzle and relap if necessary. 3. Position nozzle seal per assembly instructions. 4. Tighten seat plate assembly. 5. Lower operating pressure. 6. Replace diaphragm. 7. Tighten diaphragm assembly. 8. Install seat per assembly instructions.

**8.0 MAIN VALVE SPARE PARTS AND REPAIR KITS**

Soft goods repair kits contain all the diaphragms, seals, and seats to a repair valve. To order a kit, specify the base number and select the last three digits from the following tables. To ensure the purchase of the correct repair kit, the order should specify the valve model and serial number. For chloride rich environments, the bolts in the main valve and pilot exposed to the environment should be replaced during routine maintenance or at least every 5 years.

**8.1 TYPE 9300 Main Valve Single Chamber Repair Kit (06.0235.000)**

Kit Type	Internals	Materials	2"	3"	4"	6"	8"	10"	12"
Soft Goods	Alum	Teflon	319	321	323	526	327	329	331
	SST-LP	Teflon	496	498	500	527	504	506	508
	SST-HP	Teflon	356	360	364	528	372	376	380
Bolt	Alum	SST	332	333	334	335	336	337	338
	SST-LP	SST	339	340	341	342	343	344	345
	SST-HP <15 PSIG	SST	346	347	348	570	350	351	352
	SST-HP ≥ 15 PSIG	SST	346	347	348	349	350	351	352

**8.2 TYPE 9300 Main Valve Dual Chamber Repair Kit (06.0235.000)**

Kit Type	Internals	Materials	2"	3"	4"	6"	8"	10"	12"
Soft Goods	Alum	Tef/Kalrez	382	384	386	388	390	392	394
	SST	Tef/Kalrez	545	547	549	551	553	555	557
Bolt	Alum	SST	395	396	397	398	399	400	401
	SST	SST	402	403	404	405	406	407	408

9.0 PILOT SPARE PARTS AND REPAIR KITS9.1 91 Pilot Repair Kit (06.0235.000)

DESCRIPTION				DASH NUMBER
Pilot Type	Pressure	Kit Type	Material	Pressure
91 Pilot	15 - 50 PSIG	Soft Goods	Teflon Stainless	569

9.2 93 Pilot Repair Kit (06.0235.000)

DESCRIPTION				DASH NUMBER	
Pilot Type	Pressure	Kit Type	Material	Pressure 93P	Vacuum 93V
93 Pilot	4" - 14.9 PSIG	Soft Goods	Buna	133	152
			Viton	134	153
			EPR	135	154
		Soft Goods	Buna (1)	136	155
			Viton (1)	137	156
			EPR (1)	138	157
	15 - 50 PSIG (3 - 50 PSIG Marine)	Bolt	SST	287	287
		Soft Goods	Buna	141	---
			Viton	142	---
			EPR	143	---
		Bolt	SST	416	---

(1) Teflon Diaphragm

## 9.3

93T Pilot Repair Kit (06.0235.000)

DESCRIPTION				DASH NUMBER	
Pilot Type	Pressure	Kit Type	Material	Pressure	Vacuum
93T Pilot	4" - 15 PSIG	Soft Goods	Teflon	139	158
		Bolt	SST	287	287

## 9.4

400A/B Pilot Repair Kit (06.0235.000)

DESCRIPTION				DASH NUMBER	
Pilot Type	Pressure	Kit Type	Material	Pressure	Vacuum
400A/B Pilot	4" WC - 10	Soft Goods	Buna (1)	127	149
			Viton (1)	128	150
			EPR (1)	129	151
			Kalrez (1)	455	456
	>10" WC - 15 PSIG	Soft Goods	Buna (1)	558	562
			Viton (1)	559	563
			EPR (1)	560	564
			Kalrez (1)	561	565
	4" Wc - 15 PSIG	Bolt	SST	409	

(1) Teflon Diaphragm

## 9.5

400A Pilot Repair Kit (06.0235.000)

DESCRIPTION				DASH NUMBER	
Pilot Type	Pressure	Kit Type	Material	Pressure	Vacuum
400A Pilot	15 - 50 PSIG	Soft Goods	Buna (1)	458	---
			Viton (1)	459	---
			EPR (1)	460	---
			Kalrez (1)	461	---
		Bolt	SST	462	---

(1) Teflon Diaphragm

## 10.0 ACCESSORIES , OPTIONS, AND ACCESSORY REPAIR KIT

### 10.1 Accessories

#### 1. Field Test Connection

?In-service verification of set pressure.

?Simplifies the periodic testing of pressure relief valves.

#### 2. Backflow Preventer

?Prevents accidental reverse flow through pressure relief valve.

### 10.2 Options

#### 1. Manual Unloader

?Permits the pressure relief valve to be opened at pressures below the nameplate setting.

?Acts as manual override to normal pressure setting, but has no effect on the sealed pressure setting.

#### 2. Remote Unloader

?Permits the pressure relief valve to be remotely opened to depressurize the system.

#### 3. Pilot Exhaust Tubed to Main Valve Outlet (PEMVO)

?Eliminates any local venting of fluid media from pilot.

#### 4. Remote Pressure Sense Connection

?Pressure relief valve will respond to actual system pressure conditions.

?Eliminates undesirable cycling due to excessive inlet pressure losses.

?Improves safety under adverse operating conditions.

## 10.3

Accessory Repair Kit (06.0235.000)

Accessory	Kit Type	Material	Dash Number
Shuttle Check	Soft Goods	Teflon	140
	Bolt	SST	410
Diaphragm	Soft Goods	Teflon	144
	Bolt	SST	414
Ball Check	Soft Goods	Buna	145
		Viton	146
		EPR	147
		Kalrez	148

11.0 LUBRICANT AND SEALANTS FOR TYPE 9300 SERIES

(Only include lubricants referenced in the manual)

11.1 Lubricants Used on Pilot Parts

Pilot Parts	Description	Lubricant (1)
Pressure Adjustment Screw and Locknut	Threads	Dow Corning 33 #05.1500.012
Diaphragm and Gaskets (91 and 93T Pilots)	Seal surfaces between cases and spacer ring	Slick Stuff #05.1500.015
Stainless Steel (SS) case Bolts and nuts	Threads	Fluorolube LG 160 #05.1500.023
Carbon Steel Case Bolts	Threads	Dow Corning 33 #05.1500.012
Stainless to Aluminum or Aluminum Parts	Threads	Dow Corning 33 #05.1500.012
Sliding Seals	Teflon <sup>®</sup> or Elastomer	Dow Corning 33 #05.1500.012
Pipe Fittings and Vents	Threads	Teflon <sup>®</sup> Tape Dow Corning 33
(1) For Oxygen Service Use Krytox 240AC		



**11.2 Lubricants and Sealants Used on Main Valve Parts**

Main Valve Parts	Description	Lubricant (1)	Sealant
Carbon Steel bolts, screws And nuts, fittings	Threads	Dow Corning 33 #05.1500.012	
Stainless on Stainless bolts Screws, nuts, and fittings	Threads	Fluorolube LG 160 #05.1500.023	
Diaphragms and Gaskets (91 and 93T)	Seal surfaces between diaphragm and cases	Slick Stuff #4 #05.1500.015	
Seat Hub and Jam Nut	Threads		Loctite
Shaft assembly and Diaphragm assembler Jam Nut	Threads		Loctite
Sliding Seals	Teflon® and Elastomers	Dow Corning 33 #05.1500.012	
Pipe fittings and Vents	Threads	Teflon® Tape and Dow Corning 33	
(1) For Oxygen Service Use Krytoc 240AC.			



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**783-MA1**

**CHAPTER VII**

## **SAFETY VALVE FOR OUTER CASING WHESOE 4020-6"**

**Item Z 62038 for 1800MT LOX TANK**

**Item Z 72038 for 1000MT LIN TANK**

**SUPPLIER :**

TYCO Flow Control  
Parc d'Activité du Vert Galan  
4, rue des Oziers  
BP 688 Saint-Ouen-l'Aumône  
95004 Cergy Pointoise  
FRANCE  
Mr Frédéric PEREZ  
Tel: 01 39 09 37 31  
Fax: 01 39 09 37 27

# WHESSOE

## INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR PRESSURE & VACUUM RELIEF VALVE.

### FIG 4020A

I. INSTALLATION

II. MAINTENANCE DURING  
ATMOSPHERIC VENTING PERIOD

III.  
PARES

S

## READ THIS FIRST

### Safety Precautions

READ AND UNDERSTAND THIS INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON WHESOE 4020A PRESSURE & VACUUM RELIEF VALVE. FOLLOW ALL PRECAUTIONS AND WARNINGS NOTED HEREIN WHEN INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON THIS EQUIPMENT.

### Safety Precaution Definitions

#### CAUTION

Damage to equipment may result if this precaution is disregarded.

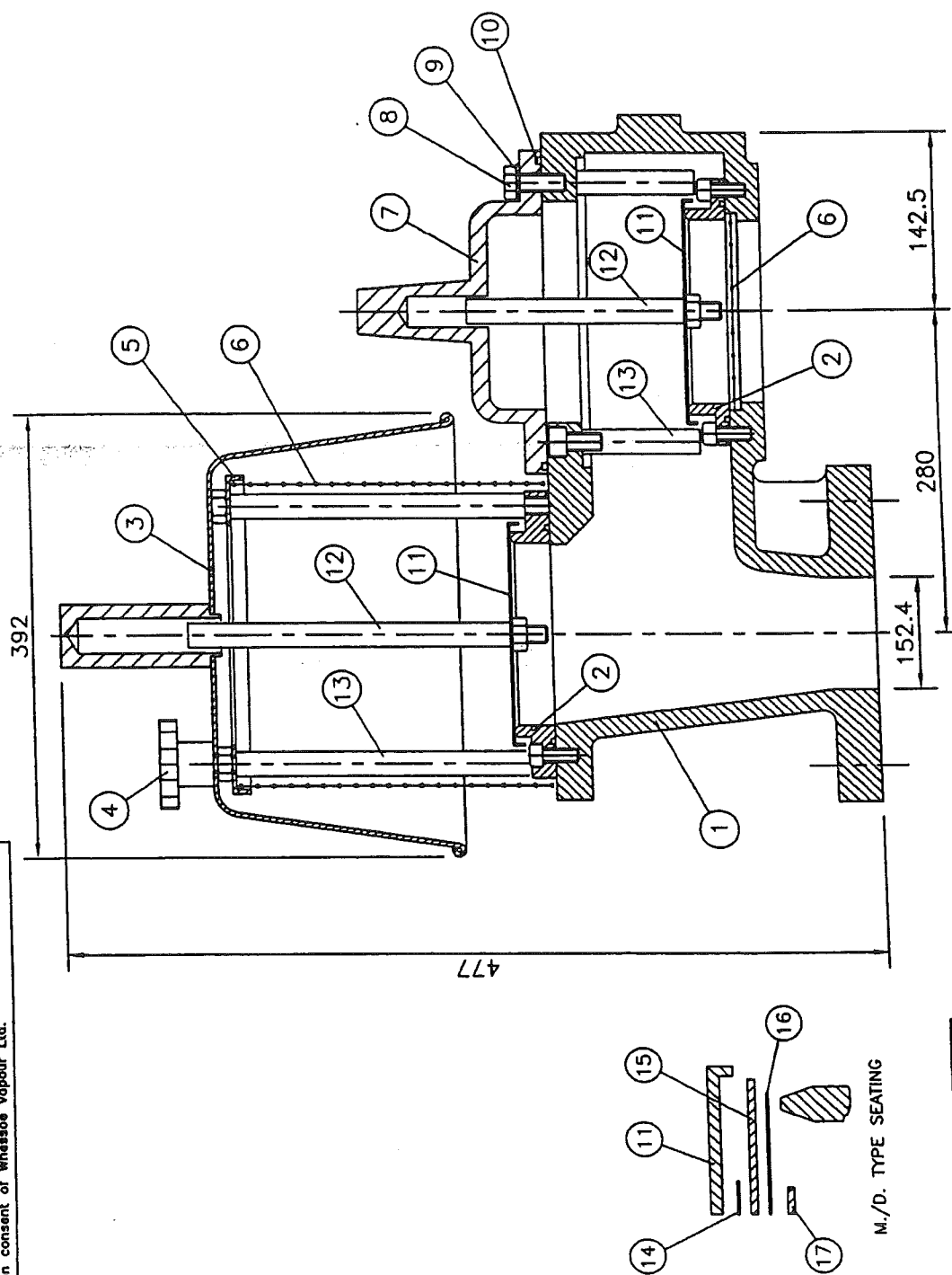
#### WARNING

Direct injury to personnel or damage to equipment that can cause injury to personnel may result if this precaution is not followed.

#### NOTE

This manual is issued for guidance only and does not effect our standard terms and conditions and our Product Limited Warranty, all of which are available upon request.

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FLANGE	FACING
ANSI 125	FF

[illegible]

4020 Pressure & Vacuum Relief valves must be mated with the appropriate flange.

1/ These valves must be gasketed and bolted to a flat machined horizontal flange. Bolts to be tightened uniformly to ensure a good seal.

3/ This valve does not contain any internal packing. Therefore internal checks should not be necessary.

4/ It is recommended that carbon steel & cast iron valves be given a coat of paint immediately after installation is complete. Apply paint to external surfaces only.

**MAINTENANCE:** (DURING ATMOSPHERIC VENTING PERIOD.)

**WARNING**

*Relief valve must be isolated from tank pressure before servicing. All gas must be blocked and pressure safely vented.*

*Wear appropriate gloves and/or breathing apparatus if hazardous vapours are present.*

- 1/ Remove weatherhood (item 3) and vacuum cover (item 7), inspect o'ring in vacuum cover for damage and replace if necessary.
- 2/ Remove pallet assemblies to inspect pallet seating for wear and replace if necessary.
- 3/ To replace damaged/worn items from pallet assembly (see recommended spares)
  - a) remove nut from pallet stem, remove support disc, diaphragm & backing disc
  - b) clean pallet surface and threads
  - c) replace with new parts
  - d) reassemble in reverse order
- 4/ Inspect valve seats (item 2) for wear and regrind or replace where necessary.
- 5/ Clean seating surface thoroughly with suitable solvent and apply a thin smear of light spindle oil.

6/ Generally clean inside of valve, remove all foreign matter and repaint exterior where possible to prevent corrosion.

7/ Replace pressure pallet on pressure seat and vacuum pallet on vacuum seat (with lead disc if fitted).

8/ Replace weatherhood, secure with handnuts.

9/ Replace vacuum cover & replace sealing washers if necessary, secure with screws.

### **CAUTION**

The end of the pallet stem must engage the stem guide in the weatherhood and vacuum cover to ensure correct seating and valve operation.

**NOTE:** The efficiency of the valve depends on maintaining good seating surfaces, therefore, maintenance periods should be adjusted to suit service conditions.

### **SPARES**

When spare parts are required the customer should quote the valve size, serial number, the item number and the material of the parts required.

The valve size and serial number can be obtained from the valve identification label. The item number and description can be obtained from the arrangement on page 3.

Care should be taken to quote the correct material as the materials quoted are for non hazardous conditions.

### **RECOMMENDED SPARES**

1. Item 10 Nitrile O'Ring
2. Item 9 Sealing Washers
3. Item 14 Spacer Disc (Non Asbestos Fibre)

4. Item 15 Diaphragm Backing Disc (Non Asbestos Fibre)

5. Item 16 Diaphragm P.T.F.E.





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**783-MA1**

**CHAPTER VIII**

## **SAFETY VENT FOR OUTER CASING WHESOE 4210-20"**

**Item Z 62001 for 1800MT LOX TANK**

**Item Z 72001 for 1000MT LIN TANK**

**SUPPLIER :**

TYCO Flow Control  
Parc d'Activité du Vert Galan  
4, rue des Oziers  
BP 688 Saint-Ouen-l'Aumône  
95004 Cergy Pointoise  
FRANCE  
Mr Frédéric PEREZ  
Tel: 01 39 09 37 31  
Fax: 01 39 09 37 27

# WHESSOE

## INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR EMERGENCY RELIEF MANHOLE COVER.

### FIG 4210A

- I. INSTALLATION
- II. MAINTENANCE DURING  
ATMOSPHERIC VENTING PERIOD
- III. SPARES

## **READ THIS FIRST**

### **Safety Precautions**

**READ AND UNDERSTAND THIS INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON WHESOE 4210A EMERGENCY RELIEF MANHOLE. FOLLOW ALL PRECAUTIONS AND WARNINGS NOTED HEREIN WHEN INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON THIS EQUIPMENT.**

### **Safety Precaution Definitions**

#### **CAUTION**

*Damage to equipment may result if this precaution is disregarded.*

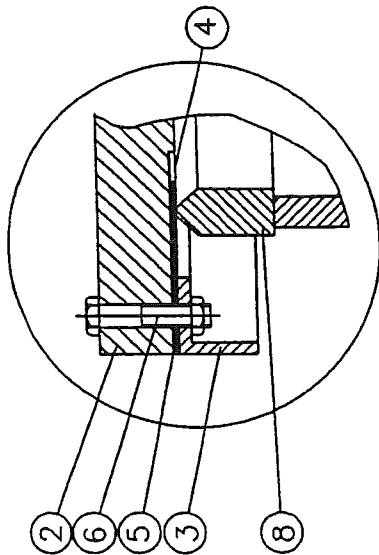
#### **WARNING**

*Direct injury to personnel or damage to equipment that can cause injury to personnel may result if this precaution is not followed.*

#### **NOTE**

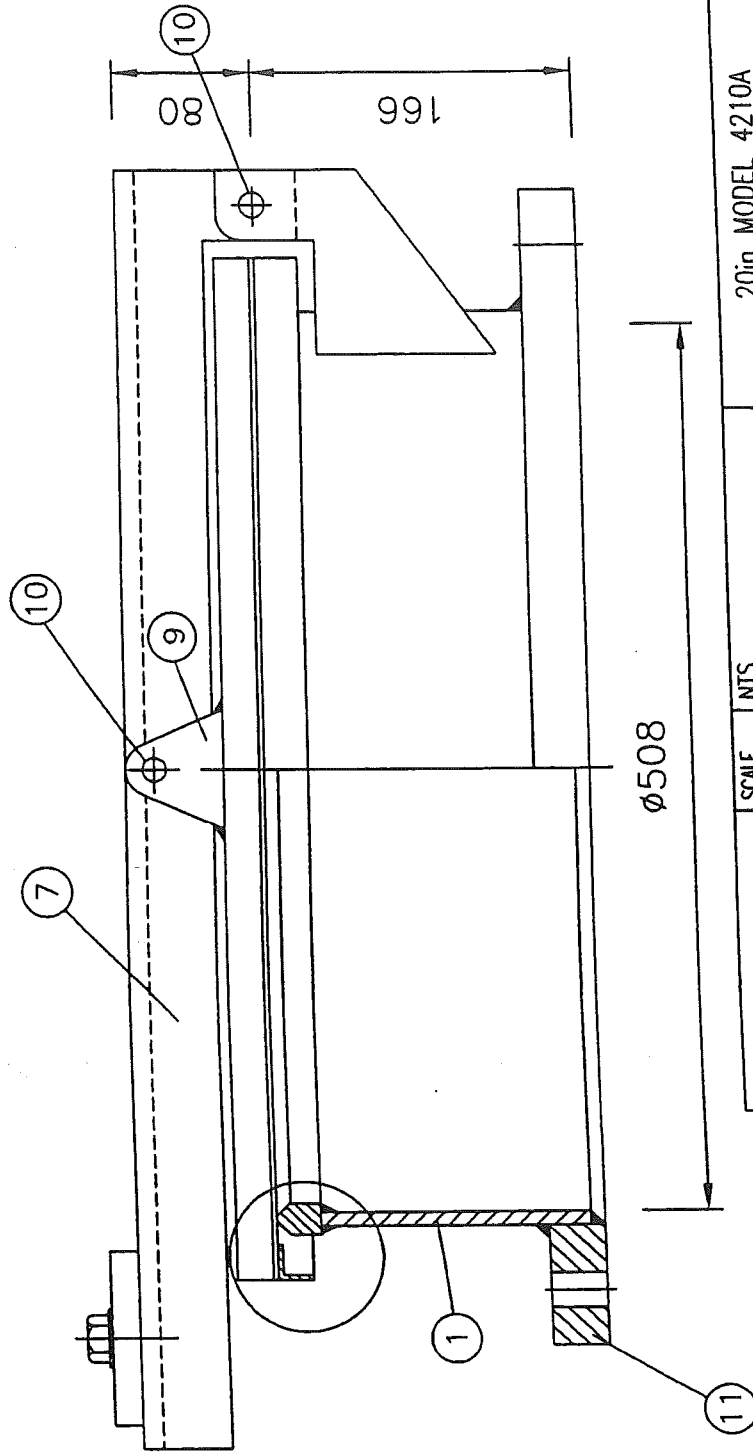
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SEAT DETAIL  
CS BODY

ITEM	DESCRIPTION	C.S. SPEC
1	BASE	C. STEEL
2	COVER PLATE	ALUM
3	DRIP RING	ALUM
4	DIAPHRAGM	P.T.F.E.
5	BACKING DISC	NON ASBESTOS
6	CLAMPING SCREWS	GALV STEEL
7	HINGE ARM	C. STEEL
8	SEAT RING	316 SS
9	COVER LUG	ALUM
10	PINS	316 SS
11	FLANGE	API 650 IMPERIAL



**WHESSOE**  
VAPOUR CONTROL LTD  
SHARP STREET, WORSLEY  
MANCHESTER, M28 3NA  
ENGLAND

SCALE	NTS	
DRAWN	G.BIRKETT	17/11/00
CHECKED	J.SAA	17/11/00
ENG. APP.	J.SAA	17/11/00
CLIENT	TYCO V & C FRANCE	
CLIENTS ORDER No.	53028185	
W.V.L. ORDER No.	313920	

20in MODEL 4210A  
PRESSURE RELIEF  
MANHOLE

DRG. No. SUFFIX 1  
DRAWING NUMBER

GA-4210A

S225691	704-02-PSE0605	7.5 mBARG	SET PRESSURE
SERIAL NUMBER	TAG NUMBER		

## INSTALLATION

4210A Emergency Relief Manholes must be mated with the appropriate flange.

- 1/ These valves must be gasketed and bolted to a flat machined horizontal flange. bolts to be tightened uniformly to ensure a good seal.
- 2/ Ensure that all packing materials are removed from under the cover (item2) and that the hinged cover is free to move.

## CAUTION

*Excessive tightening of the flange bolts could effect the sealing of the cover diaphragm.*

- 3/ It is recommended that carbon steel & cast iron valves be given a coat of paint immediately after installation is complete. Apply paint to external surfaces only.

## MAINTENANCE: (DURING ATMOSPHERIC VENTING PERIOD.)

## WARNING

*Relief manhole must be isolated from tank pressure before servicing. All gas must be blocked and pressure safely vented.*

*Wear appropriate gloves and/or breathing apparatus if hazardous vapours are present.*

- 1/ Lift cover and inspect diaphragm for wear or damage
- 2/ To replace damaged/worn items (see recommended spares)
  - a) unbolt drip ring, remove diaphragm & backing disc
  - b) clean cover surface
  - c) replace with new parts
  - d) reassemble in reverse order
- 3/ Inspect manhole seat for wear and regrind if necessary.
- 4/ Lubricate hinge pins.
- 5/ Clean seating surface thoroughly with suitable solvent and apply a thin smear of light spindle oil.
- 6/ Generally clean inside of valve, remove all foreign matter and repaint exterior where possible to prevent corrosion.
- 7/ Carefully replace cover on seat.

**NOTE:** The efficiency of the valve depends on maintaining good seating surfaces, therefore, maintenance periods should be adjusted to suit service conditions.

## **SPARES**

When spare parts are required the customer should quote the valve size, serial number, the item number and the material of the parts required.

The valve size and serial number can be obtained from the valve identification label. The item number and description can be obtained from the arrangement on page 3.

## **RECOMMENDED SPARES**

1. Item 4 Diaphragm P.T.F.E.
2. Item 5 Diaphragm Backing Disc (Non Asbestos Fibre)



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**783-MA1**

**CHAPTER IX**

## **SOLENOID VALVE HERION FOR ACTUATORS HV62008/62009 and HV7101A/7102A**

**SUPPLIER :**

AIR CA  
Rue Jacques Murgier  
ZAC La Neuville  
BP 17  
51051 Reims Cedex  
FRANCE  
Mr Didier FLORANT  
Tel: 03 26 87 35 25  
Fax: 03 26 09 03 42

## Vannes 3/2, DN 5



Pour fluides neutres, gazeux et liquides  
A commande électromagnétique directe  
Vannes à clapet équilibré  
Raccordement taraudé G 1/4, 1/4-18 NPT  
ou exécution flasquable plan de pose NAMUR  
Pression de service de 0 à 10 bar

Registre du Catalogue  
A9

Publication 7500189.48.02.94

### Description (appareil standard)

Vannes pour air, eau, huile

- Sens de passage du fluide: indifférent  
Température min.: -20 °C avec NBR  
-10 °C avec FKM  
Température du fluide max.: + 80 °C avec NBR  
+120 °C avec FKM  
(eau jusqu'à +95 °C)  
Température ambiante max.: +55 °C  
Fréquence de manoeuvres: 100/min  
Position de montage: indifférente, de préférence  
avec électroaimant vertical
- Matériaux  
- Corps: Laiton (Ms)  
Aluminium (Al),  
anodisé dur  
- Etanchéité: NBR (Perbunan)  
FKM (Viton)  
Silicone  
- Pièces internes: Acier inox 1.4104, laiton

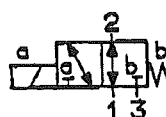
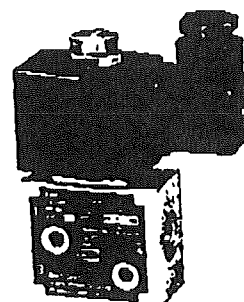
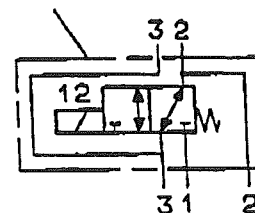


Schéma:  
Raccord de pression  
en 1, 2 ou 3

Exécution flasquable (NAMUR)



### Caractéristiques

- Fonctionne à partir de 0 bar
- Convient pour l'air instrument ou air de réglage
- Utilisable en extérieur avec électroaimant approprié
- Utilisable en atmosphère explosible avec protection anti-déflagrante
- Avec plan de pose NAMUR:  
retour d'échappement intégré  
commande manuelle en option  
nombreuses possibilités de fixation
- Avec homologation DVGW:  
vanne de sécurité normalement fermée selon  
DIN 3394, Partie 2, Groupe R<sub>M</sub>  
tension de chute ≥15% U<sub>N</sub>

Lorsque des vannes-pilotes homologuées (DIN 3394, Partie 2) sont montées sur des vannes de sécurité de fermeture homologuées (DIN 3394, Partie 1), il n'est pas nécessaire de faire homologuer l'ensemble ainsi constitué. Il suffit de s'assurer que la vanne principale est utilisée selon les règles. Les vannes-pilotes ne figurant pas dans le rapport d'homologation doivent faire l'objet d'un contrôle par l'autorité compétente.



## Caractéristiques techniques des vannes à faible consommation

DN	Raccord	Pression de service [bar] pour fluides gazeux et liquides jusqu'à 40 mm <sup>2</sup> /s		Valeur K <sub>v</sub> (base m <sup>3</sup> /h)	Matériaux		Poids sans électro-aimant [kg]	Plan de coupe N°	Plan d'encombrement N°	Référence	Caractéristiques
		min.	max.		Corps	Étanchéité					



Schéma: raccord de pression en 1, 2 ou 3

5	G 1/4	0	10	0,340	Ms	NBR	0,65	01	01	2401188.	
5	NPT 1/4	0	10	0,340	Ms	NBR	0,65	01	01	2401187.	
5	NPT 1/4	0	10	0,340	Ms	NBR	0,70	01	01	2401121.	Cde manuelle avec blocage

Commande manuelle en option (voir page 8)

5	G 1/4/ NAMUR	0	10	0,340	Al	NBR	0,55	02	04	2401191.	Avec homologation DVGW
5	G 1/4/ NAMUR	0	10	0,340	Al	NBR	0,55	02	04	2401117.	Avec homologation DVGW et pièces int. en métaux non ferreux

## Caractéristiques techniques des électroaimants

Photo	Puissance absorbée		Courant		Tolérance [%] à l'appel pour 100 % ED		Protection	Temp. ambiante (°C)	Temp. fluide (°C)	Poids (kg)	Plan d'encombrement N°	Schéma de fonction N°	Référence
	24 VDC [W]	230 VAC [VA]	24 VDC [mA]	230 VAC [mA]	+	-							
	6,8		282		10	15	IP 65	+55	+60	0,33	06	01	0813
		18,2		83	5	20	IP 65	+55	+60	0,34	06	02	0807
	3,9		161		10	15	EEx em II T5 EEx em II T6	+80 +60	+80 +60	0,85	07	03	3960
		3,0		13	10	15	EEx em II T5 EEx em II T6	+80 +60	+80 +60	0,85	07	04	3961
	3,9		161		10	15	EEx em II T5 EEx em II T6	+80 +60	+80 +60	0,85	07	03	3962 <sup>1)</sup>

<sup>1)</sup> La surface de cet électroaimant est anodisée contre la corrosion et uniquement livrable en 24 V continu

# Caractéristiques techniques des vannes avec électroaimant en protection EEx d IIC T6/T5

DN	Raccord	Pression de service (bar) pour fluides gazeux et liquides jusqu'à 40 mm <sup>2</sup> /s		Valeur K <sub>v</sub> (base m <sup>3</sup> /h)	Matériaux		Poids sans électroaimant [kg]	Plan de coupe N°	Plan d'encombrement N°	Référence	Caractéristiques
		min.	max.		Corps	Étanchéité					


Schéma: raccord de pression en 1, 2, ou 3

5	G 1/4	0	10	0,340	Ms	NBR	0,75	01	03	2401189.	
5	NPT 1/4	0	10	0,340	Ms	NBR	0,75	01	03	2401195.	
5	G 1/4	0	10	0,340	Ms	NBR	0,80	01	03	2401129.	Cde manuelle avec blocage
5	NPT 1/4	0	10	0,340	Ms	NBR	0,80	01	03	2401110.	Cde manuelle avec blocage
5	NPT 1/4	0	10	0,340	Ms	NBR	0,80	01	03	2401114.	Cde semi-automatique
5	G 1/4	0	10	0,340	Ms	Silic.	0,75	01	03	2401118.	Pour temp. ambiantes jusqu'à -40 °C
5	NPT 1/4	0	10	0,340	Ms	Silic.	0,75	01	03	2401104.	Pour temp. ambiantes jusqu'à -40 °C

Commande manuelle en option (voir page 8)

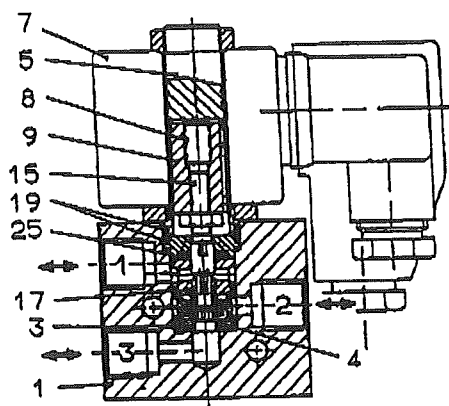
5	G 1/4 / NAMUR	0	10	0,340	AI	NBR	0,65	02	05	2401197.	
5	G 1/4 / NAMUR	0	10	0,340	AI	NBR	0,65	02	05	2401134.	Avec homologation DVGW

## Caractéristiques techniques des électroaimants

Photo	Puissance absorbée		Courant		Tolérance [%] à l'appel pour 100 % ED		Protection	Temp. ambiante	Temp. fluide	Poids [kg]	Plan d'encombrement N°	Schéma de fonction N°	Référence
	24 VDC [W]	230 VAC [VA]	24 V DC [mA]	230 V AC [mA]	+	-		(°C)	(°C)				
	14,3		598		10	20	EEx d IIC T5 EEx d IIC T6	+60 +40	+60 +40	0,8	08	05	3616
		14,7		67	10	20	EEx d IIC T5 EEx d IIC T6	+60 +40	+60 +40	0,8	08	06	3617

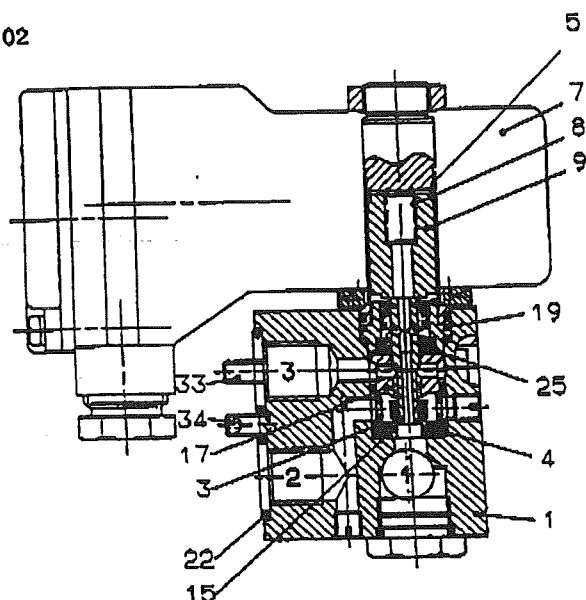
## Plans de coupe

01

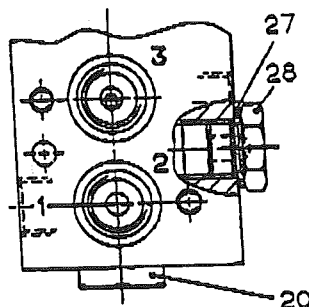


- 1 Corps
- 3 Clapet
- 4 O-Ring \*
- 5 Fourreau-guide
- 7 Electro-aimant
- 8 Ressort \*
- 9 Noyau magnétique
- 15 Broche complète \*
- 17 Clapet
- 19 O-Ring \*
- 25 Joint d'étanchéité \*

02



- 1 Corps
- 3 Clapet
- 4 O-Ring \*
- 5 Fourreau-guide
- 7 Electro-aimant
- 8 Ressort \*
- 9 Noyau magnétique
- 15 Broche complète \*
- 17 Clapet
- 19 O-Ring \*
- 20 Obturateur
- 22 O-Ring \*
- 25 Joint d'étanchéité \*
- 27 Joint plat \*
- 28 Obturateur
- 33 Vis fileté
- 34 Vis sans tête



Les joints O-Ring, vis de fixation et vis sans tête sont livrés avec chaque appareil.

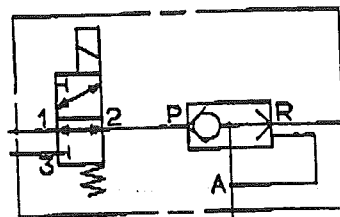
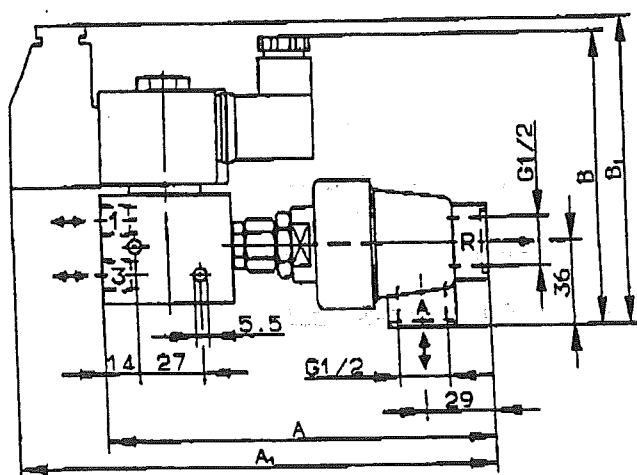
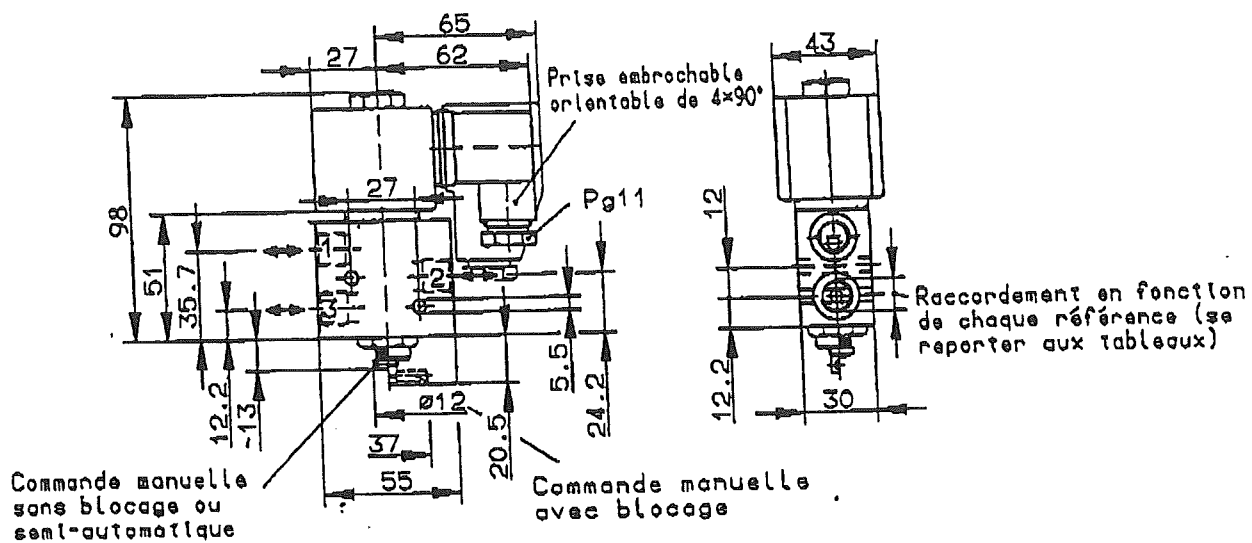
L'ensemble des pièces marquées d'un \* représente un jeu de pièces d'usure.  
En cas de commande, indiquer également la référence de la vanne.

## Pochettes de pièces de rechange

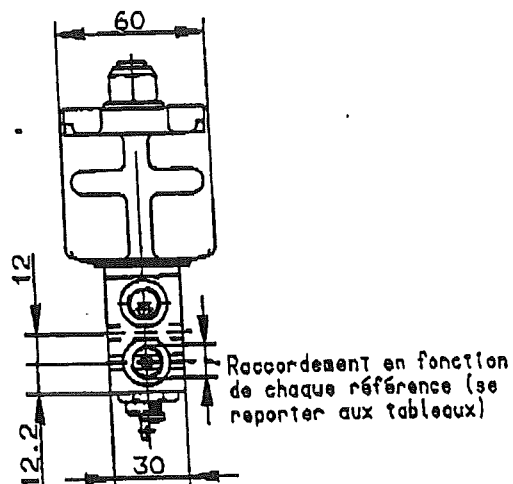
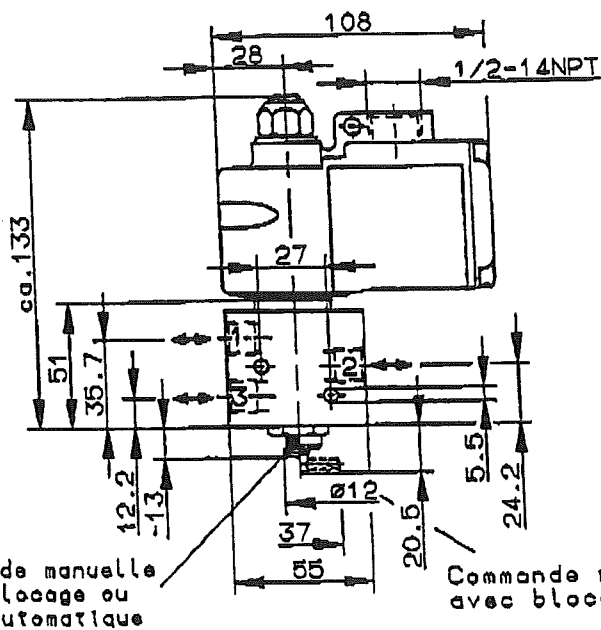
Référence Vanne	Référence Pochette
2401103	0596651
2501107	0604980
2401114	0605455
2401116	0605017
2401117	0605017
2401118	0606445
2401119	0604278
2401121	0604278
2401126	0598550
2401135	0602008
2401136	0604278
2401138	0596651
2401140	0604313

Référence Vanne	Référence Pochette
2401141	0596651
2401149	0596651
2401150	0598552
2401153	0596628
2401154	0596629
2401157	0598552
2401162	0596651
2401187	0596651
2401188	0602626
2401189	0605017
2401190	0605017
2401191	0602626
2401195	0605212
2401197	

01

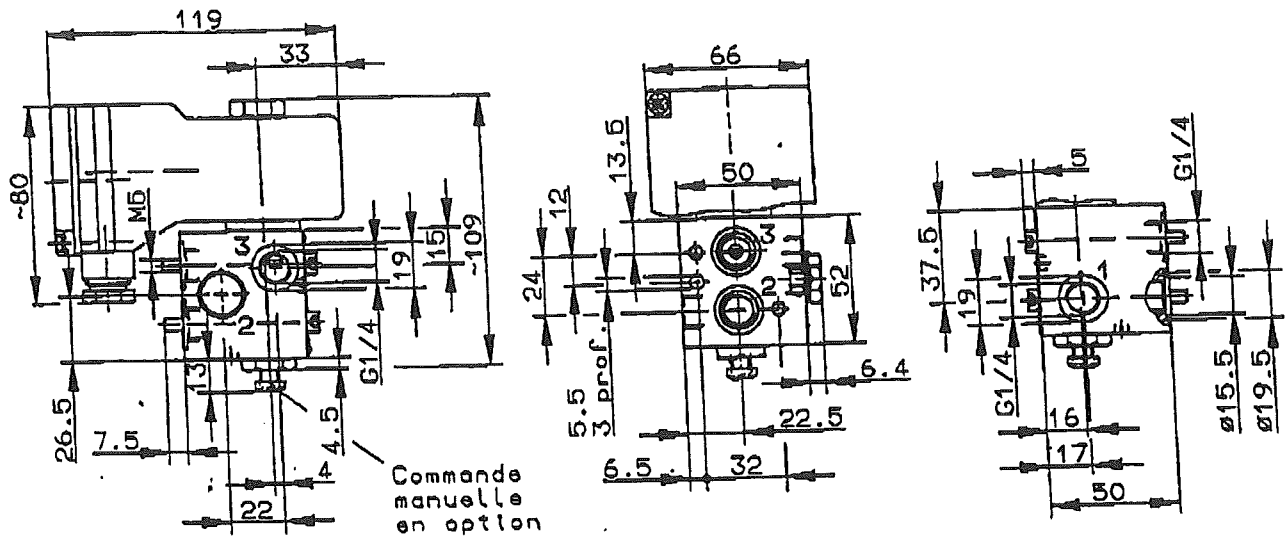


Longueur		Largeur	
A	A <sub>1</sub>	B	B <sub>1</sub>
164,5	—	117	—
—	224,5	—	145



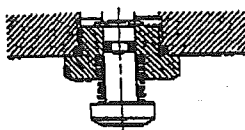
## Plans d'encombrement

04

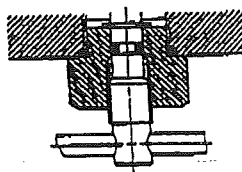


## Commande manuelle (en option)

sans blocage  
Référence 0600205



avec blocage  
Référence 0601765



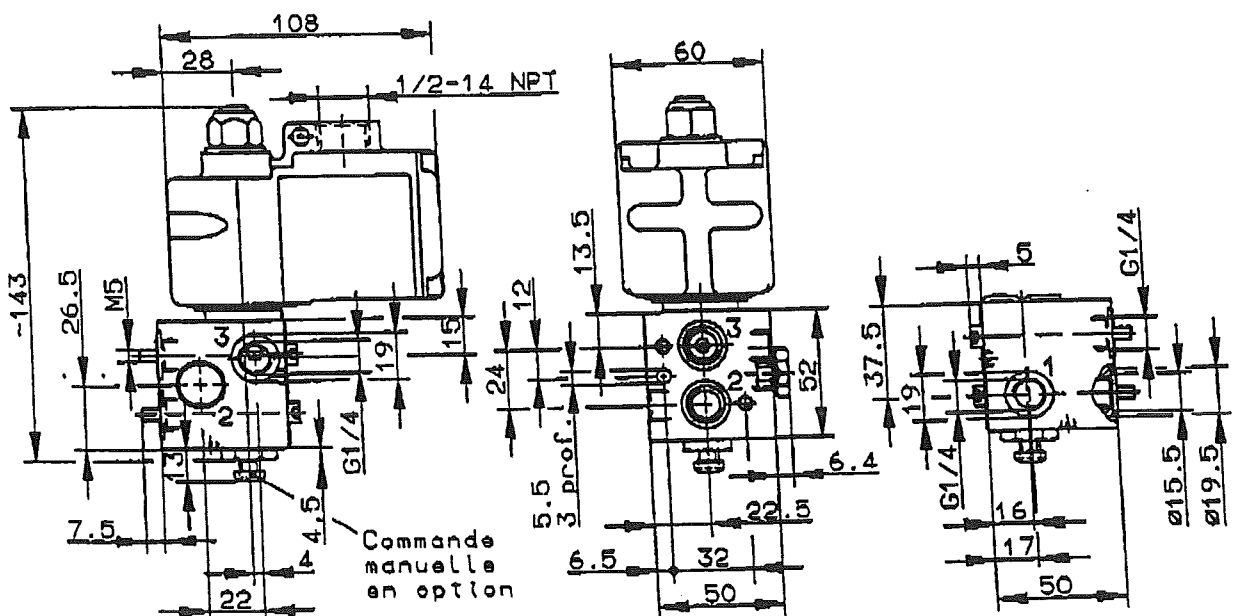
## Bouchon

Pos. 20 (éventuellement)  
Référence 0602764



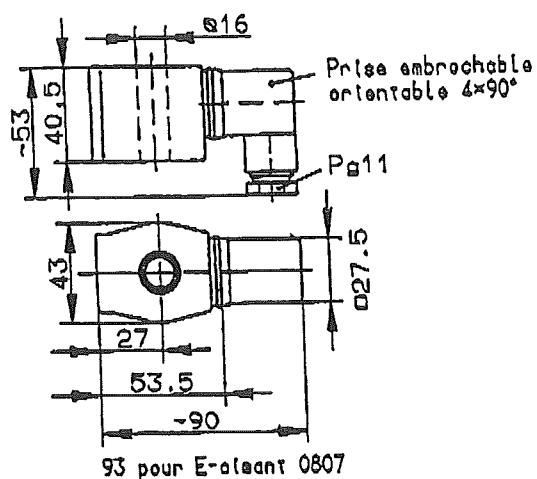
La commande manuelle n'est prévue que pour un montage provisoire ou durant la mise en service. Son installation annule l'homologation DVGW.

05

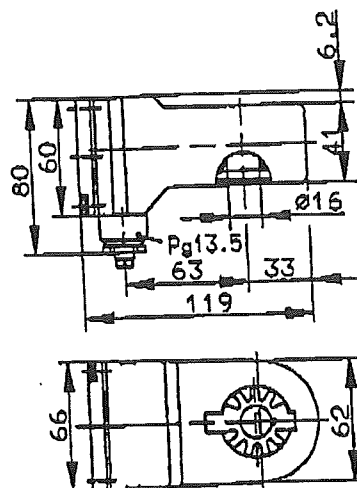


## Plans d'encombrement

06

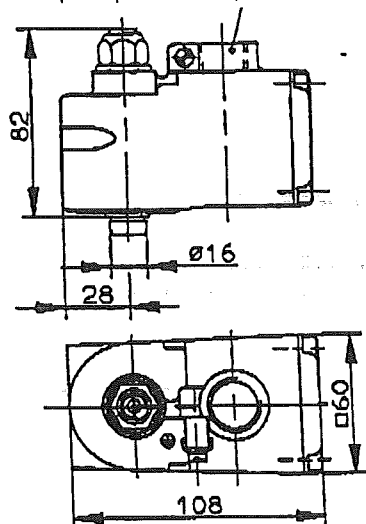


07



08

Veuillez à laisser suffisamment de place  
pour presse-étoupe 1/2-14 NPT



## Accessoires

Presse-étoupe 1/2-14 NPT en protection EEx d IIC

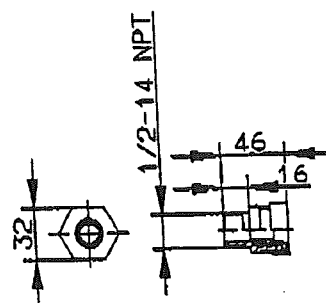
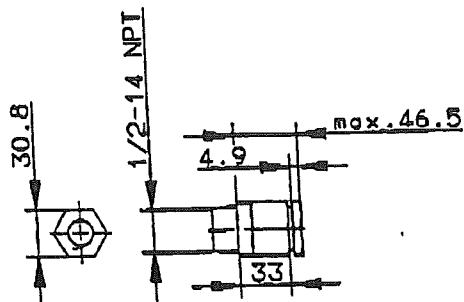
pour câble  $\varnothing$  9 à 12 mm  
Référence 0681356

pour câble  $\varnothing$  11 à 14 mm  
Référence 0681357

pour câble  $\varnothing$  6 à 8 mm  
Référence 0681289

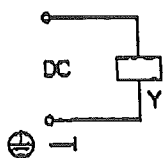
pour câble  $\varnothing$  8 à 10 mm  
Référence 0681290

pour câble  $\varnothing$  10 à 12 mm  
Référence 0681287

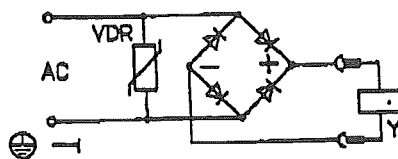


**Schéma de raccordement électrique**

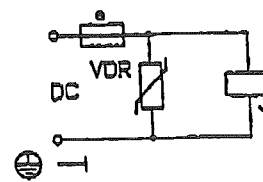
01



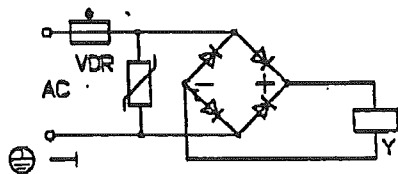
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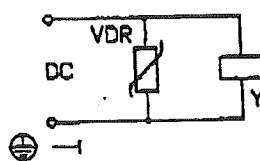
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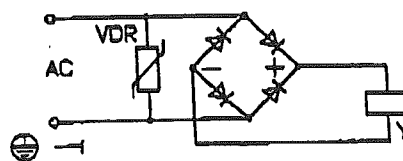
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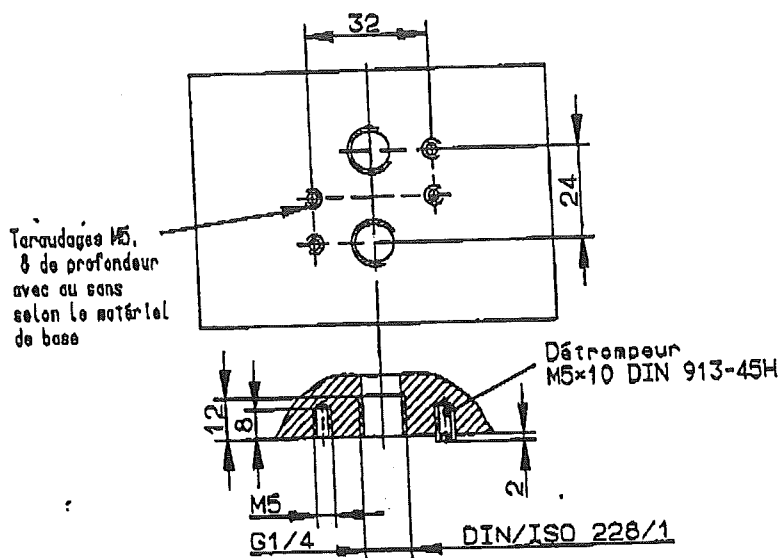
05



06



## Plan de pose NAMUR



## Éléments de fixation

Désignation	Utilisation	Autres informations voir brochure	Poids [kg]	Référence
Embase	Plaque d'adaptation pour montage direct sur actionneur pneumatique et fixation sur rail NAMUR	HERION 7502242	0,50	0559857
Etrier	A utiliser avec l'embase pour montage sur actionneur pneumatique avec rail NAMUR		0,10	0540593
Plaque d'adaptation	Pour montage ancien modèle référence 2401176		0,25	0603221
	Pour montage ancien modèles références 2401181 et 2401185		0,25	0603216



## Caractéristiques techniques des vannes en exécution standard

DN	Raccord	Pression de service (bar) pour fluides gazeux et liquides jusqu'à 40 mm <sup>2</sup> /s		Valeur K <sub>v</sub> (base m <sup>3</sup> /h)	Matériaux		Poids sans électro-aimant [kg]	Plan de coupe N°	Plan d'encombrement N°	Référence	Caractéristiques
		min.	max.		Corps	Étanchéité					


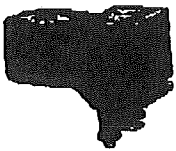
Schéma: raccord de pression en 1, 2 ou 3

5	G 1/4	0	10	0,340	Ms	NBR	0,65	01	01	2401103.	
5	G 1/4	0	10	0,340	Ms	NBR	0,65	01	01	2401149.	Homologation DVGW
5	G 1/4	0	10	0,340	Ms	NBR	1,00	—	02	2401162.	Echappement rapide
5	NPT 1/4	0	10	0,340	Ms	NBR	0,65	01	01	2401138.	
5	G 1/4	0	10	0,340	Ms	FKM	0,65	01	01	2401126.	
5	G 1/4	0	10	0,340	Ms	NBR	0,70	01	01	2401107.	Cde manuelle sans blocage
5	NPT 1/4	0	10	0,340	Ms	NBR	0,70	01	01	2401148.	Cde manuelle sans blocage
5	G 1/4	0	10	0,340	Ms	NBR	0,70	01	01	2401119.	Cde manuelle avec blocage
5	G 1/4	0	10	0,340	Ms	FKM	0,70	01	01	2401135.	Cde manuelle avec blocage
5	NPT 1/4	0	10	0,340	Ms	NBR	0,70	01	01	2401136.	Cde manuelle avec blocage
5	NPT 1/4	0	10	0,340	Ms	NBR	0,70	01	01	2401140.	Cde semi-automatique
5	G 1/4	0	10	0,340	Ms	Silic.	0,65	01	01	2401153.	Pour temp. amb. jusqu'à -40 °C
5	G 1/4	0	10	0,340	Ms	Silic.	0,70	01	01	2401154.	Cde semi-automatique, pour temp. amb. jusqu'à -40 °C

Commande manuelle de secours en option (voir page 8)

5	G 1/4 / NAMUR	0	10	0,340	Al	NBR	0,55	02	04	2401190.	Avec homologation DVGW
5	G 1/4 / NAMUR	0	10	0,340	Al	NBR	0,55	02	04	2401116.	Avec homologation DVGW et pièces int. en métaux non ferreux

## Caractéristiques techniques des électroaimants

Photo	Puissance absorbée		Courant		Tolérance [%] à l'appel pour 100 % ED		Protection	Temp. ambiante [°C]	Temp. fluide [°C]	Poids [kg]	Plan d'ensemble N°	Schéma de fonction N°	Référence
	24 VDC [W]	230 VAC [VA]	24 VDC [mA]	230 VAC [mA]	+	- <sup>2)</sup>							
	16,8		700		10	25	IP 65	+55	+80	0,33	06	01	0801
		18,2		83	10	25	IP 65	+55	+80	0,34	06	02	0807
	16,8		700		10	25	IP 65	+55	+80	0,33	06	01	0838 <sup>3)</sup>
		18,2		83	10	25	IP 65	+55	+80	0,34	06	02	0839 <sup>3)</sup>
	12		502		10	25	EEx em II T5 EEx em II T6	+60 +45	+60 +45	0,85	07	03	3980
		11,1		48	10	25	EEx em II T5 EEx em II T6	+60 +45	+60 +45	0,85	07	04	3981
	12		502		10	25	EEx em II T5 EEx em II T6	+60 +45	+60 +45	0,85	07	05	3984
		11,1		48	10	25	EEx em II T5 EEx em II T6	+60 +45	+60 +45	0,85	07	06	3985
	7,6		315		10	20	EEx em II T4 EEx em II T6	+70 +50	+70 +50	0,85	07	03	3970
		9,0		39	10	20	EEx em II T4 EEx em II T6	+70 +50	+70 +50	0,85	07	04	3971
	7,6		315		10	20	EEx em II T4 EEx em II T6	+70 +50	+70 +50	0,85	07	03	3972 <sup>1)</sup>

- <sup>1)</sup> La surface de cet électroaimant est anodisée contre la corrosion et uniquement livrable en 24 V continu  
<sup>2)</sup> En cas d'homologation DVGW la tolérance minimale des appareils est réduite de 5%  
<sup>3)</sup> Avec manchon de protection



*Constructions Métalliques  
et Préfabrication d'Arles*

1, Rue Copernic - Z.I. Nord - 13200 ARLES

☎ : 04.90.93.33.30 - Téléfax : 04.90.93.33.31

**783-MA1**

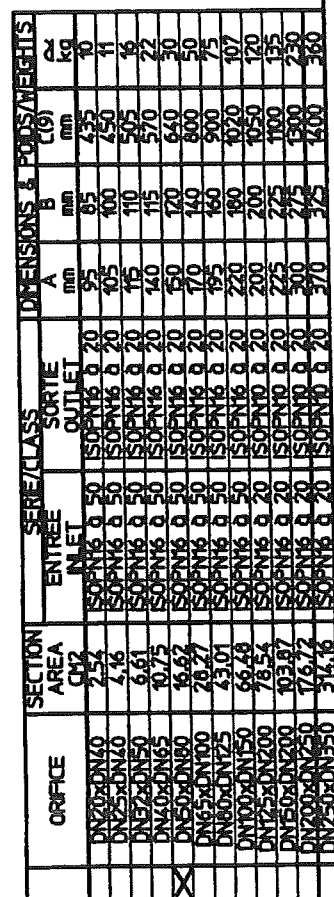
**CHAPTER X**

## **OVERFLOW SAFETY VALVE DN50**

**Item Z62022 for 1800MT LOX TANK**  
**Item Z72022 for 1000MT LIN TANK**

**SUPPLIER :**

WEIR Valves & Controls  
Rue Jean Baptiste Grison  
Z.I. du Bois Rigault  
62880 VENDIN LE VIEIL  
FRANCE  
Mr Bernard BENOUEW  
Tel: 03 21 79 54 50  
Fax: 03 21 28 62 00



CLIENT/CUSTOMER CIP ARLES		N° COMMANDE/ORDER N° 05 0465/752-ETC	
REPÈRE	N° SERIE	P.D.O.	TEMP.
TAG NUMBER	SERIAL N°	SET PRESSURE	°C
763-02-262022	004 /63547	0.50 BARG	-1% BACK PRESSURE
763-02-272022	005 /63547	0.50 BARG	SANS/NONE
			-1% SANS/NONE
CE PLAN EST LA PROPRIÉTÉ DE SARASIN INDUSTRIE		D	
ORIFICE FINITIONS BRIDES/FLANGE RATING		C	
ENTREE/INLET	SORTIE/OUTLET	B	
2" ANSI 150 RF	3" ANSI 150 RF	A 27/04/05	INITIAL
125/250 AARH	125/250 AARH	REV DATE	MODIFICATIONS
MODEL/MODEL	63X P50AVZ	BOULE/SCALE	SANS/NONE
SARASIN INDUSTRIE		N° PLAN BE	
62600 VENUN-LE-VIEL		DRAWING N° : FE63F02	
TEL/CN 03-21-73-54-50		REV: C	
FAX/CN 03-21-28-62-00		REF.SARASIN: 63547 D A	

## SOMMAIRE

## CONTENTS

### 1 GENERALITES

- 1.1 - Type de soupapes concernées
- 1.2 - Plaque de firme
- 1.3 - Ressorts
- 1.4 - Stockage

### 2 PRESCRIPTIONS POUR L'INSTALLATION

- 2.1 - Généralités
- 2.2 - Tuyauterie d'entrée
- 2.3 - Tuyauterie d'échappement

### 3 INSTALLATION DES SOUPAPES DE SURETE

- 3.1 - Installation d'une soupape sur un appareil
- 3.2 - Conception d'un collecteur d'échappement
- 3.3 - Recommandations
- 3.4 - Cas particulier de la vapeur d'eau

### 4 DEMONTAGE DES SOUPAPES

### 5 RODAGE

- 5.1 - Rodage à la main
- 5.2 - Rodage sur machine

### 6 MONTAGE

### 7 VERIFICATION DE LA PRESSION DE DEBUT D'OUVERTURE ET DE L'ETANCHEITE

- 7.1 - Recommandations
- 7.2 - Fonctionnement sur gaz
- 7.3 - Fonctionnement sur liquide
- 7.4 - Fonctionnement sur vapeur d'eau
- 7.5 - Réglage de la pression de début d'ouverture
- 7.6 - Correction de la pression de début d'ouverture en fonction de la température
- 7.7 - Contrôle de l'étanchéité sur gaz
- 7.8 - Contrôle de l'étanchéité sur liquide

### 8 MODIFICATION DE LA PRESSION DE DEBUT D'OUVERTURE

### 9 FONCTIONNEMENT

### 10 TERMINOLOGIE

### 11 PIECES DE RECHANGE

### 1 GENERAL

- 1.1 - Safety relief valve types concerned
- 1.2 - Identification plate
- 1.3 - Spring
- 1.4 - Storage

### 2 INSTALLATION INSTRUCTIONS

- 2.1 - General
- 2.2 - Inlet piping
- 2.3 - Outlet piping

### 3 INSTALLATION OF SAFETY RELIEF VALVES

- 3.1 - Installation of safety relief valves on equipment
- 3.2 - Outlet manifold design
- 3.3 - Recommendations
- 3.4 - Special case of steam

### 4 SAFETY RELIEF VALVE DISASSEMBLY

### 5 SAFETY RELIEF VALVE LAPPING IN

- 5.1 - Hand lapping
- 5.2 - Machine lapping

### 6 REASSEMBLY

### 7 CHECK SET PRESSURE AND TIGHTNESS

- 7.1 - Recommendations
- 7.2 - Operation using gas
- 7.3 - Operation using liquid
- 7.4 - Operation using steam
- 7.5 - Setting set pressure
- 7.6 - Set pressure correction for temperature
- 7.7 - Tightness check using gas
- 7.8 - Tightness check using liquid

### 8 RESETTNG SET PRESSURE

### 9 OPERATION

### 10 TERMINOLOGY

### 11 SPARE PARTS

## 1. GENERALITES

### 1.1 - TYPE DE SOUPAPES CONCERNEES

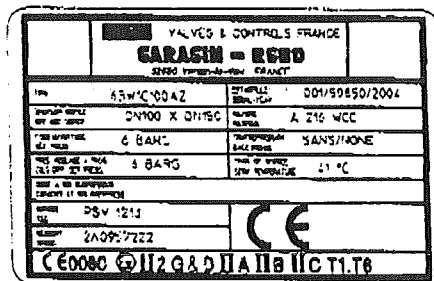
Cette notice s'applique aux soupapes du type 63

### 1.2 - PLAQUE DE FIRME

Pour toute demande d'intervention ou fourniture de pièces de rechange, il est indispensable d'indiquer les informations portées sur la plaque de firme (voir annexe 1).

Ces informations sont les suivantes :

- Numéro de série (ce numéro est aussi frappé sur la tranche de la bride de sortie)
- Type de la soupape
- Dimension entrée - classe de pression
- Dimension sortie - classe de pression
- Orifice
- Pression de début d'ouverture avec son unité
- Contre-pression avec son unité
- Numéro de repère
- Numéro d'identification du ressort



### 1.3 - RESSORT

1.3.1 Le bon fonctionnement d'une soupape dépend du choix de son ressort : raideur, compression. Un bon fonctionnement est caractérisé par :

- une levée franche
- un débit suffisant
- une fermeture rapide

1.3.2 La plage de réglage d'un ressort calculé pour une valeur de réglage déterminée ne peut excéder 5 % au-dessus ou en dessous de cette valeur.

Pour éviter tout incident, des informations concernant les ressorts pourront être obtenues auprès du Service Commercial de SARASIN-RSBD. Pour toute demande de renseignement, nous demandons à notre clientèle de bien vouloir préciser le numéro de série porté sur la plaque de

## 1. GENERAL

### 1.1 - SAFETY RELIEF VALVES TYPE CONCERNED

This document is applicable to safety valve types 63.

### 1.2 - IDENTIFICATION PLATE

The data shown on the identification plate must be quoted with all requests for work, or for the supply of spare parts.

The plate bears the following information :

- Serial number (also stamped on the edge of the outlet flange)
- Safety relief valve type
- Inlet dimension - pressure class (rating)
- Outlet dimension - pressure class (rating)
- Orifice
- Set pressure with units
- Backpressure with units
- Identification number
- Spring identification number

firme de la soupape (cf. paragraphe. 1.2). Cette information est indispensable pour identifier nos appareils.

### 1.3 - SPRING

1.3.1 The correct operation of a safety relief valve depends upon its spring characteristics : resilience, compression. Good safety relief valve operation requires:

- a clean lift
- sufficient flow rating
- quick closing

1.3.2 The adjustment range of a spring designed for a specific adjustment value must be within  $\pm 5$  % of the nominal value.

To avoid any incident, spring data may be obtained from the SARASIN-RSBD Sales Department. When requesting information, please quote the serial number on the valve identification plate (see para. 1.2). Without this number, valves cannot be identified.

#### 1.4 - STOCKAGE

Les soupapes peuvent arriver sur le site plusieurs mois avant leur mise en service. Leurs performances peuvent être détériorées si un soin particulier n'est pas apporté à leur stockage et protection.

- il est recommandé de stocker les soupapes dans un local propre, fermé, à l'abri des intempéries et des projections de sable, de poussières ou autres particules solides.
- les laisser autant que possible dans leur emballage d'origine.
- les bouchons obturateurs, les protections des filetages, les enveloppes en plastique, ne seront enlevées qu'au moment du montage.
- éviter les chocs sur les portées de joint des brides et sur les filetages.

Manutentionner les appareils avec précaution.

#### 1.4 - STORAGE

Safety relief valves may be received on a site several months before actual utilisation. If not stored and protected as necessary, safety relief valve performance may be affected.

- it is recommended that safety relief valves be stored in a clean, dry, place, well protected from the weather, sand and dust, or any other solid particles.
- wherever possible, safety relief valves should be stored in their original packaging.
- blanking plugs, thread protections and plastic covers should only be removed when a safety relief valve is installed.
- avoid any impact on flange gasket contact surfaces and on threads..

Handle very carefully.



## 2. PRESCRIPTIONS SUR L'INSTALLATION

### 2.1 - GENERALITES

Les canalisations et les appareils où circule le fluide doivent être soigneusement nettoyés. Les poussières, calamines, particules métalliques doivent disparaître en faisant circuler un jet d'air ou de vapeur.

L'interposition d'une particule solide entre le siège et le clapet de la soupape a des effets désastreux. La moindre fuite est à l'origine d'un mauvais fonctionnement et d'une érosion des surfaces qui s'accroît d'autant plus vite que la pression est élevée.

Le bon fonctionnement d'une soupape à buse longue n'est assuré que si toutes les conditions requises pour son installation sont réalisées.

### 2.2 - TUYAUTERIE D'ENTREE

Elle doit être la plus courte possible

Si la perte de charge est trop importante, elle provoque une chute de débit et peut engendrer un risque de battement en cours de fonctionnement. La perte de charge évaluée entre les conditions génératrices de l'écoulement et le point où se trouve effectivement la soupape ne doit pas excéder 3 % de la pression de début d'ouverture de la soupape, cette perte de charge étant évaluée dans les conditions de débit réel.

En aucun cas, une soupape ne peut être montée sur une tuyauterie d'un DN inférieur à son propre DN d'entrée.

Les soupapes ne doivent pas être soumises à des vibrations transmises par l'installation.

### 2.3 - TUYAUTERIE D'ECHAPPEMENT

La soupape ne doit pas supporter la tuyauterie d'échappement.

Elle ne doit pas être soumise à quelque contrainte que ce soit issue de cette tuyauterie.

La contrepression engendrée maximale admissible généralement calculée dans les conditions de débit réel maximal de la soupape, est limitée à 10 % de la pression de début d'ouverture pour les soupapes conventionnelles à action directe.

La contrepression peut être réduite en utilisant une tuyauterie d'échappement ayant un DN supérieur d'au moins une taille au DN de la bride de sortie de la soupape ainsi que des courbes à larges rayons.

## 2. INSTALLATION INSTRUCTIONS

### 2.1 - GENERAL

Piping systems and equipment through which the fluid flows must be thoroughly cleaned. Dust, deposits and metal particles must be removed using a blast of compressed air or steam.

The presence of a solid particle between the safety relief valve and its seat will have very serious effects. The slightest leak results in an improper function and erosion of the surfaces, which develops more quickly than usual, due to the high pressure.

A full nozzle safety relief valve will only operate correctly if all installation conditions are respected.

### 2.2 - INLET PIPING

The inlet piping must be as short as possible.

If the pressure drop is excessive, it will generate a flow drop, with a possible risk of chattering during operation.

The pressure difference between flow conditions and the actual safety relief valve operating point must not exceed 3 % of the safety relief valve set pressure, with the pressure drop being assessed under real flow conditions.

A safety relief valve must not be installed on piping with a nominal diameter less than the safety relief valve nominal inlet diameter.

A safety relief valve must not be subjected to vibration transmitted by the installation.

### 2.3 - OUTLET PIPING

The safety relief valve must not support the weight or installation stresses of the outlet piping.

The safety relief valve must be subjected to no stress whatsoever from piping. Maximum acceptable backpressure generated is generally calculated under actual maximum flow conditions for the safety relief valve and is limited to 10 % of the set pressure, for conventional, direct action safety relief valves.

Backpressure may be reduced by using outlet piping with a nominal diameter at least one size greater than the nominal diameter of the safety relief valve outlet flange, together with large radius elbow.

### Recommandations :

- la dimension intérieure de la tuyauterie d'échappement ne devra en aucun cas être inférieure à la dimension de l'orifice de sortie de la soupape.
- sur les liquides, il est recommandé de couder la sortie pour que la décharge s'effectue vers le bas.
- sur la vapeur d'eau, la décharge devra s'effectuer vers le haut. D'autre part il est indispensable de prévoir un dispositif de vidange des eaux pluviales à la partie basse du coude.
- la courbe de raccordement à la tuyauterie verticale sera disposée aussi près que possible de la bride de sortie de la soupape. Il conviendrait que la courbe soit boulonnée directement à la bride de la soupape.
- le rayon de cette courbe sera aussi grand que possible, au minimum  $R=2.5 d$ .
- en principe chaque soupape de sûreté aura sa tuyauterie d'échappement propre. En cas d'impossibilité le collecteur d'échappement aura une section au moins égale à la section totale des orifices de sortie des soupapes. La somme des contre-pression engendrées sera inférieure à la valeur admise par la soupape acceptant la plus faible contre-pression.

### Recommendations :

- piping inner diameter must not be less than that of the safety relief valve outlet orifice.
- in the case of liquids, it is recommended that the outlet be angled to be directed downwards.
- in the case of steam, release should be upwards and, in addition, a means of draining must be available in the lower angle.
- the connection curve to the vertical piping must be as close as possible to the safety relief valve outlet flange. The best solution is for the elbow to be bolted directly to the safety relief valve flange.
- the radius of this elbow must be as great as possible, at least  $R=2.5 d$ .
- in principle, each safety valve should have its own specific outlet piping. If this is not possible, an outlet manifold should have a cross-section at least equal to the overall cross-section of the safety relief valve outlet orifices. The sum of the backpressures generated must be less than the value accepted by the safety relief valve which accepts the least backpressure.

### 3. INSTALLATION DES SOUPAPES DE SURETE

#### 3.1 - INSTALLATION DE SOUPAPES SUR UN APPAREIL

##### 3.1.1 Montage sur un récipient sous pression.

L'ouverture dans la paroi du récipient pour recevoir la soupape doit être conçue pour donner un écoulement direct et non obstrué entre le récipient et la soupape.

##### 3.1.2 Montage sur un appareil à protéger.

La soupape doit être montée à la partie haute du système à protéger, notamment si elle doit évacuer du gaz ou de la vapeur d'eau.

La soupape doit être montée à la partie basse du système à protéger pour évacuer un liquide.

#### 3.2 - CONCEPTION D'UN COLLECTEUR D'ECHAPPEMENT

Sur une installation comportant plusieurs soupapes, le collecteur d'échappement doit être dimensionné de telle sorte que, la somme des contre-pressions engendrées soit inférieure à la valeur admise par la soupape acceptant la plus faible contre-pression.

Il faut prévoir des collecteurs séparés pour un fonctionnement en basse et haute pression.

Si les soupapes doivent fonctionner unitairement, le collecteur doit être dimensionné au minimum pour la soupape ayant le plus grand débit. L'étude permettant de connaître ou décider l'interdépendance de fonctionnement entre les différentes soupapes, la probabilité de leurs ouvertures au même moment doit être faite soigneusement.

#### 3.3 - RECOMMANDATIONS

- la soupape doit toujours être installée en position verticale.
- la soupape ne doit pas être soumise à quelque contrainte que ce soit issue de la tuyauterie.
- la force de réaction due à l'échappement implique, sur la tuyauterie d'entrée, des piquages de raccordement de type renforcé, de façon à supporter les efforts dynamiques au moment de l'échappement.
- les oreilles de levage sont destinées à la manutention de la soupape. Elles ne doivent pas servir à soulever les appareils montés en amont ou en aval de la soupape. Les oreilles de levage doivent être démontées après mise en service de la soupape.

### 3. INSTALLATION OF SAFETY RELIEF VALVES

#### 3.1 - INSTALLATION OF SAFETY RELIEF VALVES ON EQUIPMENT

##### 3.1.1 Installation on a pressure vessel

The opening in the vessel wall to accept the safety relief valve must be designed to give direct flow and there must be no obstruction between the vessel and the safety relief valve.

##### 3.1.2 Installation on equipment to be protected

The safety relief valve must be mounted on the upper part of the equipment protected, especially if the safety relief valve is releasing gas or steam.

When releasing liquid, the safety relief valve must be installed on the lower part of the equipment.

#### 3.2 - OUTLET MANIFOLD DESIGN

In the case of an installation with several safety relief valves, outlet manifold dimensions must be such that the sum of the backpressures generated is less than the value accepted by the safety relief valve which accepts the least backpressure.

Separate manifolds must be installed for operation with both low and high pressures.

If the safety relief valves only operate consecutively, the relevant manifold dimensions must be at least equal to those of the safety relief valve with the greatest flow rate. Great care must be taken with the calculations determining interdependent operation between the safety relief valves, and the possibility of their being open at the same time.

#### 3.3 - RECOMMENDATIONS

- the safety relief valve must always be installed in the vertical position.
- the safety relief valve must be subjected to no stress whatsoever from piping.
- the outlet reaction force requires the use of reinforcement on the inlet piping connections, to support dynamic loading due to the outlet.
- the lifting lugs are destined for the handling of the valve. They must not be used to lift the apparatus upstream or downstream of the valve. They should be dismantled once the valve is put into operation.

### 3.4 - CAS PARTICULIER DE LA VAPEUR D'EAU

Lorsque le fluide à évacuer est de la vapeur d'eau et si la tuyauterie d'échappement doit être longue, pour respecter les règles de sécurité il y a lieu de réaliser cette tuyauterie en deux parties (voir annexe 2). Cette disposition permet de réduire de façon sensible les efforts à encaisser par la soupape et son support.

Il est indispensable de purger le corps de la soupape de façon permanente en raccordant l'orifice de purge situé à la partie basse de ce corps avec celui placé sur le bac à égoutturer.

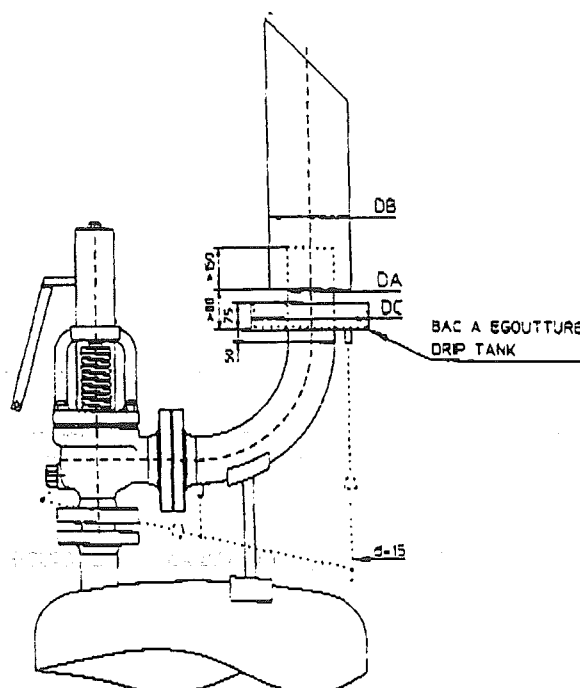
Tableau 1

DA (mm)	DB (mm)	DC (mm)
25	50	150
40	80	200
30	80	200
66	100	220
80	150	270
100	150	270
150	200	320
200	250	370
250	300	420

### 3.4 - SPECIAL CASE OF STEAM

When the fluid to be relieved is steam, and in the case of long outlet piping, in order to achieve full safety requirements, the piping should be in two parts (see appendix 2). This arrangement considerably reduces the stresses between the piping and its support.

The safety relief valve body must be permanently drained, by connecting the drain orifice, on the lower part of the body, to that on the drip tank, as shown in the diagram below.



#### 4. DEMONTAGE DES SOUPAPES

- Démonter le dispositif de relevage s'il y a lieu.
- Retirer le chapeau.
- Dégager l'écrou (18) puis desserrer la vis de réglage (17) jusqu'à ce qu'elle n'exerce plus de pression sur le ressort. Pour faciliter le pré-réglage ultérieur de la soupape, tracer un repère sur la vis de réglage (17).
- Déposer la gaine (2) le ressort et ses rondelles (16-15), le pointal (11) et le clapet (05).
- Vérifier que le ressort est resté cylindrique en le roulant sur une surface plane. S'il est déformé ou s'il porte des traces de corrosion, il est nécessaire de le remplacer.
- Vérifier les surfaces de portées sur le clapet (05) et du siège (04).
- Le siège est serti dans le corps et ne peut être démonté. Son rodage doit se faire dans le corps.
- Inspecter les pièces, spécialement les portées du clapet (05) et du siège (04), les surfaces de guidage du pointal (11) et du guide (9).

L'étanchéité et le bon fonctionnement de la soupape ne sont assurés que si l'état des portées est parfait. Au cas où celles-ci seraient endommagées, il y a lieu de procéder à un rodage (cf. chap. 5) ou à un ré-usinage.

Celui-ci devra alors être réalisé dans le respect des tolérances permises par SARASIN-RSBD. Le non-respect de cette recommandation affecterait gravement le bon fonctionnement et les performances de la soupape.

Le Service Commercial de SARASIN-RSBD reste à votre disposition pour toute information concernant ces tolérances.

- Nettoyer, dégraisser, sécher les pièces avant remontage.

Il est pratique de disposer de pièces de rechange pour permettre de remonter immédiatement la soupape avec un équipement neuf. La disponibilité de la soupape est alors optimale (cf. chap. 12).

#### 4. SAFETY RELIEF VALVES DISASSEMBLY

- Remove the lifting device, where applicable.
- Remove the cap.
- Slacken nut (18) and unscrew the adjustment screw (17) until it is no longer compressing the spring. To facilitate subsequent pre-adjustment of the safety relief valve, mark the position of the adjustment screw (17).
- Remove the bonnet (2), the spring and washers (16-15), the stem (11) and the disc (05).
- Check that the spring remains cylindrical by rolling it on a flat surface. If the spring is distorted or shows signs of corrosion, it should be replaced.
- Check the contact surface of the disc (05) and seat (04).
- The seat is pressed into the body and cannot be removed. Its lapping must be made in the body.
- Inspect the parts, especially the disc (05) and seat (04) contact surfaces, and the guide surfaces of the spindle (11) and the guide (9).

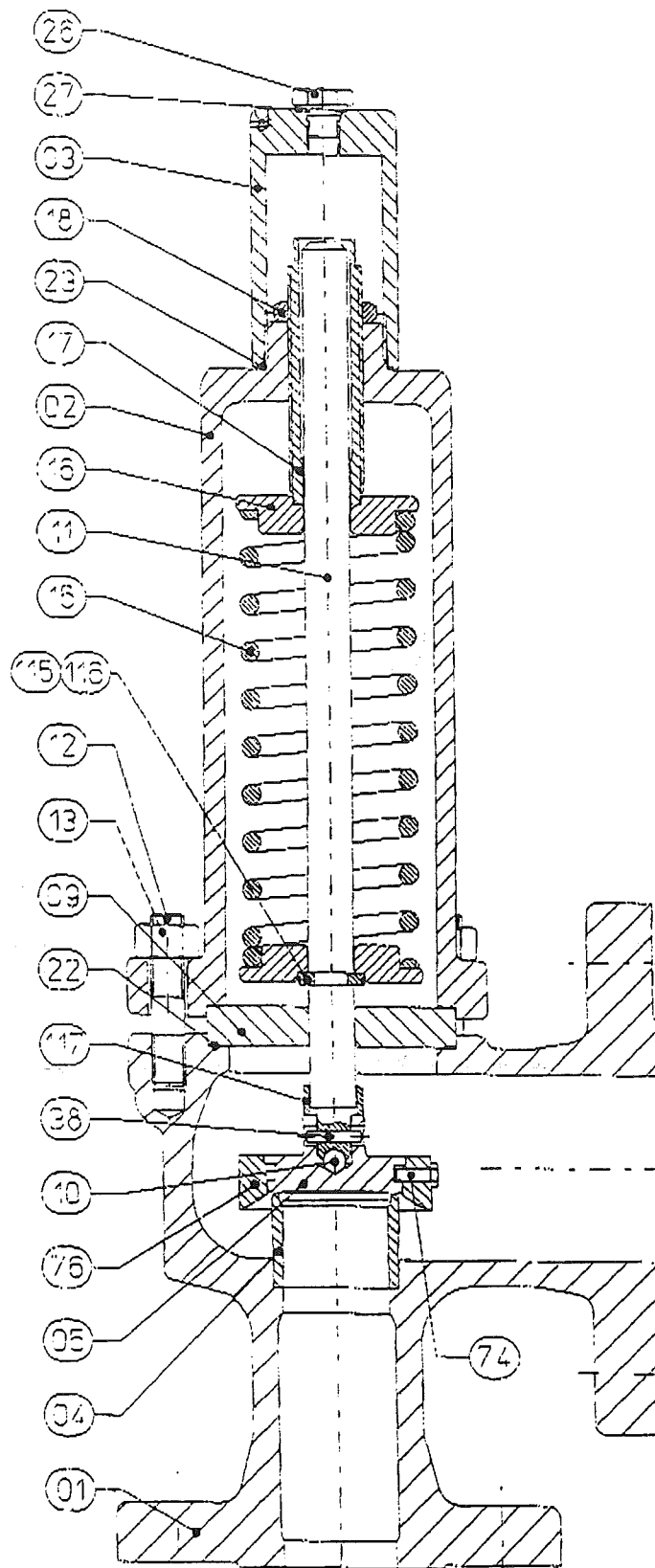
Safety relief valve tightness and correct operation are only assured if the seat surfaces are in perfect condition. If they are damaged, then they must be relapped (see chap. 5) or remachined.

Any remachining must be subject to the tolerances defined by SARASIN-RSBD. Any machining subsequently outside tolerances will not give correct operation or performance.

SARASIN-RSBD Sales Department remains at your disposal for any other information you may require concerning tolerances.

- Parts should be cleaned, degreased and dried, before reassembly.

It is practical to have spare parts available, so that a safety relief valve can be immediately reassembled, using new parts. This ensures optimum safety relief valve availability (see chap. 12).



## 5. RODAGE

Après un certain temps de service, lorsqu'une soupape commence à fuir, il faut rénover par un rodage à la main ou à la machine, les portées d'étanchéité de la buse et du clapet pour qu'elles retrouvent leur qualité.

L'opération qui exige du soin et du doigté ne peut être confiée qu'à une main-d'œuvre expérimentée, sinon une détérioration irréparable sur place peut en résulter.

Si cette main-d'œuvre fait défaut, l'appareil sera retourné chez SARASIN-RSBD qui en assurera la remise en état.

### 5.1 - Rodage à la main

En aucun cas on ne rodera le clapet sur la buse. Avant rodage, s'assurer que la surface des pièces ne présente ni bavure, ni cavité susceptible de rayer le rodoir ou de laisser des traces après l'opération. Dans le cas contraire, et pour les surfaces déformées, une reprise au tour est indispensable.

#### 5.1.1 Clapet

Démonter le déflecteur (76) et le pointal (11).

Étendre une légère couche de pâte à roder sur la surface dressée du rodoir puis poser le clapet dessus.

Ne pas roder en faisant pression à la main, le poids propre du clapet suffit.

Utiliser d'abord la pâte à roder 400. Faire un mouvement rapide en forme de 8. Soulever périodiquement le clapet. Étendre sur le rodoir une nouvelle couche de pâte 400 et répéter l'opération jusqu'à disparition de tout défaut.

Toute la surface de la portée doit apparaître du même ton, sans trace de rayures.

Nettoyer très proprement au moyen de solvant la surface de contact du clapet et du rodoir.

Utiliser pour la finition de la pâte à grain beaucoup plus fin et étendre une fine couche sur le rodoir. Faire le même mouvement en forme de 8 que précédemment pendant une dizaine de minutes. Si la surface de portée ne paraît pas entièrement polie répéter l'opération sans remettre de nouvelle couche de pâte sur le rodoir. Il suffit de passer le doigt sur toute la surface du rodoir pour répartir également le reste de la pâte.

## 5. SAFETY RELIEF VALVE LAPPING IN

After a certain period of operation, when a safety relief valve starts to leak, it must be reconditioned by lapping in the seat surfaces of the nozzle and disc, either by hand or using a machine, so that good tightness and operation are restored.

This operation requires skill and experience and can only be carried out by a qualified person, otherwise irreparable damage may be done.

If this skill is not available, the safety relief valve should be returned to SARASIN-RSBD for reconditioning.

### 5.1 - Hand lapping

The disc must never be lapped directly on the nozzle. Before lapping, check that parts are not damaged or pitted in any way which could damage the lapping set tool or leave traces after the operation. If this condition is not respected, distorted surfaces must be remachined on the lathe.

#### 5.1.1 Disc

Take off the deflector (78) and the spindle (11).

Spread a thin coat of grinding paste on the lapping tool surface and place the disc on the top.

Do not apply hand pressure, the weight of the disc will be sufficient.

Start with paste 400. Apply a quick motion in a figure of 8 pattern. Lift the disc periodically. Apply further coats of paste to the lapping tool and repeat the operation until all defects have been removed.

The entire contact surface must have an identical texture and appearance, with no trace of scoring.

Clean the contact surfaces of the lapping set and disc, using solvent.

For finishing, use a much finer grade paste and spread a thin coat on the lapping set. Proceed as before, in a figure of 8 motion, for around ten minutes. If the contact surface does not appear fully polished, repeat the operation but without putting on more paste, just spread the remaining paste evenly, using the finger.

Le rodage est terminé quand toute la surface de la portée apparaît sans tache, uniforme et glacée.

Nettoyer enfin soigneusement la portée avec le solvant à l'aide d'un chiffon blanc très propre jusqu'à ce que toute trace d'impureté disparaisse. Procéder de la même façon pour retoucher les rodoirs sur le marbre.

#### 5.1.2 Siège

Étaler sur le rodoir une faible couche de pâte à roder.

Poser le rodoir sur le portage et tourner de façon progressive dans le sens des aiguilles d'une montre, en évitant un appui excessif et vérifier de la même façon que pour le clapet.

### 5.2 - Rodage sur machine

Le rodage peut se faire sur une machine à roder avec l'emploi d'une poudre à roder diluée dans de l'huile. Le brillant de la surface ne pourra être obtenu qu'après un polissage manuel sur un bloc polissoir.

The lapping process is completed when the entire contact surface has no marks and is uniformly polished to a glazed finish.

Finally, carefully clean the contact surface, using solvent and a very clean white cloth, until all traces of impurity have been removed.

Proceed in the same way to recondition the lapping tools on the plate surface.

#### 5.1.2 Seat

Spread a thin coat of 400 lapping paste on the hone and proceed in the same way as for the disc.

### 5.2 - Machine lapping

Safety relief valve can be lapped in using a lapping machine, with lapping powder diluted in oil. However, the polished surface will only be obtained after manual polishing on the polishing block.



## 6. REMONTAGE

### 6.1 - RECOMMANDATIONS

Le remontage de la soupape se fait avec un jeu de joints neufs.

Les pièces à assembler doivent être d'une propreté absolue. Les pièces constituant l'équipage mobile de la soupape : clapet, pointal, guide, seront parfaitement dégraissées puis séchées avant le remontage. Veiller aussi à ce que ces pièces ne comportent aucune bavure.

Afin de faciliter le montage et le réglage de la soupape, il est recommandé de lubrifier les parties suivantes lorsque les conditions de service le permettent :

- assise pointal/clapet
- assise guide/pointal
- filetage des vis de réglage

Le lubrifiant utilisé doit être compatible avec les conditions de service. Nous préconisons l'emploi d'un bisulfure de molybdène (MOS2) en lubrification sèche à appliquer par pulvérisation.

### 6.2 - PROCEDURE

- Poser l'ensemble clapet-guide (05-76-117-11-09) sur la portée de la siège (04). Ajuster ensuite le guide (09) et ses joints (22).
- Positionner le ressort et ses rondelles (15-16) et la gaine (2). Serrer les goujons de gaine.
- Comprimer le ressort (15) au moyen de la vis de réglage (17) jusqu'au repère tracé lors du démontage. Visser le contre-écrou dans une position médiane.

## 6. REASSEMBLY

### 6.1 - RECOMMENDATIONS

The safety relief valve should be reassembled with a set of new gaskets.

Parts must be absolutely clean before assembly. Moving parts : disc, spindle, guide must be thoroughly degreased and dried before reassembly. Check that there are no burrs on these parts.

Safety relief valve assembly and adjustment is easier if the parts listed below are lubricated, before assembly, when operating conditions allow :

- disc/spindle contact
- guide/spindle contact
- adjustment screw threads

The lubricant used must be compatible with operating conditions. A molybdenum bisulphide (MOS2) lubricant is recommended, in powder spray form.

### 6.2 - PROCEDURE

- Install the disc/guide assembly (05-76-117-11-09) on the seat (04). Then adjust the guide (09) and the gaskets (22).
- Position the spring and washers (15-16) and bonnet (2). Tighten the bonnet studs.
- Using the adjustment screw (17), compress the spring (15), up to the mark made before disassembly. Screw the lock-nut to a medium setting.

## 7. VERIFICATION DE LA PRESSION DE DEBUT D'OUVERTURE ET DE L'ETANCHEITE

### 7.1 - RECOMMANDATIONS

Le tarage et le réglage des soupapes de sûreté doit être réalisé sur un banc d'essai approprié (les soupapes montées sur des installations fonctionnant en service liquide doivent être réglées sur banc liquide, les soupapes installées sur service gaz doivent être réglées sur banc gaz ).

Le bridage doit être homogène et comporter au minimum 3 points de serrage.

#### 7.1.1 Précautions lors du réglage sur banc ou sur l'installation

L'ouverture de la soupape engendre des niveaux de bruit très élevés. Les personnes exposées doivent être équipées de protections adéquates.

L'ouverture de la soupape peut provoquer des projections de fluide non canalisées (au travers de la gaine repère 2 pour les soupapes vapeur ou soupapes sans raccordement à la bride de sortie). L'installation doit être conçue de façon à limiter l'accès aux abords de la soupape.

#### 7.1.2 L'installation d'essai doit comprendre :

- un réservoir à pression dans lequel on peut faire monter la pression par un robinet (par exemple à pointeau) et une source de pression.
- une connexion sur ce réservoir sur laquelle la soupape à régler doit être bridée.

La connexion entre le réservoir et la soupape doit être suffisamment large pour minimiser les effets de la perte de charge pendant l'essai de la soupape.

Le volume du réservoir à pression est un compromis entre les contraintes économiques et les nécessités techniques. Plus il est important en regard de la capacité de la soupape, plus le réglage est précis.

Si le volume est petit, on pourra régler la pression de début d'ouverture, mais la chute de pression à la refermeture sera réglée de manière empirique.

Si le volume est grand, on pourra régler à la fois la pression de début d'ouverture et la chute de pression à la refermeture avec précision.

## 7. CHECK SET PRESSURE AND TIGHTNESS

### 7.1 - RECOMMENDATIONS

Safety valve setting and adjustment must be executed on the appropriate test bench . (valves on liquid service should be adjusted on a liquid bench).

Flanging must be homogeneous and have at least 3 tightening points.

#### 7.1.1 Precautions during adjustment on test bench or on installation

The opening of the valve entails a very high noise level. Persons exposed should be adequately protected.

The opening of the valve can cause the projection of undirected fluid (through the bonnet item 2 for steam valves or valves with no connection on the outlet flange. The installation should be designed so that access to the area around the valve is limited.

#### 7.1.2 Composition of test installation :

- pressure tank, which can be pressurised through a valve (e.g. needle valve) and a source of pressure.
- a connection on the reservoir, on which the valve to be adjusted must be flange-mounted.

The connection between the reservoir and safety relief valve must be sufficiently wide to minimise pressure drops during the safety relief valve test.

The pressure tank volume is a compromise between economic considerations and technical necessity. The greater the reservoir volume, in relation to the safety relief valve, the more accurate the adjustment.

If the volume is small, the set pressure can be adjusted, but the closing pressure drop adjustment will be empirical.

If the volume is large, both the set pressure and the closing pressure drop can be accurately adjusted.

#### 7.1.3 Pour régler la pression de début d'ouverture :

- a/- brider la soupape sur le réservoir à pression.
- b/- augmenter la pression dans le réservoir et noter la pression à laquelle la soupape commence à fuser ou déclencher.
- c/- faire chuter la pression sous la soupape d'au moins 50 % et régler de nouveau la compression du ressort au moyen de la vis de réglage (17).
- d/- procéder de la même façon qu'en b/ et atteindre la pression de début d'ouverture déterminée par les approches successives. Ne jamais oublier de faire chuter la pression de 50 % avant de modifier la charge du ressort.
- e/- régler la bague de réglage.

### 7.2 - FONCTIONNEMENT SUR GAZ

La soupape est réglée avec de l'air ou de l'azote, sec et propre.

### 7.3 - FONCTIONNEMENT SUR LIQUIDE

La soupape est réglée avec de l'eau propre contenant un inhibiteur de corrosion. Il faut éviter d'utiliser de l'huile ou dérivés.

### 7.4 - FONCTIONNEMENT SUR VAPEUR D'EAU

La soupape est réglée soit à chaud sur banc vapeur à sa pression de début d'ouverture soit à froid sur banc air à sa pression de début d'ouverture multipliée par le coefficient donné dans le tableau 2.

**REMARQUE :** Pour procéder à ces essais, il est recommandé d'utiliser le même fluide que celui utilisé par SARASIN-RSBD. La nature de ce fluide figure sur le certificat d'essai qui est fourni avec chaque appareil.

### 7.5 - REGLAGE DE LA PRESSION DE DEBUT D'OUVERTURE

Pour une soupape conventionnelle devant fonctionner avec une contre-pression constante, la valeur de la pression de réglage est égale à la différence entre la pression de début d'ouverture demandée et la contre-pression initiale.

#### 7.1.3 Setting of the set pressure :

- a/- clamp the safety relief valve on the pressure reservoir.
- b/- increase the reservoir pressure and note the pressure at which the safety relief valve starts to open.
- c/- drop the pressure on the safety relief valve by at least 50 % and reset the spring compression, using adjustment screw (17).
- d/- Proceed as in c/ and obtain the set pressure by successive approaches. Ensure that the pressure is dropped by 50 % before resetting the spring loading.
- e/- adjust the adjusting ring.

### 7.2 - OPERATION USING GAS

The safety relief valve must be adjusted using clean, dry air or nitrogen.

### 7.3 - OPERATION USING LIQUID

The safety relief valve is adjusted using clean water with a corrosion inhibitor. Do not use oil or similar fluids.

### 7.4 - OPERATION USING STEAM

If the safety relief valve is stamped "UV" (ASME VIII), it must be adjusted using steam.

**NOTE :** For these tests, it is recommended that the fluid used be the same as that used by SARASIN-RSBD. The specification of this fluid is shown on the test certificate supplied with all equipment.

### 7.5 - SETTING SET PRESSURE

For a conventional safety relief valve operating with constant backpressure, the pressure setting is the difference between the set pressure and the initial backpressure.

Pour un ressort donné la possibilité de variation de la pression de réglage ne peut excéder  $\pm 5\%$  de la pression de début d'ouverture.

Le réglage de la pression de début d'ouverture se fait en agissant sur la vis de réglage en tournant dans le sens des aiguilles d'une montre pour augmenter la pression de réglage.

#### IMPORTANT :

Avant d'agir sur la vis de réglage, il est indispensable d'avoir fait chuter la pression d'au moins 50 %.

#### 7.6 - CORRECTION DE LA PRESSION DE DEBUT D'OUVERTURE EN FONCTION DE LA TEMPERATURE (réglage à froid)

Afin de compenser la faible perte de charge du ressort de la soupape destinée à fonctionner à des températures élevées, on effectue le réglage de la pression de début d'ouverture à froid puis on augmente d'un pourcentage précisé dans le tableau 2 cette pression de réglage.

Température Working temperature °C (°F)		Tous fluides All fluids
De From	à To	
	66(150)	Aucune/none
67(151)	120(248)	+ 1%
121(249)	200(392)	+2%
201(393)	315(599)	+3%

#### 7.7 - CONTROLE DE L'ETANCHEITE SUR GAZ

La vérification de l'étanchéité se fait suivant la norme A.P.I 527 (voir annexe 4).

La soupape est montée sur une capacité d'un volume suffisant pour permettre l'ouverture franche de la soupape. Le manomètre préalablement contrôlé est choisi de manière à ce que la zone de graduation utilisée se situe entre le 1/4 et les 3/4 de l'échelle.

Après le réglage de la pression de début d'ouverture, l'orifice de sortie est obstrué et la pression du réservoir est ramenée à 90 % de la pression de début d'ouverture (pression d'essai). Pour des soupapes réglées à 3,45 bar ou en dessous, la pression d'essai de l'étanchéité sera la pression de réglage diminuée de 0,350 bar.

For a given spring, the adjustment pressure variation must be within  $\pm 5\%$  of the set pressure. The set pressure is adjusted by turning the adjustment screw clockwise to increase pressure.

#### IMPORTANT :

Before moving the adjustment screw, pressure must be reduced by at least 50 %.

#### 7.6 - SET PRESSURE CORRECTION FOR TEMPERATURE (cold adjustment)

To compensate for low pressure drop in the safety relief valve spring designed to operate at high temperatures, the set pressure is adjusted cold, and the pressure is then increased by a percentage given in the table below.

#### 7.7 - TIGHTNESS CHECK USING GAS

Safety relief valve tightness is checked in compliance with the requirements of API 527 standard.

The safety relief valve is connected as shown in table 1 below, to a reservoir with sufficient volume to enable clean safety relief valve opening. The proper pressure gauge is before hand controlled, and selected so that the graduation area used is between 1/4 and 3/4 FSD.

When the set pressure has been adjusted, the outlet orifice is blanked off and reservoir pressure is increased to 90 % of set pressure.

For safety relief valves set to 3,45 bar or less, the tightness test pressure will be the pressure setting, less 0,350 bar.

Un dispositif de mesure est monté sur le plateau obturateur fixé à la sortie de la soupape. La fuite est mesurée en comptant le nombre de bulles d'air s'échappant par un tuyau de diamètre intérieur 6 mm plongé sous 12 mm d'eau.

Le comptage commence après avoir appliqué la pression d'essai 1 minute pour les diamètres d'entrée jusque 2", 2 minutes pour les diamètres de 2½" à 4" et 5 minutes pour les orifices supérieurs ou égaux à 6".

La soupape n'est acceptable que si la fuite est inférieure à la quantité de bulles tolérées par minute portée dans le tableau 3 ci-dessous ( A.P.I 527 ).

A measuring device is mounted on the safety relief valve outlet blanking plate. Leak rate is then measured by counting the number of air bubbles escaping through a pipe, i.e. 6 mm, under 12 mm of water.

Counting starts after application of test pressure for 1 minute for inlet diameters up to 2", 2 minutes for diameters from 2 ½ to 4" and 5 minutes for orifices above or equal to 6".

The safety relief valve is only acceptable if the leak rate is less than the allowed bubble rate, shown in table 2, below API 527).

Pression de tarage Set pressure			Orifices inférieurs ou égaux à F Orifices ≤ to F		Orifices supérieurs à F Orifices > to F	
Bar	Psi	MPa	Bulles/minute Bubbles/min.	Nm³/24h	Bulles/minute	Nm³/24h
1,03-68.96	15-1000	0.103-6.896	40	0.017	20	0.0085
103	1500	10.3	60	0.026	30	0.013
130	2000	13.0	80	0.034	40	0.017
172	2500	17.2	100	0.043	50	0.021
207	3000	20.7	100	0.043	60	0.026
276	4000	27.6	100	0.043	80	0.034
385	5000	38.5	100	0.043	100	0.043
414	6000	41.4	100	0.043	100	0.043

**Nota :** pour soupapes vapeur à gaine ouverte, les critères sont :

- a/ sur banc air : taux de bulles acceptable suivant tableau ci-dessus divisé par 2 (bride de sortie obturée et corps rempli d'eau).
- b/ sur banc d'essai vapeur : aucune fuite visible ou audible à la pression d'essai.

#### 7.8 - CONTROLE DE L'ETANCHEITE SUR LIQUIDE

Pour les liquides, il est toléré une fuite équivalente à 10 mm³/h/mm de diamètre d'orifice.

**N.B :** for steam valves with opened bonnet, test criteria is as follows :

- a/ on an air test bench : acceptable bubble rate according to above table divided by 2 (outlet flange sealed and body filled with water).
- b/ on a steam test bench : no visible or audible leak at test pressure.

#### 7.8 - TIGHTNESS CHECK USING LIQUID

For liquids, the tolerated leak rate is equivalent to 10 mm³/h per mm of orifice diameter.

TUBE Ø EXTERIEUR 7.9 mm EPAISSEUR DE PAROI 0.69 mm  
TUBE OUTLET DIAMETER 5/16 inch WALL THICKNESS 0.035 inch

TROU DE MANTEN A NIVEAU  
WATER LEVEL CONTROL HOLE

12.7 mm (1/2 inch)

ADAPTATION BRIDE OU VISSEE MONTÉE  
SUR LA SORTIE DE LA SOUPAPE  
FLANGED OR THREADED OUTLET ADAPTER  
FOR PRESSURE RELIEF VALVE

EAL  
WATER

RÉCIPENT SOUDÉ AU DÉTECTEUR  
CUP WELD TO DETECTOR

12.7 mm (1/2 inch)

MEMBRANE ÉTANCHE DURANT L'ESSAI.  
ÉCLATANT EN CAS DE DÉCLENCHEMENT ACCIDENTEL  
MEMBRANE SEALS DURING TEST, BURSTS  
IF VALVE ACCIDENTALLY OPENS

JOINT CAOUTCHOUC  
SOFT RUBBER GASKET

BRIDGE  
C CLAMP

AIR SOUS PRESSION  
AIR PRESSURE

TROU DE MANTEN A NIVEAU  
WATER LEVEL CONTROL HOLE

## 8. MODIFICATION DE LA PRESSION DE DEBUT D'OUVERTURE

L'installation exige parfois la modification de la pression de début d'ouverture sur une soupape de sûreté SARASIN-RSBD.

Il est nécessaire alors de s'adresser au Service Commercial de SARASIN -RSBD pour savoir si le ressort en place peut être conservé et si le nouveau réglage est compatible avec les caractéristiques de la soupape installée.

Si la soupape ne peut être renvoyée chez SARASIN-RSBD pour effectuer cette correction, il y a lieu de respecter les règles suivantes :

- Faire chuter la pression à l'entrée de la soupape à 50 % de la pression de début d'ouverture avant de procéder au nouveau réglage.

## 8. RESETTING SET PRESSURE

It is sometimes necessary to modify the set pressure of a SARASIN -RSBD safety relief valve. In this case, SARASIN-RSBD Sales Department should be consulted in order to find out whether or not the spring needs to be changed and whether the new setting is compatible with the characteristics of the valve concerned.

If the valve cannot be sent back to SARASIN-RSBD for modification, the following rules should be respected :

- Bring the pressure at the valve inlet down to 50 % of the set pressure before proceeding with the new adjustment.

## 9. FONCTIONNEMENT

Nos soupapes peuvent être équipées d'un dispositif de soulèvement manuel. Conformément à la réglementation, ce dispositif ne peut être actionné que lorsque la pression dans l'enceinte est supérieure ou égale à 75 % de la pression de réglage.

Lors de la manœuvre, la personne exposée doit se protéger du bruit et des projections éventuelles de fluide.

## 9. FUNCTIONING

Our valves can be equipped with a manual lifting device. According to regulation, this device can only be activated when the pressure in the enclosure is higher than or equal to 75 % of the set pressure.

During operation, the exposed person should protect themselves from noise and possible projection of fluid.



## 10. TERMINOLOGIE

Définition de quelques termes employés dans ce guide ( extrait de la norme NFE 29410 )

### 10.1 - PRESSION DE DEBUT D'OUVERTURE

Pression effective à laquelle le clapet d'une soupape de sûreté commence à s'ouvrir dans les conditions d'exploitation. C'est la pression effective qui dans ces conditions, exerce sous le clapet une force qui équilibre celles qui maintiennent le clapet sur son siège.

### 10.2 - PRESSION DE REGLAGE

Pression effective à laquelle une soupape de sûreté commence à s'ouvrir sur un banc d'essai. La pression de réglage peut différer de la pression de début d'ouverture en raison des corrections nécessitées en particulier par la température et l'éventuelle incidence d'une contre-pression.

### 10.3 - SURPRESSION

Augmentation de pression par rapport à la pression de début d'ouverture généralement exprimée en pourcentage de la pression de début d'ouverture.

### 10.4 - PRESSION DE REFERMETURE

Valeur de la pression effective mesurée dans l'appareillage protégé par la soupape de sûreté lorsque le clapet de celle-ci retombe sur son siège.

### 10.5 - CHUTE DE PRESSION A LA REFERMETURE

Différence entre la pression de début d'ouverture et la pression de re-fermeture. Elle est généralement exprimée en pourcentage de la pression de début d'ouverture.

### 10.6 - PRESSION D'ETANCHEITE

Pression à laquelle une soupape est étanche, elle est généralement différente de la pression de re-fermeture. C'est à cette pression qu'est effectuée la vérification de la qualité de l'étanchéité. La pression d'étanchéité est égale à 90 % de la pression de réglage.

### 10.7 - CONTRE-PRESSION INITIALE

Pression existant à l'aval d'une soupape de sûreté au moment où celle-ci va entrer en fonctionnement.

## 10. TERMINOLOGY

Definition of some of the terms used in this guide (extracts from NFE 29410 standard).

### 10.1 - SET PRESSURE

The effective pressure at which the disc of a safety relief valve starts to open under working conditions. It is this effective pressure which, under these conditions, exerts the force under the disc which balances out the pressure keeping the disc on its seat.

### 10.2 - COLD DIFFERENTIAL TEST PRESSURE

The effective pressure at which a safety relief valve starts to open on a test bench. The cold differential set pressure can be different from the set pressure because of the corrections which have to be made in order to compensate for certain conditions such as temperature and the possible effect of back pressure.

### 10.3 - OVERPRESSURE

The increase in pressure over set pressure, generally expressed as a percentage of the set pressure.

### 10.4 - CLOSING PRESSURE

The value of the effective pressure measured in the installation protected by the safety relief valve once the disc re-establishes contact with the seat.

### 10.5 - BLOWDOWN

The difference between the set pressure and the closing pressure. This is generally expressed as a percentage of the set pressure.

### 10.6 - LEAK TEST PRESSURE

The pressure at which a safety relief valve is leak-free. This is generally different from the closing pressure. It is at this pressure that tightness is checked. Leak test pressure is equal to 90 % of cold differential test pressure.

### 10.7 - INITIAL BACK PRESSURE

The pressure existing downstream from the safety relief valve at the moment it starts to function.

## 11. PIECES DE RECHANGE

Il peut s'avérer qu'après un usage prolongé, intensif ou des conditions de service exceptionnelles, une remise en état de la soupape soit rendue nécessaire.

Cette remise en état doit être effectuée par notre Service Après Ventes ou par une société de réparation adhérente au Réseau "QS" à qui notre Service Assurance Qualité et notre service technique a donné son agrément.

Toutefois pour que l'utilisateur puisse procéder à cette remise en état dans le plus court délai, nous préconisons que lors de sa commande, il approvisionne un stock usuel de pièces de rechange.

Ce stock peut se composer de la façon suivante :

Pour 4 soupapes identiques

- 1 - clapet
- 1 - ressort
- 1 - pointal
- 2 - jeux de joints

### REMARQUE :

Pour que nous puissions garantir l'interchangeabilité de nos pièces de rechange il est indispensable que vous nous transmettiez le numéro de série frappé sur la plaque de firme.

## 11. SPARE PARTS

If can happen that, after prolonged or intensive use or exceptional working conditions, a safety relief valve needs to be overhauled.

This overhaul should be carried out by our After Sales Service or by a repair company belonging to the "QS" network, which has been approved by our Quality Assurance and Technical Departments.

In any case, in order to permit the user to carry out this overhaul in the shortest possible time, we recommend stocking up on current spare parts at the time of order.

This stock can be made up of the following :

For 4 identical safety relief valves :

- 1 - disc
- 1 - spring
- 1 - stem
- 2 - set of gaskets

### NOTE :

It is necessary to quote the serial number stamped on the firm plate so that we can guarantee the interchangeability of our spare parts.

**RUPTURE DISC FOR INNER VESSEL  
DN150****Item Z62004 for 1800MT LOX TANK  
Item Z72004 for 1000MT LIN TANK****SUPPLIER :****BECEP  
84/86 rue de Buzenval  
75020 Paris  
FRANCE  
Mme Pascale HERBIN  
Tel.: 01 44 93 20 53  
Fax: 01 44 93 20 59**

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6" MONO WITH VS GENERAL LAYOUT  
REF BECEP PO 29/04/5494  
ZOOK REF 05.0335

325 MBARG ±50 MBARG @ 20°C  
ANSI 150 FLANGE RATING  
OXYGEN CLEANED

TAG

- ~~3 NO 781-02-Z62004~~
- 3 NO 783-02-Z62004
- 3 NO 783-102-Z72004
- ~~3 NO 812-102-Z72004~~

NOMINAL BORE		A	B	C
MM	IN	MM	MM	MM
150	6	22.22	152.40	219.00

**BECEP SARL**

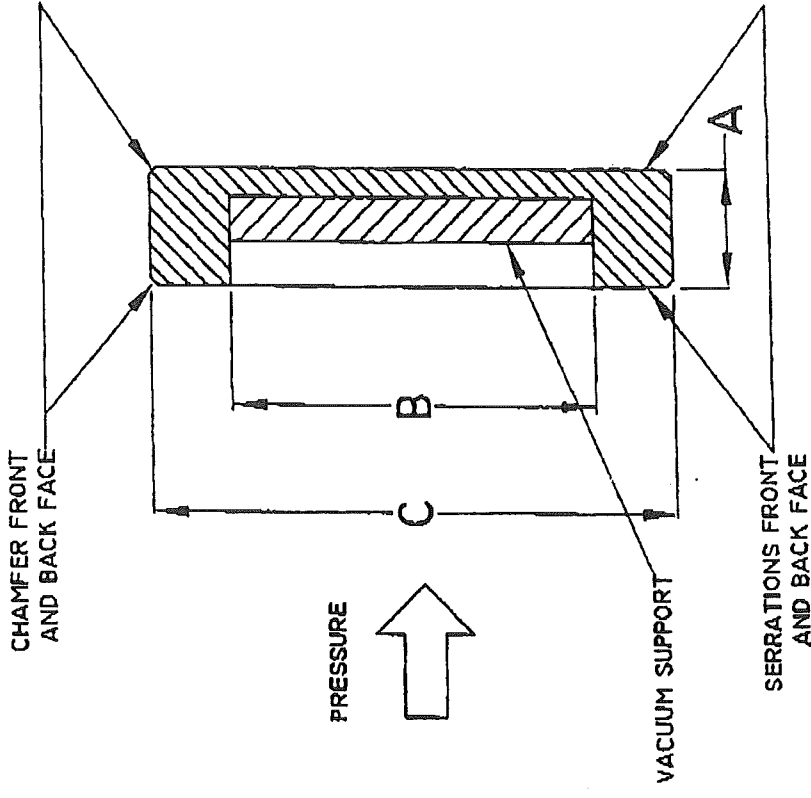
84/86, rue de Buzenval  
F-75020 PARIS

Tél : 01 44 93 20 50  
Fax : 01 44 93 20 59

DO NOT SCALE

IF IN DOUBT ASK

QTY. PART MATERIAL/DESCRIPTION



6" MONO WITH VACUUM  
SUPPORT, FINISHED SIZES

MATERIAL GRAPHITE

ZOOK EUROPE LTD

(INC RUPATURE DISCS INTERNATIONAL LTD)  
UNIT 33, DUNNINGTON BUSINESS CENTRE  
COLLIERY CLOSE, DUNGLAND LANE  
DUNNINGTON, SHEFFIELD S25 3QX  
Tel. 01909 500999 Fax 01909 500660  
www.zook.co.uk zook@zook.co.uk

ANGLE PROJECTION

PROJECTION

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REVISION

1503 05.0335 (2)

DESCRIPTION OF REVISION

DATE



# ZOOK ENTERPRISES RUPTURE DISKS

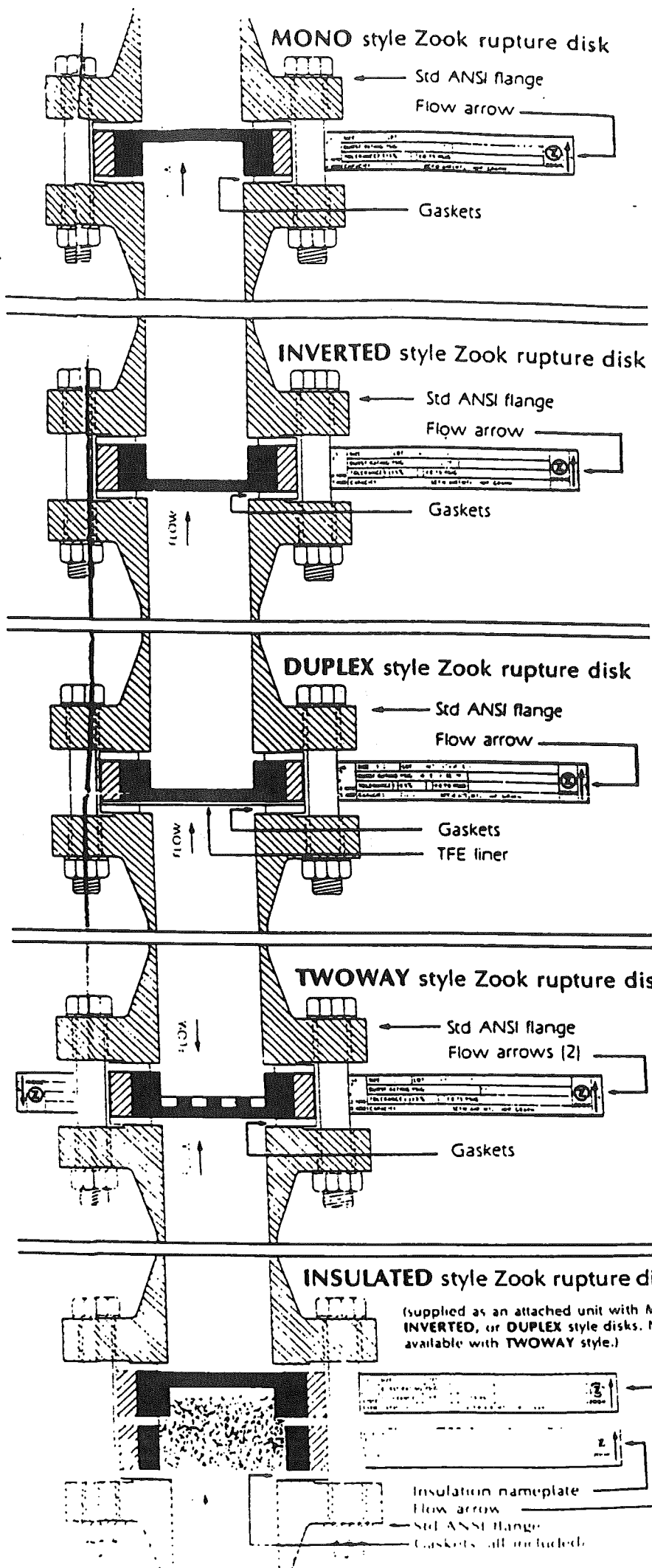
PO BOX 419 • 16809 PARK CIRCLE DRIVE  
CHAGRIN FALLS, OHIO, USA 44022-0419  
TEL (216) 543-1010 • FAX (216) 543-4930

## Installation Guide Standard ANSI Series

1. For proper disk orientation in the vent line, the flow arrow appearing on the end of the nameplate must point in the venting direction.
2. Make sure flange faces are clean, flat, and parallel to each other.
3. Follow gasket dimensions shown on the of this sheet. The I.D. dimension provides proper clearance during rupture. Gasket O.D. must equal disk O.D. to assure proper alignment in flange.
4. Carefully center disk and gaskets in vent line. Misalignment may alter disk performance.
5. Lubricate flange bolts with graphite and oil to eliminate uneven clamping of the disk. To further assure uniform pressure on the disk, **cross-tighten bolts**.
6. Flange bolts should be tightened equally and with no more force than required to prevent leakage under operating conditions. Bolt torquing values for non-asbestos gaskets, shown on the back of this sheet, are provided as a guide, only.
7. Extraneous stresses from vent line, supports, surrounding structure and subsequent structural changes must not be allowed to create unequal forces on the disk.
8. Make sure vent piping is adequately supported to withstand forces generated during blow-down conditions.

### WARNINGS

1. The flow arrow appearing on the disk nameplate must point in the venting direction.
2. Discharge from open vents can be hazardous to personnel and equipment because of toxic and flammable materials; fragments from rupture disks; pipe scale, product solids, and high velocity discharge.
3. Rupture disks described in this guide are intended for application only by persons possessing requisite skill, and at their own discretion and risk.
4. Because installation and use of rupture disks are beyond control of the manufacturer, Zook Enterprises does not assume any liability exceeding the purchase price of the disk. This express warranty excludes all implied warranties.



# Dimensions & Torque Guide

FLANGE CLASS <small>ASME ANSI 16.5</small>	NOZZLE SIZE	MAX' DISK BURST RATING	ZOOK DISK				GASKETS		FLANGE BOLTS		TORQUE*** GUIDE
			DIAMETER		THICKNESS		ID	OD	Number	Dia.	
			ID	OD	Disk	Insulated Disk**					
	inch	psi	inch	inch	inch	inch	inch	inch			
150	1/2	290	1/2	1-3/4	5/8	1-3/4	3/4	1-3/4	4	1/2	5
	3/4	290	3/4	2-1/8	5/8	1-3/4	1	2-1/8	4	1/2	7
	1	290	1	2-1/2	7/8	2-1/4	1-5/16	2-1/2	4	1/2	8
	1-1/2	290	1-1/2	3-1/4	7/8	2-1/4	1-29/32	3-1/4	4	1/2	17
	2	290	2	4	7/8	2-1/4	2-1/2	4	4	5/8	29
	3	290	3	5-1/4	7/8	2-1/4	3-3/4	5-1/4	4	5/8	45
	4	250	4	6-3/4	7/8	2-1/4	5	6-3/4	8	5/8	28
	6	170	6	8-5/8	7/8	2-1/4	7-1/8	8-5/8	8	3/4	50
	8	170	8	10-7/8	1-1/8	2-3/4	8-7/8	10-7/8	8	3/4	69
	10	150	10	13-1/4	1-1/2	3-3/8	11-5/8	13-1/4	12	7/8	54
	12	150	12	16	2	4-3/8	13-3/4	16	12	7/8	68
	14	150	13-1/4	17-5/8	2-1/4	4-7/8	14-1/2	17-5/8	12	1	99
	16	150	15-1/4	20-1/8	2-1/2	5-3/8	17	20-1/8	16	1	79
	18	75	17-1/4	21-1/2	2-3/4	5-7/8	19-1/2	21-1/2	16	1-1/8	101
	20	75	19-1/4	23-3/4	3	6-3/8	21-3/4	23-3/4	20	1-1/8	81
	24	75	23-1/4	28-1/8	3	6-3/8	25	28-1/8	20	1-1/4	143
300	1/2	750	1/2	2	5/8	1-3/4	3/4	2	4	1/2	10
	3/4	750	3/4	2-1/2	5/8	1-3/4	1	2-1/2	4	5/8	18
	1	750	1	2-3/4	1	2-1/2	1-5/16	2-3/4	4	5/8	22
	1-1/2	750	1-1/2	3-5/8	1	2-1/2	1-29/32	3-5/8	4	3/4	55
	2	400	2	4-1/4	1	2-1/2	2-1/2	4-1/4	8	5/8	22
	3	400	3	5-3/4	1-1/4	3	3-3/4	5-3/4	8	3/4	44
	4	400	4	7	1-1/4	3	5	7	8	3/4	59
	6	350	6	9-3/4	1-3/4	4	7-1/8	9-3/4	12	3/4	59
8	300	8	12	2-1/4	5	9	12	12	7/8	99	
400 & 600	1/2	1000	1/2	2	5/8	1-3/4	3/4	2	4	1/2	13
	3/4	1000	3/4	2-1/2	5/8	1-3/4	1	2-1/2	4	5/8	23
	1	1000	1	2-3/4	1	2-1/2	1-5/16	2-3/4	4	5/8	30
	1-1/2	1000	1-1/2	3-5/8	1	2-1/2	1-29/32	3-5/8	4	3/4	73
	2	500	2	4-1/4	1	2-1/2	2-1/2	4-1/4	8	5/8	22
	3	500	3	5-3/4	1-1/4	3	3-3/4	5-3/4	8	3/4	44

\* For each flange class shown, Max Disk Burst Rating is either the maximum rating of the flange depending on material and temperature, or the lower disk burst rating imposed by Zook.

\*\* Thickness of Insulated Disk includes all gaskets.

\*\*\* Actual field conditions may differ from room temperature nitrogen test conditions on which these torque values are based. Tests utilized ANSI weldneck

flanges. Washered bolts with free running threads (and 25,000 psi allowable stress) were lubricated with a graphite and oil mixture. Non-asbestos 1/8" thick gaskets (sized to dimensions shown above) were rated for seating stress (y) at 4400 psi, for gasket factor (m) at 5.2, and were re-torqued as necessary to nullify torque loss caused by compression set. ASME Sec. VIII Div. 1 was followed for estimating required seating and operating bolt loads.

## Gasket Service

For your convenience, we stock pre-cut gaskets in the materials shown. On order, we will attach gaskets of your choice directly to your disks to help simplify installation. If you cut your own gaskets, follow the dimensions shown in the table. The I.D. allows clearance for proper burst. The O.D. helps to center the disk in the flange.

material	thickness (in)	temp limit (F)
Neoprene	1/8	250
PTFE Teflon*	1/8	450
Non-asbestos	1/8	700
Teflon envelope		
Neoprene filler	3/16	250
Non-asbestos filler	3/16	450

\*Teflon is a registered trademark of E. I. duPont

**DIFFERENTIAL PRESSURE TRANSMITTER  
EJA110A installed in control board****Item LT62005 for 1800MT LOX TANK****Item LT72005 for 1000MT LIN TANK****SUPPLIER :**

**YOKOGAWA**  
Velizy, Valley  
18 rue Grange Dame Rose  
BP 267  
78147 VELIZY Cedex  
FRANCE  
Mr F. GERBER  
Tel: 03 44 08 92 49  
Fax: 01 39 26 10 65

---

**User's  
Manual**

***DP*harp**

**Model EJA110A, EJA120A and  
EJA130A  
Differential Pressure Transmitters**

IM 01C21B01-01E

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# CONTENTS

<b>1. INTRODUCTION</b>	<b>1-1</b>
Regarding This Manual	1-1
1.1 For Safe Use of Product	1-2
1.2 Warranty	1-2
<b>2. HANDLING CAUTIONS</b>	<b>2-1</b>
2.1 Model and Specifications Check	2-1
2.2 Unpacking	2-1
2.3 Storage	2-1
2.4 Selecting the Installation Location	2-2
2.5 Pressure Connection	2-2
2.6 Waterproofing of Cable Conduit Connections	2-2
2.7 Restrictions on Use of Radio Transceiver	2-2
2.8 Insulation Resistance and Dielectric Strength Test	2-2
2.9 Installation of Explosion Protected Type	2-3
2.9.1 FM Approval	2-3
2.9.2 CSA Certification	2-5
2.9.3 SAA Certification	2-6
2.9.4 CENELEC ATEX (KEMA) Certification	2-7
2.10 EMC Conformity Standards	2-10
2.11 PED (Pressure Equipment Directive)	2-10
<b>3. COMPONENT NAMES</b>	<b>3-1</b>
<b>4. INSTALLATION</b>	<b>4-1</b>
4.1 Precautions	4-1
4.2 Mounting	4-1
4.3 Changing the Process Connection	4-2
4.4 Swapping the High/Low-pressure Side Connection	4-3
4.4.1 Rotating Pressure-detector Section 180°	4-3
4.4.2 Using the BRAIN TERMINAL BT200	4-3
4.5 Rotating Transmitter Section	4-4
<b>5. INSTALLING IMPULSE PIPING</b>	<b>5-1</b>
5.1 Impulse Piping Installation Precautions	5-1
5.1.1 Connecting Impulse Piping to the Transmitter	5-1
5.1.2 Routing the Impulse Piping	5-2
5.2 Impulse Piping Connection Examples	5-4
<b>6. WIRING</b>	<b>6-1</b>
6.1 Wiring Precautions	6-1
6.2 Selecting the Wiring Materials	6-1
6.3 Connections of External Wiring to Terminal Box	6-1
6.3.1 Power Supply Wiring Connection	6-1
6.3.2 External Indicator Connection	6-1
6.3.3 BRAIN TERMINAL BT200 Connection	6-1
6.3.4 Check Meter Connection	6-2

6.4	Wiring .....	6-2
6.4.1	Loop Configuration .....	6-2
(1)	General-use Type and Flameproof Type .....	6-2
(2)	Intrinsically Safe Type .....	6-2
6.4.2	Wiring Installation .....	6-2
(1)	General-use Type and Intrinsically Safe Type .....	6-2
(2)	Flameproof Type .....	6-3
6.5	Grounding .....	6-3
6.6	Power Supply Voltage and Load Resistance .....	6-3
<b>7.</b>	<b>OPERATION .....</b>	<b>7-1</b>
7.1	Preparation for Starting Operation .....	7-1
7.2	Zero Point Adjustment .....	7-2
7.3	Starting Operation .....	7-3
7.4	Shutting Down Operation .....	7-3
7.5	Venting or Draining Transmitter Pressure-detector Section .....	7-4
7.5.1	Draining Condensate .....	7-4
7.5.2	Venting Gas .....	7-4
7.6	Setting the Range Using the Range-setting Switch .....	7-4
<b>8.</b>	<b>BRAIN TERMINAL BT200 OPERATION .....</b>	<b>8-1</b>
8.1	BT200 Operation Precautions .....	8-1
8.1.1	Connecting the BT200 .....	8-1
8.1.2	Conditions of Communication Line .....	8-1
8.2	BT200 Operating Procedures .....	8-1
8.2.1	Key Layout and Screen Display .....	8-1
8.2.2	Operating Key Functions .....	8-2
(1)	Alphanumeric Keys and Shift Keys .....	8-2
(2)	Function Keys .....	8-2
8.2.3	Calling Up Menu Addresses Using the Operating Keys .....	8-3
8.3	Setting Parameters Using the BT200 .....	8-4
8.3.1	Parameter Summary .....	8-4
8.3.2	Parameter Usage and Selection .....	8-6
8.3.3	Setting Parameters .....	8-7
(1)	Tag No. Setup .....	8-7
(2)	Calibration Range Setup .....	8-7
(3)	Damping Time Constant Setup .....	8-8
(4)	Output Mode and Integral Indicator Display Mode Setup .....	8-9
(5)	Output Signal Low Cut Mode Setup .....	8-9
(6)	Integral Indicator Scale Setup .....	8-10
(7)	Unit Setup for Displayed Temperature .....	8-11
(8)	Unit Setup for Displayed Static Pressure .....	8-12
(9)	Operation Mode Setup .....	8-12
(10)	Impulse Line Connection Orientation Setup .....	8-12
(11)	Output Status Display/Setup when a CPU Failure .....	8-12
(12)	Output Status Setup when a Hardware Error Occurs .....	8-12
(13)	Bi-directional Flow Measurement Setup .....	8-13
(14)	Range Change while Applying Actual Inputs .....	8-13
(15)	Zero Point Adjustment .....	8-14
(16)	Test Output Setup .....	8-15
(17)	User Memo Fields .....	8-15

8.4	Displaying Data Using the BT200 .....	8-16
8.4.1	Displaying Measured Data .....	8-16
8.4.2	Display Transmitter Model and Specifications .....	8-16
8.5	Self-Diagnostics .....	8-16
8.5.1	Checking for Problems .....	8-16
(1)	Identifying Problems with BT200 .....	8-16
(2)	Checking with Integral Indicator .....	8-17
8.5.2	Errors and Countermeasures .....	8-18
<b>9.</b>	<b>MAINTENANCE .....</b>	<b>9-1</b>
9.1	Overview .....	9-1
9.2	Calibration Instruments Selection .....	9-1
9.3	Calibration .....	9-1
9.4	Disassembly and Reassembly .....	9-3
9.4.1	Replacing the Integral Indicator .....	9-3
9.4.2	Replacing the CPU Board Assembly .....	9-4
9.4.3	Cleaning and Replacing the Capsule Assembly .....	9-4
9.4.4	Replacing the Process Connector Gaskets .....	9-5
9.5	Troubleshooting .....	9-6
9.5.1	Basic Troubleshooting .....	9-6
9.5.2	Troubleshooting Flow Charts .....	9-6
<b>10.</b>	<b>GENERAL SPECIFICATIONS .....</b>	<b>10-1</b>
10.1	Standard Specifications .....	10-1
10.2	Model and Suffix Codes .....	10-3
10.3	Optional Specifications .....	10-6
10.4	Dimensions .....	10-8

### Customer Maintenance Parts List

DPharp EJA Series Transmitter Section .....	CMPL 01C21A01-02E
Model EJA110A, EJA120A and EJA130A	
Differential Pressure Transmitter .....	CMPL 01C21B00-01E

### REVISION RECORD

# 1. INTRODUCTION

Thank you for purchasing the DPharp electronic pressure transmitter.

The DPharp Pressure Transmitters are precisely calibrated at the factory before shipment. To ensure correct and efficient use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

## ■ Regarding This Manual

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instruments.
- Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.



## NOTE

For FOUNDATION Fieldbus and HART protocol versions, please refer to IM 01C22T02-01E and IM 01C22T01-01E respectively, in addition to this manual.

- The following safety symbol marks are used in this manual:



## WARNING

Indicates a potentially hazardous situation which, if not avoided, *could* result in death or serious injury.



## CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against *unsafe practices*.



## IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.



## NOTE

Draws attention to information essential for understanding the operation and features.

## 1.1 For Safe Use of Product

For the protection and safety of the operator and the instrument or the system including the instrument, please be sure to follow the instructions on safety described in this manual when handling this instrument. In case the instrument is handled in contradiction to these instructions, Yokogawa does not guarantee safety. Please give your attention to the followings.

### (a) Installation

- The instrument must be installed by an expert engineer or a skilled personnel. The procedures described about INSTALLATION are not permitted for operators.
- In case of high process temperature, care should be taken not to burn yourself because the surface of body and case reaches a high temperature.
- The instrument installed in the process is under pressure. Never loosen the process connector bolts to avoid the dangerous spouting of process fluid.
- During draining condensate from the pressure-detector section, take appropriate care to avoid contact with the skin, eyes or body, or inhalation of vapors, if the accumulated process fluid may be toxic or otherwise harmful.
- When removing the instrument from hazardous processes, avoid contact with the fluid and the interior of the meter.
- All installation shall comply with local installation requirement and local electrical code.

### (b) Wiring

- The instrument must be installed by an expert engineer or a skilled personnel. The procedures described about WIRING are not permitted for operators.
- Please confirm that voltages between the power supply and the instrument before connecting the power cables and that the cables are not powered before connecting.

### (c) Operation

- Wait 10 min. after power is turned off, before opening the covers.

### (d) Maintenance

- Please do not carry out except being written to a maintenance descriptions. When these procedures are needed, please contact nearest YOKOGAWA office.

- Care should be taken to prevent the build up of drift, dust or other material on the display glass and name plate. In case of its maintenance, soft and dry cloth is used.

## 1.2 Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurred during the warranty period shall basically be repaired free of charge.
- In case of problems, the customer should contact the Yokogawa representative from which the instrument was purchased, or the nearest Yokogawa office.
- If a problem arises with this instrument, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- Responsible party for repair cost for the problems shall be determined by Yokogawa based on our investigation.
- The Purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
  - Improper and/or inadequate maintenance by the purchaser.
  - Failure or damage due to improper handling, use or storage which is out of design conditions.
  - Use of the product in question in a location not conforming to the standards specified by Yokogawa, or due to improper maintenance of the installation location.
  - Failure or damage due to modification or repair by any party except Yokogawa or an approved representative of Yokogawa.
  - Malfunction or damage from improper relocation of the product in question after delivery.
  - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

### 1.3 ATEX Documentation

This procedure is only applicable to the countries in European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöohjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellänne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

## 2. HANDLING CAUTIONS

This chapter describes important cautions regarding how to handle the transmitter. Read carefully before using the transmitter.

The EJA-A Series pressure transmitters are thoroughly tested at the factory before shipment. When the transmitter is delivered, visually check them to make sure that no damage occurred during shipment.

Also check that all transmitter mounting hardware shown in Figure 2.1 is included. If the transmitter was ordered without the mounting bracket or without the process connector, the transmitter mounting hardware is not included. After checking the transmitter, repack it in the way it was delivered until installation.

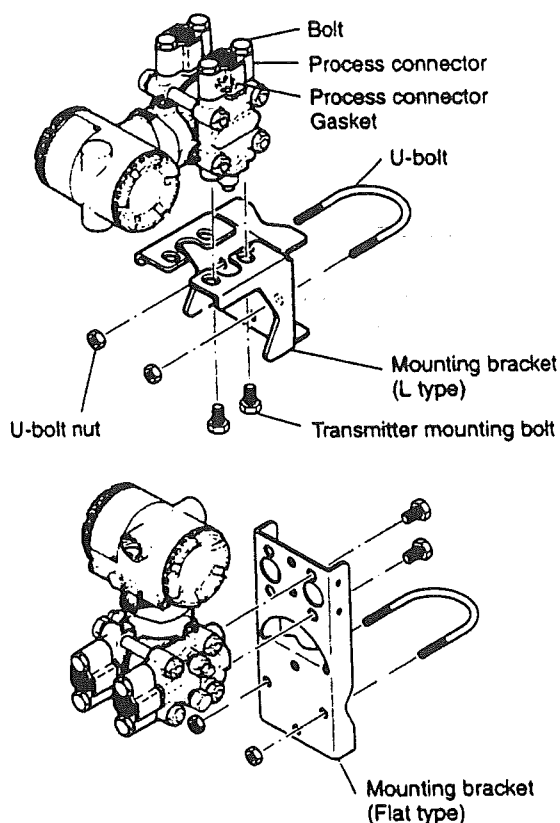


Figure 2.1 Transmitter Mounting Hardware

### 2.1 Model and Specifications Check

The model name and specifications are indicated on the name plate attached to the case. If the *reverse* operating mode was ordered (reverse signal), 'REVERSE' will be inscribed in field \*1; if *square root* display

mode was ordered, 'SQRT' is inscribed in field \*2; if *square root* output mode was ordered, 'SQRT' is inscribed in field \*3.

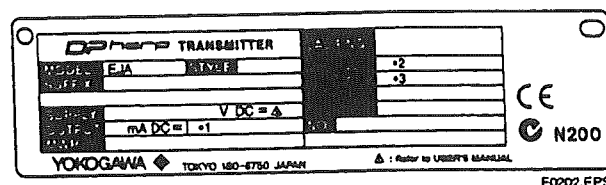


Figure 2.2 Name Plate

### 2.2 Unpacking

When moving the transmitter to the installation site, keep it in its original packaging. Then, unpack the transmitter there to avoid damage on the way.

### 2.3 Storage

The following precautions must be observed when storing the instrument, especially for a long period.

(a) Select a storage area which meets the following conditions:

- It is not exposed to rain or water.
- It suffers minimum vibration and shock.
- It has an ambient temperature and relative humidity within the following ranges.

Ambient temperature:

- 40 to 85°C without integral indicator
- 30 to 80°C with integral indicator

Relative humidity:

- 5% to 100% R.H. (at 40°C)

Preferred temperature and humidity:

- approx. 25°C and 65% R.H.

- (b) When storing the transmitter, repack it as nearly as possible to the way it was packed when delivered from the factory.
- (c) If storing a transmitter that has been used, thoroughly clean the chambers inside the cover flanges, so that no measured fluid remains in it. Also make sure before storing that the pressure-detector and transmitter section are securely mounted.

## 2.4 Selecting the Installation Location

The transmitter is designed to withstand severe environmental conditions. However, to ensure stable and accurate operation for years, observe the following precautions when selecting an installation location.

### (a) Ambient Temperature

Avoid locations subject to wide temperature variations or a significant temperature gradient. If the location is exposed to radiant heat from plant equipments, provide adequate thermal insulation and/or ventilation.

### (b) Ambient Atmosphere

Avoid installing the transmitter in a corrosive atmosphere. If the transmitter must be installed in a corrosive atmosphere, there must be adequate ventilation as well as measures to prevent intrusion or stagnation of rain water in conduits.

### (c) Shock and Vibration

Select an installation site suffering minimum shock and vibration (although the transmitter is designed to be relatively resistant to shock and vibration).

### (d) Installation of Explosion-protected Transmitters

Explosion-protected transmitters can be installed in hazardous areas according to the types of gases for which they are certified. See Subsection 2.9

"Installation of Explosion Protected Type Transmitters."

## 2.5 Pressure Connection



### WARNING

- Instrument installed in the process is under pressure. Never loosen the process connector bolts to avoid the dangerous spouting of process fluid.
- During draining condensate from the pressure-detector section, take appropriate care to avoid contact with the skin, eyes or body, or inhalation of vapors, if the accumulated process fluid may be toxic or otherwise harmful.

The following precautions must be observed in order to safely operate the transmitter under pressure.

- Make sure that the four process connector bolts are tightened firmly.
- Make sure that there are no leaks in the impulse piping.
- Never apply a pressure higher than the specified maximum working pressure.



### CAUTION

Maximum working pressure of the model EJA120A differential pressure transmitter is 50 kPa {0.5 kgf/cm<sup>2</sup>}.

Should the pressure exceed 50 kPa {0.5 kgf/cm<sup>2</sup>}, it is possible to break the sensor. Proceed with caution when applying pressure.

## 2.6 Waterproofing of Cable Conduit Connections

Apply a non-hardening sealant to the threads to waterproof the transmitter cable conduit connections. (See Figure 6.4.2a, 6.4.2b and 6.4.2c.)

## 2.7 Restrictions on Use of Radio Transceiver



### IMPORTANT

Although the transmitter has been designed to resist high frequency electrical noise, if a radio transceiver is used near the transmitter or its external wiring, the transmitter may be affected by high frequency noise pickup. To test for such effects, bring the transceiver in use slowly from a distance of several meters from the transmitter, and observe the measurement loop for noise effects. Thereafter, always use the transceiver outside the area affected by noise.

## 2.8 Insulation Resistance and Dielectric Strength Test

Since the transmitter has undergone insulation resistance and dielectric strength tests at the factory before shipment, normally these tests are not required. However, if required, observe the following precautions in the test procedures.

- Do not perform such tests more frequently than is absolutely necessary. Even test voltages that do not cause visible damage to the insulation may degrade the insulation and reduce safety margins.
- Never apply a voltage exceeding 500 V DC (100 V DC with an internal lightning protector) for the insulation resistance test, nor a voltage exceeding 500 V AC (100 V AC with an internal lightning protector) for the dielectric strength test.



- (c) Before conducting these tests, disconnect all signal lines from the transmitter terminals. Perform the tests in the following procedure:

#### • Insulation Resistance Test

- 1) Short-circuit the + and – SUPPLY terminals in the terminal box.
- 2) Turn OFF the insulation tester. Then connect the insulation tester plus (+) lead wire to the shorted SUPPLY terminals and the minus (–) leadwire to the grounding terminal.
- 3) Turn ON the insulation tester power and measure the insulation resistance. The voltage should be applied short as possible to verify that the insulation resistance is at least 20 MΩ.
- 4) After completing the test and being very careful not to touch exposed conductors disconnect the insulation tester and connect a 100 kΩ resistor between the grounding terminal and the short-circuiting SUPPLY terminals. Leave this resistor connected at least one second to discharge any static potential. Do not touch the terminals while it is discharging.

#### • Dielectric Strength Test

- 1) Short-circuit the + and – SUPPLY terminals in the terminal box.
- 2) Turn OFF the dielectric strength tester. Then connect the tester between the shorted SUPPLY terminals and the grounding terminal. Be sure to connect the grounding lead of the dielectric strength tester to the ground terminal.
- 3) Set the current limit on the dielectric strength tester to 10 mA, then turn ON the power and gradually increase the test voltage from '0' to the specified voltage.
- 4) When the specified voltage is reached, hold it for one minute.
- 5) After completing this test, slowly decrease the voltage to avoid any voltage surges.

## 2.9 Installation of Explosion Protected Type

In this section, further requirements and differences and for explosionproof type instrument are described. For explosionproof type instrument, the description in this chapter is prior to other description in this users manual.

For the intrinsically safe equipment and explosionproof equipment, in case the instrument is not restored to its original condition after any repair or modification undertaken by the customer, intrinsically safe construction or explosionproof construction is damaged

and may cause dangerous condition. Please contact Yokogawa for any repair or modification required to the instrument.



#### NOTE

For FOUNDATION Fieldbus explosion protected type, please refer to IM 01C22T02-01E.



#### CAUTION

This instrument is tested and certified as intrinsically safe type or explosionproof type. Please note that the construction of the instrument, installation, external wiring, maintenance or repair is strictly restricted, and non-observance or negligence of this restriction would result in dangerous condition.



#### WARNING

To preserve the safety of explosionproof equipment requires great care during mounting, wiring, and piping. Safety requirements also place restrictions on maintenance and repair activities. Please read the following sections very carefully.

### 2.9.1 FM Approval

#### a. FM Intrinsically Safe Type

Caution for FM intrinsically safe type. (Following contents refer "DOC. No. IFM012-A12 P.1 and 2.")

Note 1. Model EJA Series pressure transmitters with optional code /FS1 are applicable for use in hazardous locations.

- Intrinsically Safe for Class I, Division 1, Groups A, B, C & D, Class II, Division 1, Groups E, F & G and Class III, Division 1 Hazardous Locations.
- Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division 2, Groups E, F & G and Class III, Division 1 Hazardous Locations.
- Outdoor hazardous locations, NEMA 4X.
- Temperature Class: T4
- Ambient temperature: –40 to 60°C

Note 2. Entity Parameters

- Intrinsically Safe Apparatus Parameters  
[Groups A, B, C, D, E, F and G]  
V<sub>max</sub> = 30 V      C<sub>i</sub> = 22.5 nF  
I<sub>max</sub> = 165 mA    L<sub>i</sub> = 730 μH  
P<sub>max</sub> = 0.9 W

\* Associated Apparatus Parameters  
(FM approved barriers)

$$\begin{aligned} V_{oc} &\leq 30 \text{ V} & C_a &> 22.5 \text{ nF} \\ I_{sc} &\leq 165 \text{ mA} & L_a &> 730 \text{ } \mu\text{H} \\ P_{max} &\leq 0.9 \text{ W} \end{aligned}$$

• Intrinsically Safe Apparatus Parameters  
[Groups C, D, E, F and G]

$$\begin{aligned} V_{max} &= 30 \text{ V} & C_i &= 22.5 \text{ nF} \\ I_{max} &= 225 \text{ mA} & L_i &= 730 \text{ } \mu\text{H} \\ P_{max} &= 0.9 \text{ W} \end{aligned}$$

\* Associated Apparatus Parameters  
(FM approved barriers)

$$\begin{aligned} V_{oc} &\leq 30 \text{ V} & C_a &> 22.5 \text{ nF} \\ I_{sc} &\leq 225 \text{ mA} & L_a &> 730 \text{ } \mu\text{H} \\ P_{max} &\leq 0.9 \text{ W} \end{aligned}$$

• Entity Installation Requirements

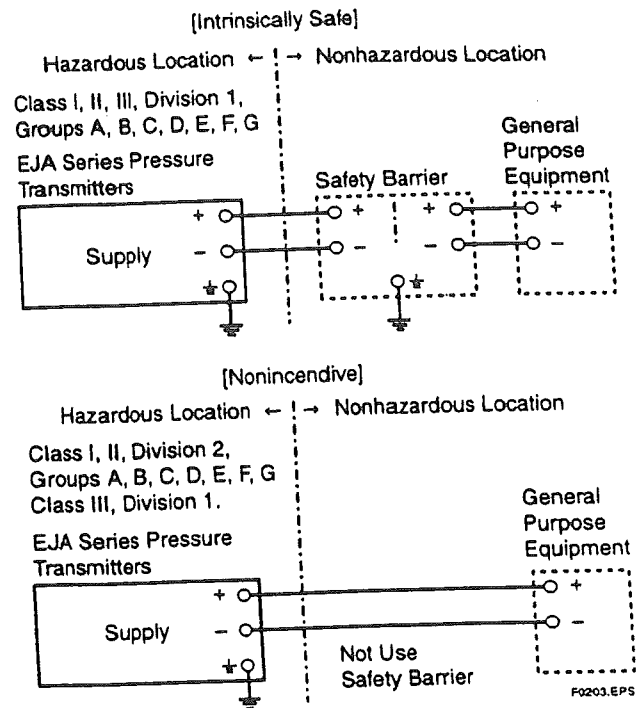
$$\begin{aligned} V_{max} &\geq V_{oc} \text{ or } V_t, I_{max} \geq I_{sc} \text{ or } I_t, \\ P_{max} \text{ (IS Apparatus)} &\geq P_{max} \text{ (Barrier)} \\ C_a &\geq C_i + C_{cable}, L_a \geq L_i + L_{cable} \end{aligned}$$

Note 3. Installation

- Barrier must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01.
- Control equipment connected to barrier must not use or generate more than 250 V rms or V dc.
- Installation should be in accordance with ANSI/ISA RP12.6 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electric Code (ANSI/NFPA 70).
- The configuration of associated apparatus must be FMRC Approved.
- Dust-tight conduit seal must be used when installed in a Class II, III, Group E, F and G environments.
- Associated apparatus manufacturer's installation drawing must be followed when installing this apparatus.
- The maximum power delivered from the barrier must not exceed 0.9 W.
- Note a warning label worded "SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY," and "INSTALL IN ACCORDANCE WITH DOC. No. IFM012-A12 P.1 and 2."

Note 4. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Factory Mutual Intrinsically safe and Nonincendive Approval.



b. FM Explosionproof Type

Caution for FM explosionproof type.

Note 1. Model EJA Series differential, gauge, and absolute pressure transmitters with optional code /FF1 are applicable for use in hazardous locations.

- Explosionproof for Class I, Division 1, Groups B, C and D.
- Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G.
- Outdoor hazardous locations, NEMA 4X.
- Temperature Class: T6
- Ambient Temperature: -40 to 60°C
- Supply Voltage: 42 V dc max.
- Output signal: 4 to 20 mA

Note 2. Wiring

- All wiring shall comply with National Electrical Code ANSI/NEPA70 and Local Electrical Codes.
- When installed in Division 1, "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED."

Note 3. Operation

- Keep the "CAUTION" nameplate attached to the transmitter.  
**CAUTION: OPEN CIRCUIT BEFORE REMOVING COVER. FACTORY SEALED, CONDUIT SEAL NOT REQUIRED. INSTALL IN ACCORDANCE WITH THE INSTRUCTION MANUAL IM 1C22.**
- Take care not to generate mechanical sparking when accessing to the instrument and peripheral devices in a hazardous location.

**Note 4. Maintenance and Repair**

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Factory Mutual Explosionproof Approval.

**c. FM Intrinsically Safe Type/FM Explosionproof Type**

Model EJA Series pressure transmitters with optional code /FU1 can be selected the type of protection (FM Intrinsically Safe or FM Explosionproof) for use in hazardous locations.

**Note 1.** For the installation of this transmitter, once a particular type of protection is selected, any other type of protection cannot be used. The installation must be in accordance with the description about the type of protection in this instruction manual.

**Note 2.** In order to avoid confusion, unnecessary marking is crossed out on the label other than the selected type of protection when the transmitter is installed.

**2.9.2 CSA Certification****a. CSA Intrinsically Safe Type**

Caution for CSA Intrinsically safe type. (Following contents refer to "DOC No. ICS003-A12 P.1-1 and P.1-2.")

**Note 1.** Model EJA Series differential, gauge, and absolute pressure transmitters with optional code /CS1 are applicable for use in hazardous locations

- Intrinsically Safe for Class I, Division 1, Groups A, B, C & D. Class II, Division 1, Groups E, F & G and Class III, Division 1 Hazardous Locations.
- Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division 2, Groups F & G, and Class III, Hazardous Locations. (not use Safety Barrier)
- Encl. "Type 4X"
- Temperature Class: T4
- Ambient temperature: -40 to 60°C
- Process Temperature: 120°C max.

**Note 2. Entity Parameters**

- Intrinsically safe ratings are as follows:

Maximum Input Voltage ( $V_{max}$ ) = 30 V

Maximum Input Current ( $I_{max}$ ) = 165 mA

Maximum Input Power ( $P_{max}$ ) = 0.9 W

Maximum Internal Capacitance ( $C_i$ ) = 22.5 nF

Maximum Internal Inductance ( $L_i$ ) = 730  $\mu$ H

- \* Associated apparatus (CSA certified barriers)

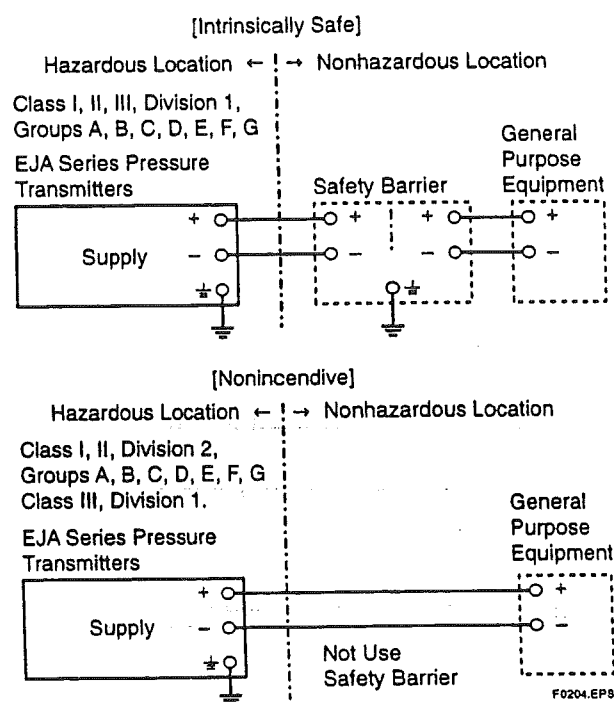
Maximum output voltage ( $V_{oc}$ )  $\leq$  30 V

Maximum output current ( $I_{sc}$ )  $\leq$  165 mA

Maximum output power ( $P_{max}$ )  $\leq$  0.9 W

**Note 3. Installation**

- All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation and Yokogawa Corporation of America is prohibited and will void Canadian Standards Intrinsically safe and nonincendive Certification.

**b. CSA Explosionproof Type**

Caution for CSA explosionproof type.

**Note 1.** Model EJA Series differential, gauge, and absolute pressure transmitters with optional code /CF1 are applicable for use in hazardous locations:

- Explosionproof for Class I, Division 1, Groups B, C and D.
- Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G.
- Encl "Type 4X"
- Temperature Class: T6, T5, and T4
- Process Temperature: 85°C (T6), 100°C (T5), and 120°C (T4)
- Ambient Temperature: -40 to 80°C
- Supply Voltage: 42 V dc max.
- Output Signal: 4 to 20 mA

**Note 2. Wiring**

- All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
- In hazardous location, wiring shall be in conduit as shown in the figure.

**CAUTION: SEAL ALL CONDUITS  
WITHIN 50 cm OF THE ENCLOSURE.  
UN SCELEMENT DOIT ÊTRE  
INSTALLÉ À MOINS DE 50 cm DU  
BÂTIER.**

- When installed in Division 2, "SEALS NOT REQUIRED."

**Note 3. Operation**

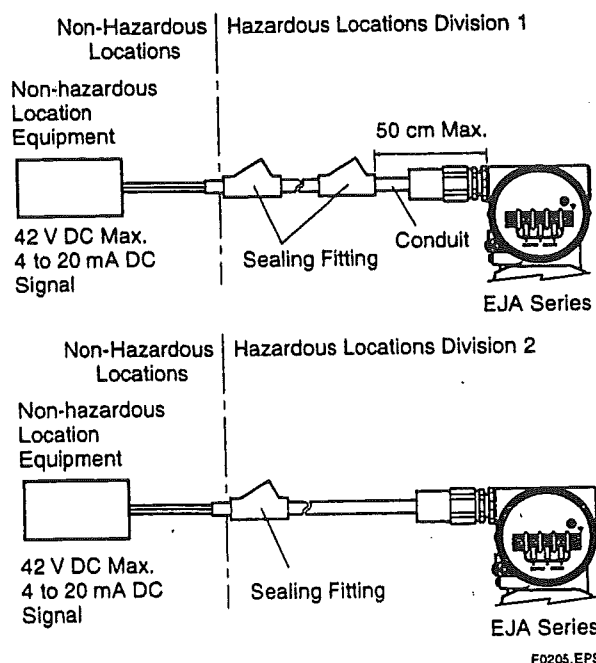
- Keep the "CAUTION" label attached to the transmitter.

**CAUTION: OPEN CIRCUIT BEFORE  
REMOVING COVER.  
OUVRIR LE CIRCUIT AVANT  
D'NLEVER LE COUVERCLE.**

- Take care not to generate mechanical sparking when accessing to the instrument and peripheral devices in a hazardous location.

**Note 4. Maintenance and Repair**

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation and Yokogawa Corporation of America is prohibited and will void Canadian Standards Explosionproof Certification.

**c. CSA Intrinsically Safe Type/CSA Explosionproof Type**

Model EJA Series pressure transmitters with optional code /CU1 can be selected the type of protection (CSA Intrinsically Safe or CSA Explosionproof) for use in hazardous locations.

**Note 1.** For the installation of this transmitter, once a particular type of protection is selected, any other type of protection cannot be used. The installation must be in accordance with the description about the type of protection in this instruction manual.

**Note 2.** In order to avoid confusion, unnecessary marking is crossed out on the label other than the selected type of protection when the transmitter is installed.

**2.9.3 SAA Certification****a. SAA Intrinsically Safe Type**

Caution for SAA Intrinsically safe type and Type n.

**Note 1.** Model EJA Series differential, gauge, and absolute pressure transmitters with optional code /SU1 are applicable for use in hazardous locations.

- Type of Protection and Marking Code:  
Ex ia IIC T4 ( $T_{amb} = 60^{\circ}\text{C}$ ) IP67 Class I Zone 0  
Ex ia I IP67 Class I Zone 0  
Ex n IIC T4 ( $T_{amb} = 60^{\circ}\text{C}$ ) IP67 Class I Zone 2
- Ambient Temperature:  $-40$  to  $60^{\circ}\text{C}$

**Note 2. Entity Parameters**

- Intrinsically safe rating of the transmitters are as follows.

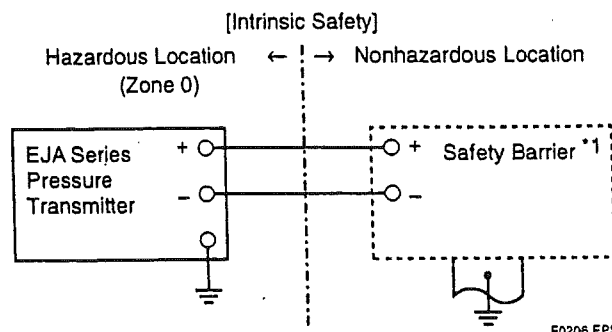
Maximum Input Voltage ( $U_i$ ) = 30 V  
Maximum Input Current ( $I_i$ ) = 165 mA  
Maximum Input Power ( $P_i$ ) = 0.9 W  
Maximum Internal Capacitance ( $C_i$ ) = 0.02  $\mu\text{F}$   
Maximum Internal Inductance ( $L_i$ ) = 0.73 mH

**Note 3. Wiring**

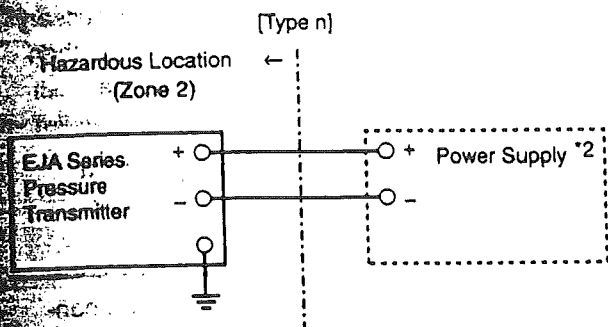
- All Wiring shall comply with the Australian Standard.

**Note 4. Maintenance and Repair**

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Standards Association of Australia Intrinsically safe and Type n Certification.



\*1: Any safety barriers used for the output current must be limited by a resistor "R" such that  $I_{maxout} \leq U_z/R$ .



\*2: The voltage of the power supply is not exceed 30V dc.

### 6. SAA Flameproof Type

Caution for SAA flameproof type.

**Note 1.** Model EJA Series differential, gauge, and absolute pressure transmitters with optional code /SU1 are applicable for use in hazardous locations:

Type of Protection and marking Code:

Ex d IIC T\* IP67 Class I Zone 1 (T\* see schedule)

Temperature Class: T6, T5, and T4

Process Temperature:

150°C (T6), 100°C (T5), and 120°C (T4)

Supply voltage: 42 V dc max.

Output Signal: 4 to 20 mA

Ambient Temperature: -40 to 80°C

### 7. Wiring

All wiring shall comply with the Australian Standard.

### 8. Operation

Keep the "CAUTION" label attached to the transmitter.

**CAUTION: AMBIENT TEMPERATURE ABOVE 75 DEG C SELECT SUITABLE CABLE. DISCONNECT POWER AND WAIT 1 MINUTE BEFORE REMAKING COVER**

Do not generate mechanical sparking when accessing to the instrument and peripheral devices in a hazardous location.

### 9. Maintenance and Repair

The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void KEMA Intrinsically safe Certification.

### 10. CENELEC ATEX (KEMA) Certification

#### Electrical Data

#### CENELEC ATEX (KEMA) Intrinsically Safe

Model for CENELEC ATEX (KEMA) Intrinsically safe type.

**Note 1.** Model EJA Series differential, gauge, and absolute pressure transmitters with optional code /KS2 for potentially explosive atmospheres:

- No. KEMA 02ATEX1030 X
- Type of Protection and Marking code: EEx ia IIC T4
- Temperature Class: T4
- Enclosure: IP67
- Process Temperature: 120°C max.
- Ambient Temperature: -40 to 60°C

### Note 2. Electrical Data

- In type of explosion protection intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit with following maximum values:

$U_i = 30 \text{ V}$

$I_i = 165 \text{ mA}$

$P_i = 0.9 \text{ W}$

Effective internal capacitance;  $C_i = 22.5 \text{ nF}$

Effective internal inductance;  $L_i = 730 \text{ μH}$

### Note 3. Installation

- All wiring shall comply with local installation requirements. (Refer to the installation diagram)

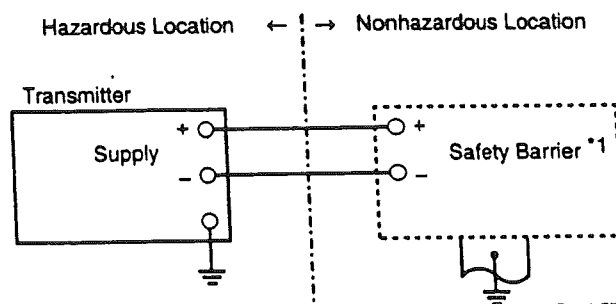
### Note 4. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void KEMA Intrinsically safe Certification.

### Note 5. Special Conditions for Safe Use

- In the case where the enclosure of the Pressure Transmitter is made of aluminium, if it is mounted in an area where the use of category 1 G apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

[Installation Diagram]



\*1: In any safety barriers used the output current must be limited by a resistor "R" such that  $I_{maxout} \leq U_z/R$ .

**b. CENELEC ATEX (KEMA) Flameproof Type**

Caution for CENELEC ATEX (KEMA) flameproof type.

Note 1. Model EJA Series differential, gauge, and absolute pressure transmitters with optional code /KF2 for potentially explosive atmospheres:

- No. KEMA 02ATEX2148
- Type of Protection and Marking Code: EEx d IIC T6...T4
- Temperature Class: T6, T5, and T4
- Enclosure: IP67
- Maximum Process Temperature: 85°C (T6), 100°C (T5), and 120°C (T4)
- Ambient Temperature: T4 and T6; -40 to 75°C, T5; -40 to 80°C

**Note 2. Electrical Data**

- Supply voltage: 42 V dc max.
- Output signal: 4 to 20 mA

**Note 3. Installation**

- All wiring shall comply with local installation requirement.
- The cable entry devices shall be of a certified flameproof type, suitable for the conditions of use.

**Note 4. Operation**

- Keep the "CAUTION" label to the transmitter.  
CAUTION: AFTER DE-ENERGIZING, DELAY 10 MINUTES BEFORE OPENING. WHEN THE AMBIENT TEMP.  $\geq 70^{\circ}\text{C}$ , USE HEAT-RESISTING CABLES  $\geq 90^{\circ}\text{C}$ .

- Take care not to generate mechanical sparking when accessing to the instrument and peripheral devices in a hazardous location.

**Note 5. Maintenance and Repair**

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void KEMA Flameproof Certification.

**c. CENELEC ATEX (KEMA) Intrinsically Safe Type/CENELEC ATEX (KEMA) Flameproof Type/CENELEC ATEX Type n**

Model EJA-A Series pressure transmitters with optional code /KU2 can be selected the type of protection CENELEC ATEX (KEMA) Intrinsically Safe, Flameproof or CENELEC ATEX Type n for use in hazardous locations.

Note 1. For the installation of this transmitter, once a particular type of protection is selected, any other type of protection cannot be used. The installation must be in accordance with the description about the type of protection in this user's manual.

Note 2. In order to avoid confusion, unnecessary marking is crossed out on the label other than the selected type of protection when the transmitter is installed.

**● CENELEC ATEX Type of Protection "n"****WARNING**

When using a power supply not having a non-incendive circuit, please pay attention not to ignite in the surrounding flammable atmosphere. In such a case, we recommend using wiring metal conduit in order to prevent the ignition.

- Type of Protection and Marking Code: EEx nL IIC T4
- Temperature Class: T4
- Enclosure: IP67
- Process Temperature: 120°C max.
- Ambient Temperature: -40 to 60°C

**Note 1. Electrical Data**

$U_i = 30 \text{ V}$

Effective internal capacitance;  $C_i = 22.5 \text{ nF}$

Effective internal inductance;  $L_i = 730 \text{ } \mu\text{H}$

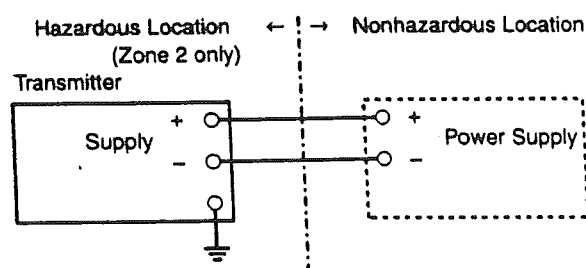
**Note 2. Installation**

- All wiring shall comply with local installation requirements. (refer to the installation diagram)

**Note 3. Maintenance and Repair**

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Type of Protection "n".

[Installation Diagram]



F0209.EPS

Ratings of the Power Supply as follows;  
Maximum Voltage: 30 V

**● CENELEC ATEX Type of Protection "Dust"**

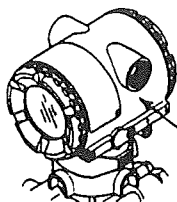
- Type of Protection and Marking Code: II 1D
- Maximum Surface Temperature: T65°C (Tamb.: 40°C), T85°C (Tamb.: 60°C), and T105°C (Tamb.: 80°C)

**(2) Electrical Connection**

The type of electrical connection is stamped near the electrical connection port according to the following marking.

Screw Size	Marking
ISO M20×1.5 female	△ M
ANSI 1/2 NPT female	△ A

T0201.EPS



Location of the marking

F0200.EPS

**(3) Installation****WARNING**

- All wiring shall comply with local installation requirement and local electrical code.
- There is no need of the conduit seal for both of Division 1 and Division 2 hazardous locations because this product is sealed at factory.

**(4) Operation****WARNING**

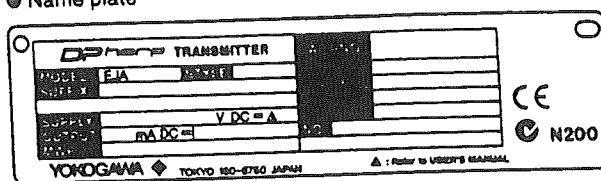
- OPEN CIRCUIT BEFORE REMOVING COVER. INSTALL IN ACCORDANCE WITH THIS USER'S MANUAL
- Take care not to generate mechanical sparking when access to the instrument and peripheral devices in hazardous locations.

**(5) Maintenance and Repair****WARNING**

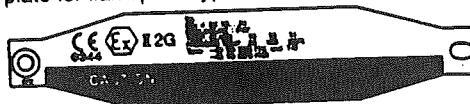
The instrument modification or parts replacement by other than authorized Representative of Yokogawa Electric Corporation is prohibited and will void the certification.

**(6) Name Plate**

## ● Name plate



## ● Tag plate for flameproof type



## ● Tag plate for intrinsically safe type



## ● Tag plate for type n protection



## ● Tag plate for flameproof, intrinsically safe type, type n protection, and Dust



F0298.EPS

MODEL: Specified model code.

STYLE: Style code.

SUFFIX: Specified suffix code.

SUPPLY: Supply voltage.

OUTPUT: Output signal.

MWP: Maximum working pressure.

CAL RNG: Specified calibration range.

DISP MODE: Specified display mode.

OUTPUT MODE: Specified output mode.

NO.: Serial number and year of production\*1.

YOKOGAWA ♦ TOKYO 180-8750 JAPAN:

The manufacturer name and the address\*2.

\*1: The third figure from the last shows the last one figure of the year of production. For example, the production year of the product engraved in "NO." column on the name plate as follows is 2001.

12A819857 132

The year 2001

\*2: "180-8750" is a zip code which represents the following address.

2-9-32 Nakacho, Musashino-shi, Tokyo Japan

## 2.10 EMC Conformity Standards

EN61326, AS/NZS 2064



### NOTE

YOKOGAWA recommends customer to apply the Metal Conduit Wiring or to use the twisted pair Shield Cable for signal wiring to conform the requirement of EMC Regulation, when customer installs the EJA Series Transmitters to the plant.

## 2.11 PED (Pressure Equipment Directive)

### (1) General

- EJA series of pressure transmitters are categorized as pressure accessories under the piping section of this directive 97/23/EC, which corresponds with Article 3, Paragraph 3 of PED, denoted as Sound Engineering Practice (SEP).
- EJA130A, EJA440A, EJA510A, and EJA530A can be used above 200 bar and therefore considered as a part of a pressure retaining vessel where category III, Module H applies. These models can be specified by using the optional code /PE3.

### (2) Technical Data

Module: H

Type of Equipment: Pressure Accessory - Vessel

Type of Fluid: Liquid and Gas

Group of Fluid: 1 and 2

Model	PS(bar)*1	V(L)	PS-V(bar·L)	Category*2
EJA110A	160	0.01	1.6	Article 3, Paragraph 3
EJA120A	0.5	0.01	0.005	Article 3, Paragraph 3
EJA130A	420	0.01	4.2	III
EJA310A	140	0.01	1.4	Article 3, Paragraph 3
EJA430A	140	0.01	1.4	Article 3, Paragraph 3
EJA440A	500	0.01	5	III
EJA510A	500	0.1	50	III
EJA530A	500	0.1	50	III

\*1: PS is maximum allowable pressure for vessel itself.

\*2: Referred to Table 1 covered by ANNEX II of EC Directive on Pressure Equipment Directive 97/23/EC

T0299.EPS

### (3) Operation



### CAUTION

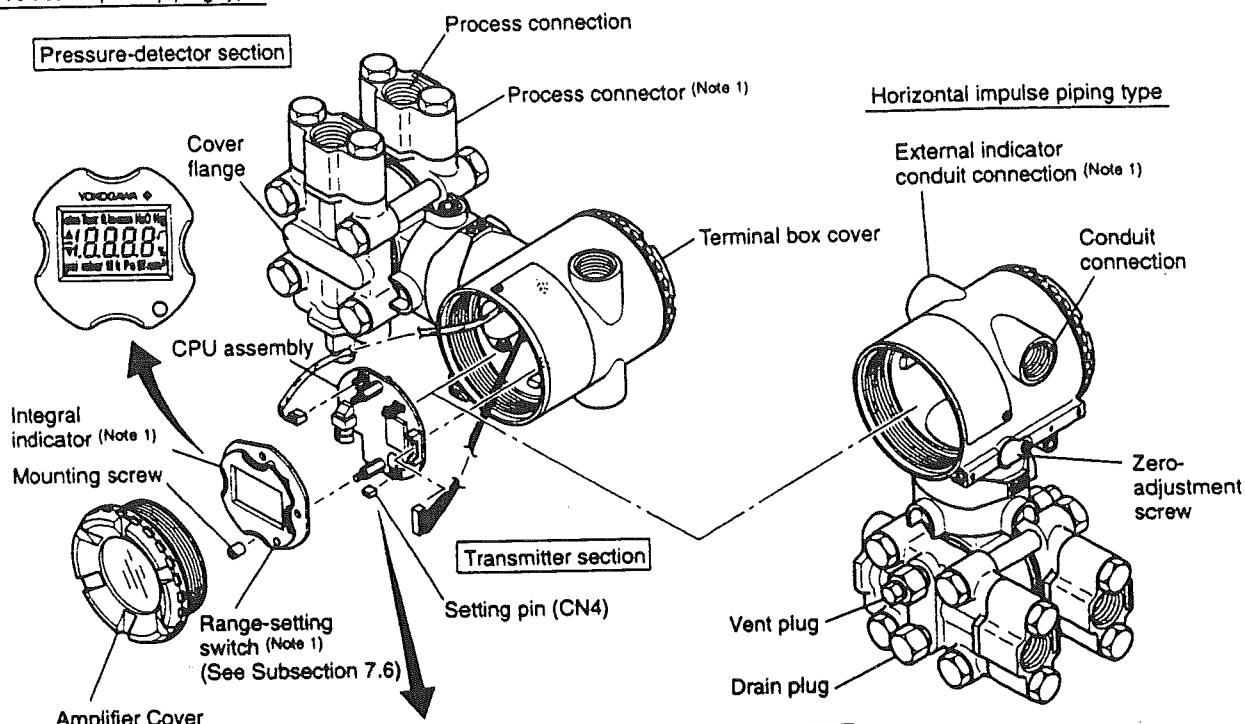
- The temperature and pressure of fluid should be applied under the normal operating condition.
- The ambient temperature should be applied under the normal operating condition.
- Please pay attention to prevent the excessive pressure like water hammer, etc. When water hammer is to be occurred, please take measures to prevent the pressure from exceeding PS by setting the safety valve, etc. at the system and the like.
- When external fire is to be occurred, please take safety measures at the device or system not to influence the transmitters.





17



# 3. COMPONENT NAMES

## Vertical impulse piping type



Setting Pin (CN4) Position (Note 2)	Burn-Out Direction	Output at Burn-Out
H 	HIGH	110% or higher
L 		
H 	LOW	-5% or lower
L 		

F0301.EPS

Note 1: See Subsection 10.2, "Model and Suffix Codes," for details.

Note 2: Insert the pin (CN4) as shown in the figure above to set the burn-out direction. The pin is set to the H side for delivery (unless option code /C1 is specified in the order).

The setting can be confirmed by calling up parameter D52 using the BRAIN TERMINAL. Refer to Subsection 8.3.3 (11).

Figure 3.1 Component Names

Table 3.1 Display Symbol

Display Symbol	Meaning of Display Symbol
$\sqrt{\quad}$	Display mode is 'square root'. (Display is not lit when 'proportional' mode.)
$\blacktriangle$	The output signal being zero-adjusted is increasing.
$\blacktriangledown$	The output signal being zero-adjusted is decreasing.
%, Pa, kPa, MPa, kgf/cm <sup>2</sup> , gf/cm <sup>2</sup> , mbar, bar, atm, mmHg, mmH <sub>2</sub> O, inH <sub>2</sub> O, inHg, ftH <sub>2</sub> O, psi, Torr	Select one of these sixteen available engineering units for the display.

T0301.EPS

## 4. INSTALLATION

### 4.1 Precautions

Before installing the transmitter, read the cautionary notes in Section 2.4, "Selecting the Installation Location." For additional information on the ambient conditions allowed at the installation location, refer to Subsection 10.1 "Standard Specifications."



#### IMPORTANT

- When welding piping during construction, take care not to allow welding currents to flow through the transmitter.
- Do not step on this instrument after installation.

### 4.2 Mounting

- The distance between the impulse piping connection ports is usually 54 mm (Figure 4.2.1). By changing the orientation of the process connector, the dimension can be changed 51 mm or 57 mm.
- The transmitter is shipped with the process connection, according to the ordering specifications. To change the orientation of the process connections, refer to Section 4.3.
- The transmitter can be mounted on a nominal 50 mm (2-inch) pipe using the mounting bracket supplied, as shown in Figure 4.2.2 and 4.2.3. The transmitter can be mounted on either a horizontal or a vertical pipe.
- When mounting the bracket on the transmitter, tighten the (four) bolts that hold the transmitter with a torque of approximately 39 N·m (4kgf·m).

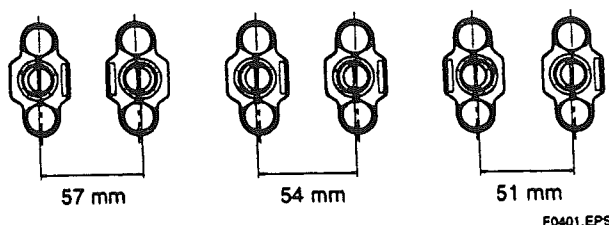
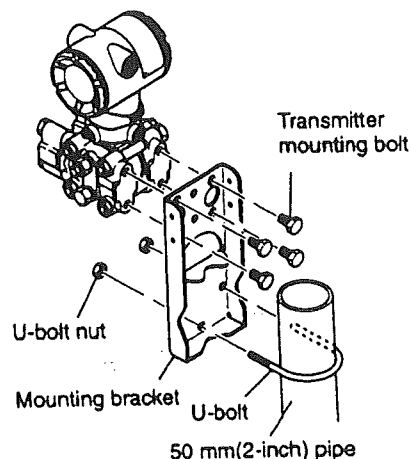
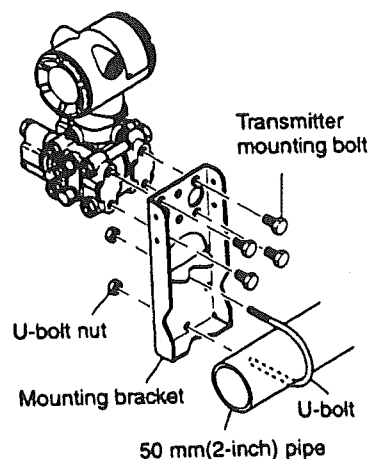


Figure 4.2.1 Process Connector Impulse Piping Connection Distances

#### Vertical pipe mounting



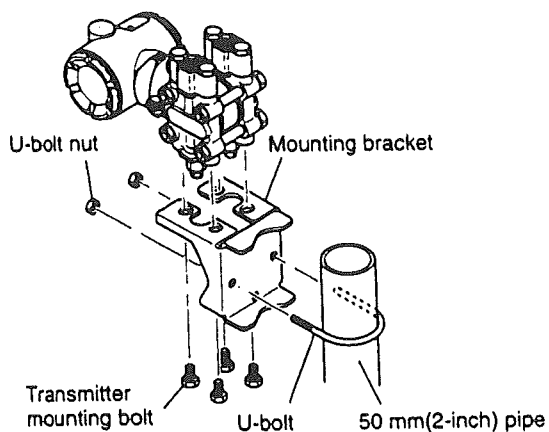
#### Horizontal pipe mounting



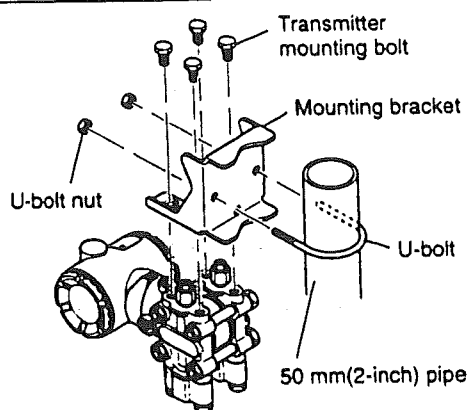
F0402.EPS

Figure 4.2.2 Transmitter Mounting (Horizontal Impulse Piping Type)

Vertical pipe mounting  
(Process connector upside)



Vertical pipe mounting  
(Process connector downside)



F0403.EPS

Figure 4.2.3 Transmitter Mounting (Vertical Impulse Piping Type)

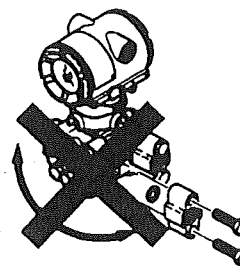
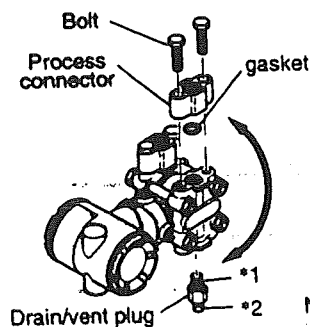
### 4.3 Changing the Process Connection

The transmitter is shipped with the process connection specified at the time of ordering. To make a change such as modifying the drain (vent) plug(s) attached to the upside of the cover flange on shipment to be attached to the downside follow the procedure below.

To begin, use a wrench to slowly and gently unscrew the drain (vent) plug(s). Then, remove and remount them on the opposite side. Wrap sealing tape around the drain (vent) plug threads (\*1 in the figure below), and apply a lubricant to the threads of the drain (vent) screw(s) (\*2 below) to screw it (them) in. To tighten the drain (vent) plugs, apply a torque of 34 to 39 N·m {3.5 to 4 kgf·m}. Tighten the process connector bolts uniformly to a torque of 39 to 49 N·m {4 to 5 kgf·m}.

Vertical impulse piping type

Horizontal impulse piping type



Note: For a horizontal impulse piping type, moving the process connectors from the front side to the back is not allowed.

F0404.EPS

Figure 4.3 Changing Process Connection

## 4.4 Swapping the High/Low-pressure Side Connection

### 4.4.1 Rotating Pressure-detector Section 180°

This procedure can be applied only to a transmitter with a vertical impulse piping type.

The procedure below can be used to turn the pressure-detector assembly 180°. Perform this operation in a maintenance shop with the necessary tools laid out and ready for use, and then install the transmitter in the field after making the change.

- 1) Use a Allen wrench (JIS B4648, nominal 5 mm) to remove the two Allen screws at the joint between the pressure-detector section and transmitter section.
- 2) Leaving the transmitter section in position, rotate the pressure-detector section 180°.
- 3) Tighten the two Allen screws to fix the pressure-detector section and transmitter section together (at a torque of 5 N·m).



#### IMPORTANT

Do not rotate the pressure-detector section more than 180°.

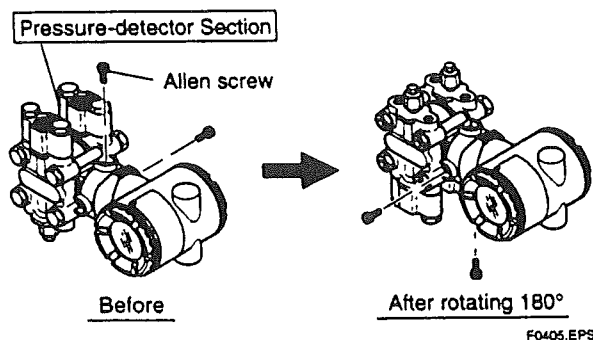


Figure 4.4 Before and After Modification

### 4.4.2 Using the BRAIN TERMINAL BT200

This method is applicable only to the Model EJA110A-□L, EJA110A-□M, EJA110A-□H, EJA120A-□E, EJA130A-□M and EJA130A-□H.

With a BRAIN TERMINAL, you can change which process connection is used as the high-pressure side without mechanically rotating the pressure-detector section 180 as described in Subsection 4.4.1. To change, call parameter 'D45: H/L SWAP' and select REVERSE (right side: low pressure; left side: high pressure) or select NORMAL to change back to normal (right side: high pressure; left side: low pressure).

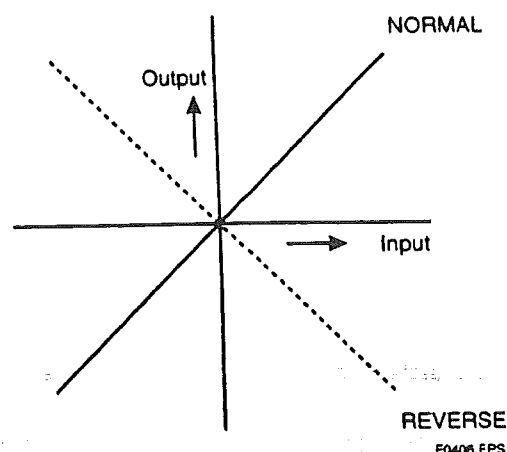


Figure 4.5 Input/Output Relationship



#### IMPORTANT

Since the H/L label plate on the capsule assembly will remain unchanged even if this function is used, use this function only if you cannot switch the impulse piping. If the 'D45: H/L SWAP' setting is changed, the input/output relationship is reversed as shown in Figure 4.5; be sure this is understood by all. Whenever possible, use the procedure in Subsection 4.4.1.

## 4.5 Rotating Transmitter Section

The DPharp transmitter section can be rotated in 90° segments.

- 1) Remove the two Allen screws that fasten the transmitter section and capsule assembly, using the Allen wrench.
- 2) Rotate the transmitter section slowly in 90° segments.
- 3) Tighten the two Allen screws to a torque of 5 N·m.

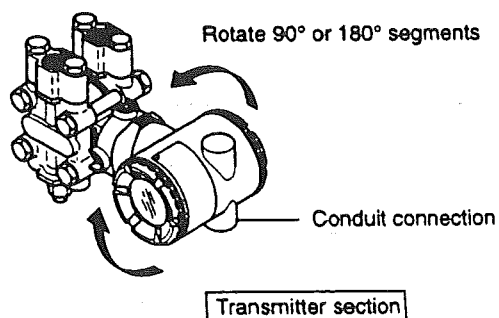


### IMPORTANT

Do not rotate the transmitter section more than 180°.

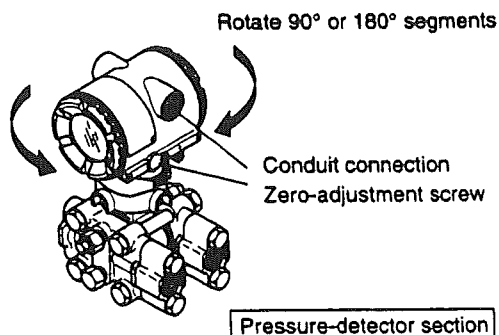
#### Vertical impulse piping type

Pressure-detector section



#### Horizontal impulse piping type

Transmitter section



F0407.EPS

Figure 4.6 Rotating Transmitter Section

## 5. INSTALLING IMPULSE PIPING

### 5.1 Impulse Piping Installation Precautions

The impulse piping that connects the process outputs to the transmitter must convey the process pressure accurately. If, for example, gas collects in a liquid-filled impulse piping, or the drain of a gas-filled impulse piping becomes plugged, the impulse piping will not convey the pressure accurately. Since this will cause errors in the measurement output, select the proper piping method for the process fluid (gas, liquid, or steam). Pay careful attention to the following points when routing the impulse piping and connecting the impulse piping to the transmitter.

#### 5.1.1 Connecting Impulse Piping to the Transmitter

##### (1) Check the High and Low Pressure Connections on the Transmitter (Figure 5.1.1a)

Symbols "H" and "L" are shown on a capsule assembly to indicate high and low pressure side. Connect the impulse piping to the "H" side, and the low impulse piping to the "L" side.

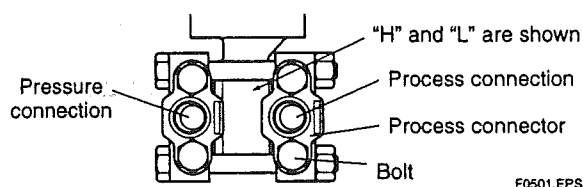


Figure 5.1.1a "H" and "L" Symbols on a Capsule Assembly

##### (2) Changing the Process Connector Piping Connections (Figure 4.1)

The impulse piping connection distances can be changed between 51 mm, 54 mm and 57 mm by changing the orientation of the process connectors. This is convenient for aligning the impulse piping with the process connectors when connecting the piping.

##### (3) Tightening the Process Connector Mounting Bolts

After connecting the impulse piping, tighten the process connector mounting bolts uniformly.

##### (4) Removing the Impulse Piping Connecting Port Dustproof Cap

The impulse piping connecting port of the transmitter is covered with a plastic cap to exclude dust. This cap must be removed before connecting the piping. (Be careful not to damage the threads when removing this cap. Never insert a screwdriver or other tool between the cap and port threads to remove the cap.)

##### (5) Connecting the Transmitter and 3-Valve Manifold

A 3-valve manifold consists of two stop valves to block process pressure and an equalizing valve to equalize the pressures on the high and low pressure sides of the transmitter. Such a manifold makes it easier to disconnect the transmitter from the impulse piping, and is convenient when adjusting the transmitter zero point.

There are two types of 3-valve manifold: the pipe-mounting type and the direct-mounting type; care should be taken with respect to the following points when connecting the manifold to the transmitter.

##### ■ Pipe-Mounting Type 3-Valve Manifold (Figure 5.1.1b)

- 1) Screw nipples into the connection ports on the transmitter side of the 3-valve manifold, and into the impulse piping connecting ports on the process connectors. (To maintain proper sealing, wind sealing tape around the nipple threads.)
- 2) Mount the 3-valve manifold on the 50 mm (2-inch) pipe by fastening a U-bolt to its mounting bracket. Tighten the U-bolt nuts only lightly at this time.
- 3) Install the pipe assemblies between the 3-valve manifold and the process connectors and lightly tighten the ball head lock nuts. (The ball-shaped ends of the pipes must be handled carefully, since they will not seal properly if the ball surface is scratched or otherwise damaged.)
- 4) Now tighten the nuts and bolts securely in the following sequence:  
 Process connector bolts → transmitter-end ball head lock nuts → 3-valve manifold ball head lock nuts → 3-valve manifold mounting bracket U-bolt nuts

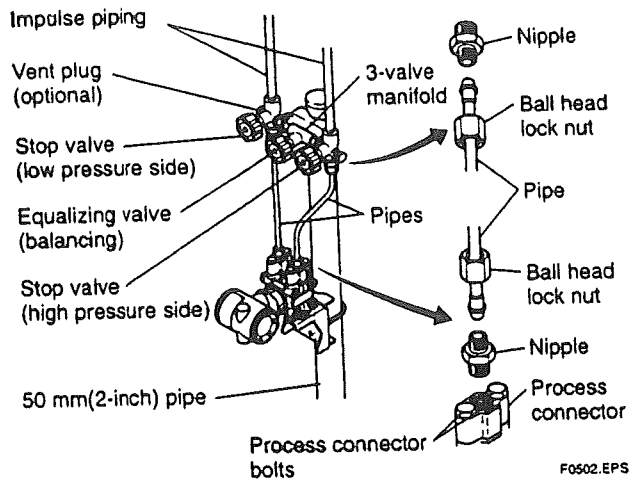


Figure 5.1.1b 3-Valve Manifold (Pipe-Mounting Type)

### ■ Direct-Mounting Type 3-Valve Manifold (Figure 5.1.1c)

- 1) Mount the 3-valve manifold on the transmitter. (When mounting, use the two gaskets and the four bolts provided with the 3-valve manifold. Tighten the bolts evenly.)
- 2) Mount the process connectors and gaskets on the top of the 3-valve manifold (the side on which the impulse piping will be connected).

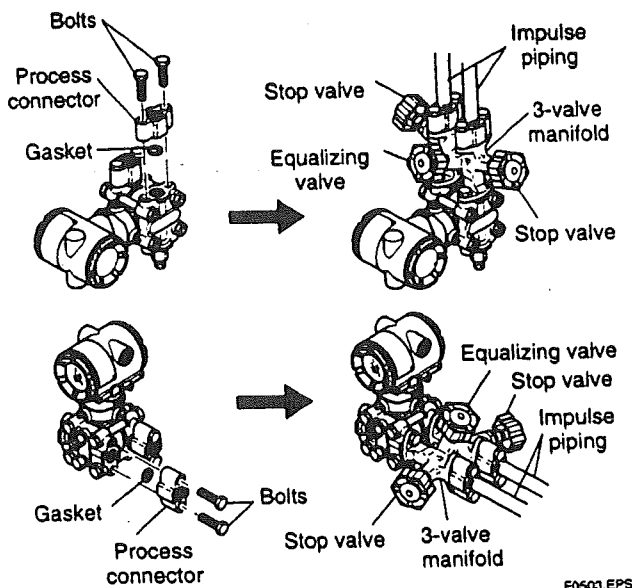


Figure 5.1.1c 3-Valve Manifold (Direct-Mounting Type)



### NOTE

After completing the connection of the transmitter and 3-valve manifold, be sure to CLOSE the low pressure and high pressure stop valves. OPEN the equalizing valve, and leave the manifold with the equalizing valve OPEN. You must do this in order to avoid overloading the transmitter from either the high or the low pressure side when beginning operation. This instruction must also be strictly followed as part of the startup procedure (Chapter 7).

## 5.1.2 Routing the Impulse Piping

### (1) Process Pressure Tap Angles

If condensate, gas, sediment or other extraneous material in the process piping gets into the impulse piping, pressure measurement errors may result. To prevent such problems, the process pressure taps must be angled as shown in Figure 5.1.2 according to the kind of fluid being measured.



### NOTE

- If the process fluid is a gas, the taps must be vertical or within 45° either side of vertical.
- If the process fluid is a liquid, the taps must be horizontal or below horizontal, but not more than 45° below horizontal.
- If the process fluid is steam or other condensing vapor, the taps must be horizontal or above horizontal, but not more than 45° above horizontal.

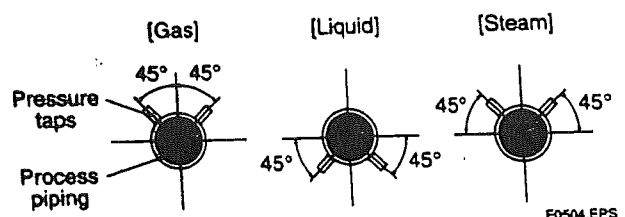


Figure 5.1.2 Process Pressure Tap Angle (For Horizontal Piping)

25

**(2) Position of Process Pressure Taps and Transmitter**

If condensate (or gas) accumulates in the impulse piping, it should be removed periodically by opening the drain (or vent) plugs. However, this will generate a transient disturbance in the pressure measurement, and therefore it is necessary to position the taps and route the impulse piping so that any extraneous liquid or gas generated in the leadlines returns naturally to the process piping.

- If the process fluid is a gas, then as a rule the transmitter must be located higher than the process pressure taps.
- If the process fluid is a liquid or steam, then as a rule the transmitter must be located lower than the process pressure taps.

**(3) Impulse Piping Slope**

The impulse piping must be routed with only an upward or downward slope. Even for horizontal routing, the impulse piping should have a slope of at least 1/10 to prevent condensate (or gases) from accumulating in the pipes.

**(4) Temperature Difference Between Impulse Piping**

If there is a temperature difference between the high and low impulse piping, the density difference of the fluids in the two lines will cause an error in the measurement pressure. When measuring flow, impulse piping must be routed together so that there is no temperature difference between them.

**(5) Condensate Pots for Steam Flow Measurement**

If the liquid in the impulse piping repeatedly condenses or vaporizes as a result of changes in the ambient or process temperature, this will cause a difference in the fluid head between the high pressure and low pressure sides. To prevent measurement errors due to these head differences, condensate pots are used when measuring steam flow.

**(6) Preventing Wind Speed Effects in Very Low Differential Pressure Measurement****IMPORTANT**

When using a differential pressure transmitter to measure very low pressures (draft pressure), the low pressure connection port is left open to atmospheric pressure (the reference pressure). Any wind around the differential pressure transmitter will therefore cause errors in the measurement. To prevent this, it will be necessary either to enclose the transmitter in a box, or to connect a impulse piping to the low pressure side and insert its end into a wind-excluding pot (cylindrical with a base plate).

**(7) Preventing Freezing**

If there is any risk that the process fluid in the impulse piping or transmitter could freeze, use a steam jacket or heater to maintain the temperature of the fluid.

**NOTE**

After completing the connections, close the valves on the process pressure taps (*main valves*), the valves at the transmitter (*stop valves*), and the impulse piping drain valves, so that condensate, sediment, dust and other extraneous material cannot enter the impulse piping.

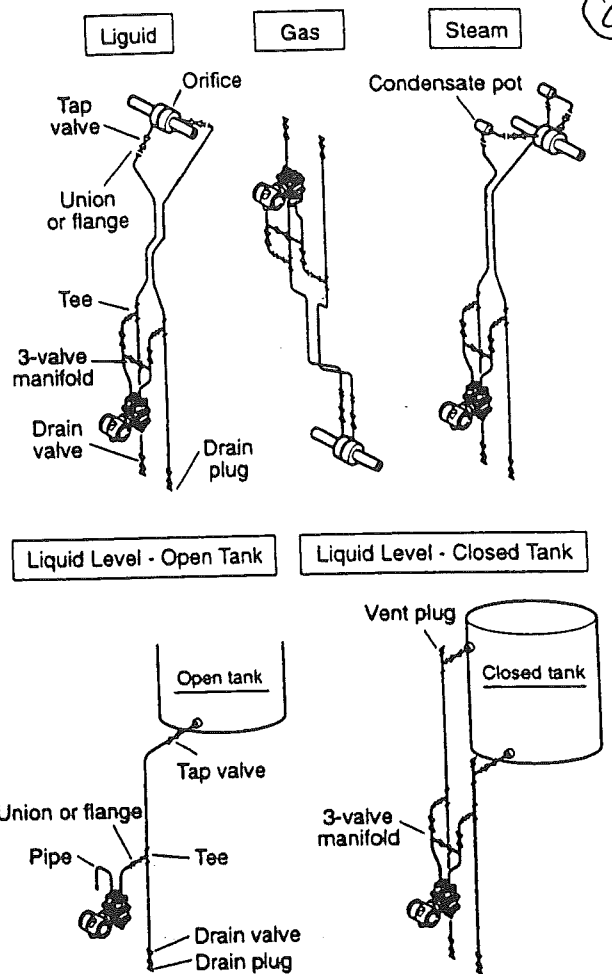


## 5.2 Impulse Piping Connection Examples

Figure 5.2 shows examples of typical impulse piping connections. Before connecting the transmitter to the process, study the transmitter installation location, the process piping layout, and the characteristics of the process fluid (corrosiveness, toxicity, flammability, etc.), in order to make appropriate changes and additions to the connection configurations.

Note the following points when referring to these piping examples.

- The high pressure connecting port on the transmitter is shown on the right (as viewed from the front).
- The transmitter impulse piping connection is shown for a vertical impulse piping connection configuration in which the direction of connection is either upwards or downwards.
- If the impulse piping is long, bracing or supports should be provided to prevent vibration.
- The impulse piping material used must be compatible with the process pressure, temperature, and other conditions.
- A variety of process pressure tap valves (main valves) are available according to the type of connection (flanged, screwed, welded), construction (globe, gate, or ball valve), temperature and pressure. Select the type of valve most appropriate for the application.



F0505.EPS

Figure 5.2 Impulse Piping Connection Examples

## 6. WIRING

### 6.1 Wiring Precautions



#### IMPORTANT

- Lay wiring as far as possible from electrical noise sources such as large capacity transformers, motors, and power supplies.
- Remove electrical connection dust cap before wiring.
- All threaded parts must be treated with water-proofing sealant. (A non-hardening silicone group sealant is recommended.)
- To prevent noise pickup, do not pass signal and power cables through the same ducts.
- Explosion-protected instruments must be wired in accordance with specific requirements (and, in certain countries, legal regulations) in order to preserve the effectiveness of their explosion-protected features.
- The terminal box cover is locked by an Allen head bolt (a shrouding bolt) on CENELEC and SAA flameproof type transmitters. When the shrouding bolt is driven clockwise by an Allen wrench, it is going in and cover lock is released, and then the cover can be opened by hand. See Subsection 9.4 "Disassembly and Reassembly" for details.

### 6.2 Selecting the Wiring Materials

- Use stranded leadwires or cables which are the same as or better than 600 V grade PVC insulated wire (JIS C3307) or equivalent.
- Use shielded wires in areas that are susceptible to electrical noise.
- In areas with higher or lower ambient temperatures, use appropriate wires or cables.
- In environment where oils, solvents, corrosive gases or liquids may be present, use wires or cables that are resistant to such substances.
- It is recommended that crimp-on solderless terminal lugs (for 4 mm screws) with insulating sleeves be used for leadwire ends.

### 6.3 Connections of External Wiring to Terminal Box

#### 6.3.1 Power Supply Wiring Connection

Connect the power supply wiring to the SUPPLY + and - terminals.

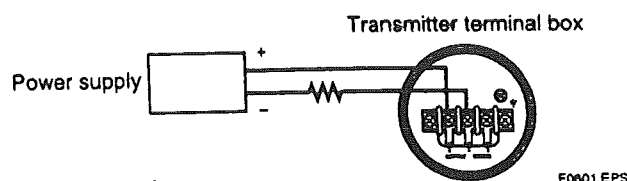


Figure 6.3.1 Power Supply Wiring Connection

#### 6.3.2 External Indicator Connection

Connect wiring for external indicators to the CHECK + and - terminals.

(Note) Use a external indicator whose internal resistance is 10  $\Omega$  or less.

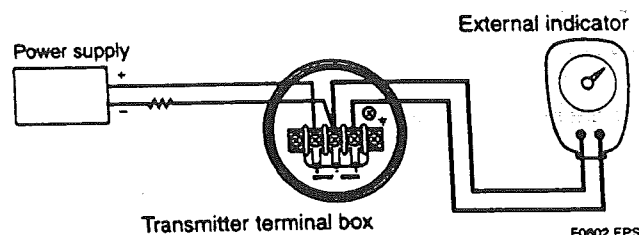


Figure 6.3.2 External Indicator Connection

#### 6.3.3 BRAIN TERMINAL BT200 Connection

Connect the BT200 to the SUPPLY + and - terminals (Use hooks).

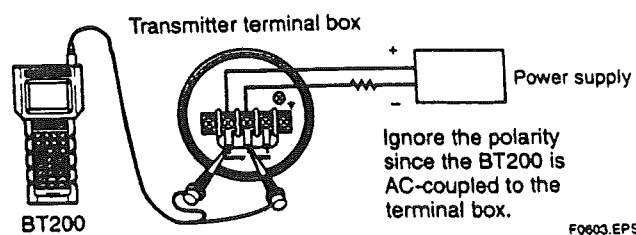


Figure 6.3.3 BT200 Connection

### 6.3.4 Check Meter Connection

Connect the check meter to the CHECK + and - terminals (use hooks).

- A 4 to 20 mA DC output signal from the CHECK + and - terminals.

(Note) Use a check meter whose internal resistance is 10  $\Omega$  or less.

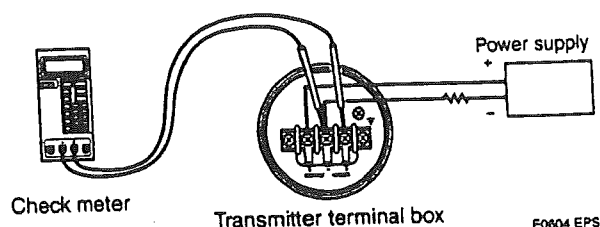


Figure 6.3.4 Check Meter Connection

## 6.4 Wiring

### 6.4.1 Loop Configuration

Since the DPharp uses a two-wire transmission system, signal wiring is also used as power wiring.

DC power is required for the transmitter loop. The transmitter and distributor are connected as shown below.

For details of the power supply voltage and load resistance, see Section 6.6; for communications line requirements, see Subsection 8.1.2.

#### (1) General-use Type and Flameproof Type

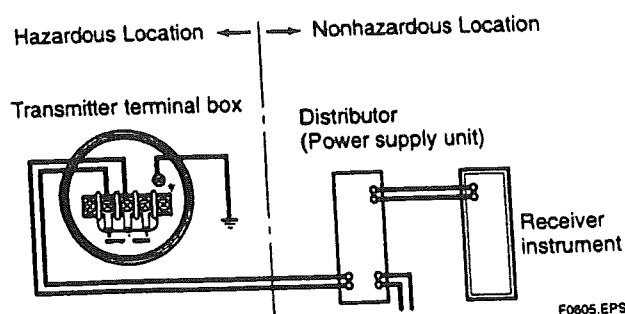


Figure 6.4.1a Connection between Transmitter and Distributor

### (2) Intrinsically Safe Type

For intrinsically safe type, a safety barrier must be included in the loop.

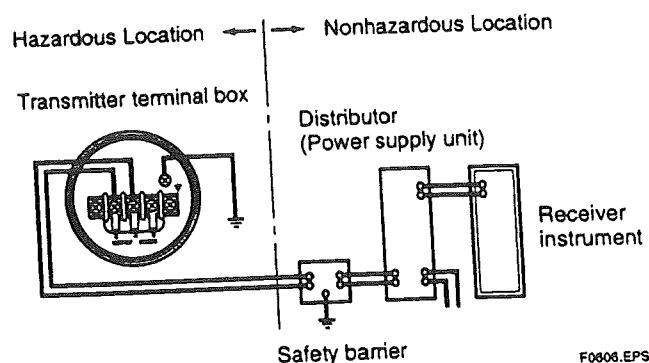


Figure 6.4.1b Connection between Transmitter and Distributor

### 6.4.2 Wiring Installation

#### (1) General-use Type and Intrinsically Safe Type

Make cable wiring using metallic conduit or waterproof glands.

- Apply a non-hardening sealant to the terminal box connection port and to the threads on the flexible metal conduit for waterproofing.

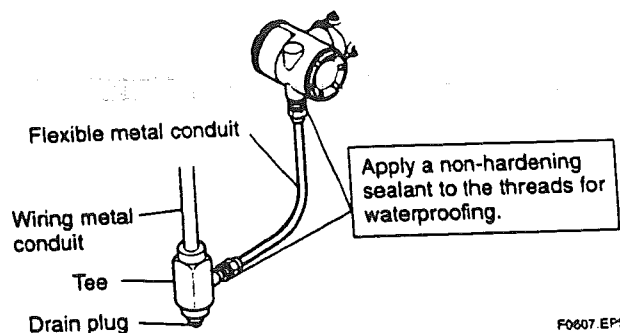


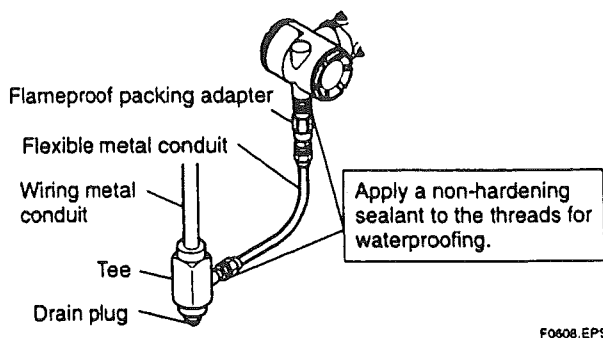
Figure 6.4.2a Typical Wiring Using Flexible Metal Conduit

## (2) Flameproof Type

Wire cables through a flameproof packing adapter, or using a flameproof metal conduit.

### ■ Wiring cable through flameproof packing adapter.

- Apply a nonhardening sealant to the terminal box connection port and to the threads on the flameproof packing adapter for waterproofing.

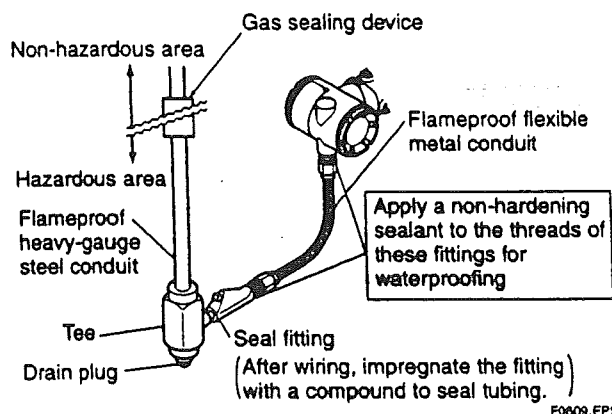


F0608.EPS

Figure 6.4.2b Typical Cable Wiring Using Flameproof Packing Adapter

### ■ Flameproof metal conduit wiring

- A seal fitting must be installed near the terminal box connection port for a sealed construction.
- Apply a non-hardening sealant to the threads of the terminal box connection port, flexible metal conduit and seal fitting for waterproofing.



F0609.EPS

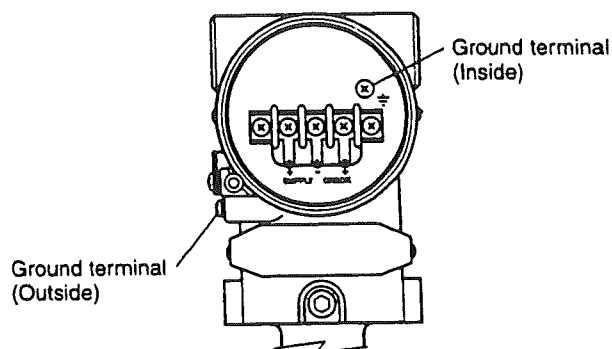
Figure 6.4.2c Typical Wiring Using Flameproof Metal Conduit

## 6.5 Grounding

Grounding is always required for the proper operation of transmitters. Follow the domestic electrical requirements as regulated in each country. For a transmitter with built-in lightning protector, grounding should satisfy ground resistance of  $10\Omega$  or less.

Ground terminals are located on the inside and outside of the terminal box. Either of these terminals may be used.

Transmitter terminal box



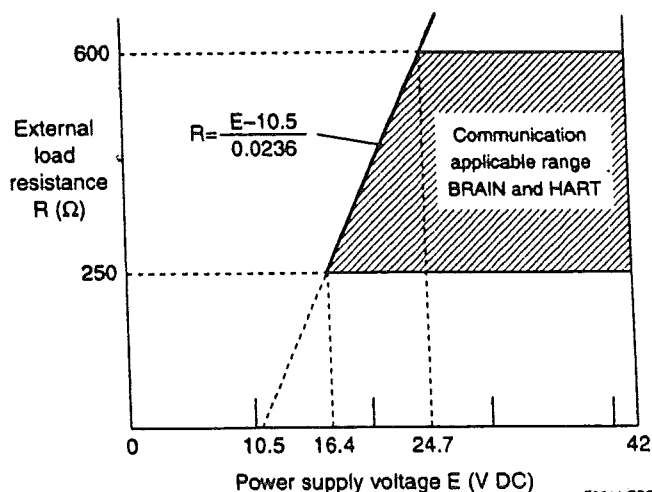
F0610.EPS

Figure 6.5 Ground Terminals

## 6.6 Power Supply Voltage and Load Resistance

When configuring the loop, make sure that the external load resistance is within the range in the figure below.

(Note) In case of an intrinsically safe transmitter, external load resistance includes safety barrier resistance.



F0611.EPS

Figure 6.6 Relationship between Power Supply Voltage and External Load Resistance

# 7. OPERATION

## 7.1 Preparation for Starting Operation

The Model EJA110A, EJA120A and EJA130A pressure transmitter measures the flow rates and the pressure of liquids, gases, and steam, and also liquid levels. This section describes the operation procedure for the EJA110A as shown in Figure 7.1 (vertical impulse piping type, high-pressure connection: right side) when measuring a liquid flow rate.



### NOTE

Check that the process pressure tap valves, drain valves, and 3-valve manifold stop valves on both low pressure and high pressure sides are closed, and that the 3-valve manifold equalizing valve is opened.

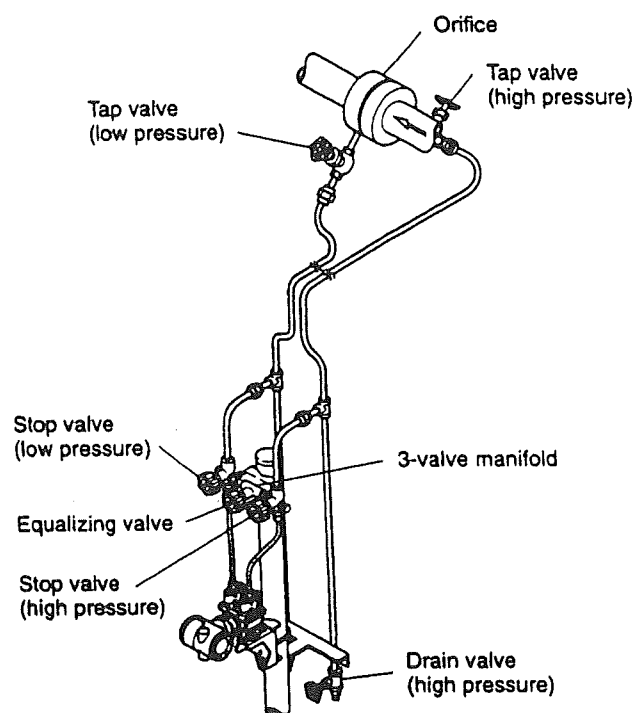
- (a) Follow the procedures below to introduce process pressure into the impulse piping and transmitter.
  - 1) Open the low pressure and high pressure tap valves to fill the impulse piping with process liquid.
  - 2) Slowly open the high pressure stop valve to fill the transmitter pressure-detector section with process liquid.
  - 3) Close the high pressure stop valve.
  - 4) Gradually open the low pressure stop valve and completely fill the transmitter pressure-detector section with process liquid.
  - 5) Close the low pressure stop valve.
  - 6) Gradually open the high pressure stop valve. At this time, equal pressure is applied to the low and high pressure sides of the transmitter.
  - 7) Check that there are no liquid leaks in the impulse piping, 3-valve manifold, transmitter, or other components.

### Venting Gas from the Transmitter Pressure-detector Section

- Since the piping in the example of Figure 7.1 is constructed to be self-venting, no venting operation is required. If it is not possible to make the piping self-venting, refer to Subsection 7.5 for instructions. Leave the equalizing valve open even after venting gas.

- (b) Turn ON power and connect the BT200.  
Open the terminal box cover, and connect the BT200 to the SUPPLY + and – terminals.
- (c) Using the BT200, confirm that the transmitter is operating properly. Check parameter values or change the setpoints as necessary. See Chapter 8 for BT200 operation.

If the transmitter is equipped with an integral indicator, its indication can be used to confirm that the transmitter is operating properly.



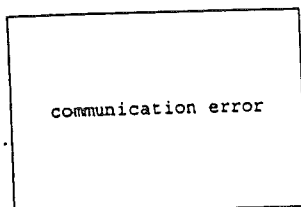
F0701.EPS

Figure 7.1 Liquid Flow Measurement

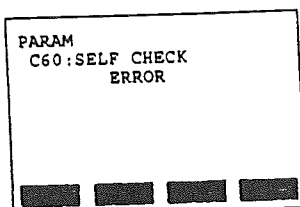
## ■ Confirming that Transmitter is Operating Properly

### Using the BT200

- If the wiring system is faulty, 'communication error' appears on the display.
- If the transmitter is faulty, 'SELF CHECK ERROR' appears on the display.



Communication error  
(Faulty wiring)

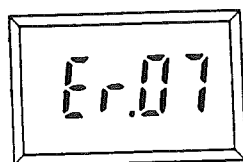


Self-diagnostic error  
(Faulty transmitter)

F0702.EPS

### Using the integral indicator

- If the wiring system is faulty, the display stays blank.
- If the transmitter is faulty, an error code will appear on the display according to the nature of the error.



Self-diagnostic error on  
the integral indicator  
(Faulty transmitter)

F0703.EPS



## NOTE

If any of the error indications above appears on the display of the integral indicator or BT200, refer to Subsection 8.5.2 for corrective action.

## ■ Verify and Change Transmitter Parameter Setting and Values

The following parameters are the minimum settings required for operation. The transmitter has been shipped with these parameters. To confirm or change the values, see Subsection 8.3.3.

- Measuring range ..... See Subsection 8.3.3 (2)
- Output/integral indicator mode .....  
See Subsection 8.3.3 (4)
- Operation mode ..... See Subsection 8.3.3 (9)

## 7.2 Zero Point Adjustment

Adjust the zero point after operating preparation is completed.



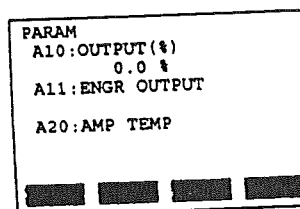
## IMPORTANT

Do not turn off the power to the transmitter immediately after a zero adjustment. Powering off within 30 seconds after a zero adjustment will return the adjustment back to the previous settings.

The zero point adjustment can be made in either way: using the zero-adjustment screw of the transmitter or the BT200 operation.

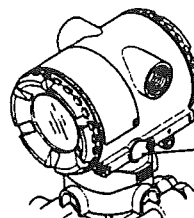
For output signal checking, display the parameter **A10: OUTPUT (%)** in the BT200.

### ●BT200



Output signal (%)  
display

### ●Zero-adjustment Screw



Zero-adjustment  
screw

F0704.EPS

## ■ Using the Transmitter Zero-adjustment Screw

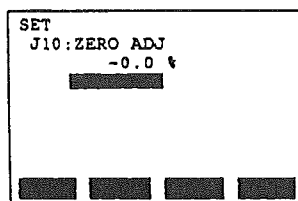
Before adjusting a screw, check that the parameter **J20: EXT ZERO ADJ** displays **ENABLE**. See Subsection 8.3.3 (15) for the setting procedure.

Use a slotted screwdriver to turn the zero-adjustment screw. Turn the screw clockwise to increase the output or counterclockwise to decrease the output. The zero point adjustment can be made with a resolution of 0.01% of the setting range. Since the degree of zero adjustments varies with the screw turning speed, turn the screw slowly for fine adjustment and quickly for coarse adjustment.

### ■ Using the BT200

Zero point can be adjusted by simple key operation of the BT200.

Select parameter **J10: ZERO ADJ**, and press the **ENTER** key twice. The zero point will be adjusted automatically to the output signal 0% (4 mA DC). Confirm that the setting value displayed for the parameter is '0.0%' before pressing the **ENTER** key. See Subsection 8.3.3 (15) for BT200 operating procedures.



A display when parameter J10 is selected.

Press **ENTER** key twice for 0% output 4 mA DC.

F0706.EPS

## 7.3 Starting Operation

After completing the zero point adjustment, follow the procedure below to start operation.

- 1) Close the equalizing valve.
- 2) Gradually open the low pressure stop valve.  
This places the transmitter in an operational condition.
- 3) Confirm the operating status. If the output signal exhibits wide fluctuations (hunting) due to periodic variation in the process pressure, use BT200 to dampen the transmitter output signal. Confirm the hunting using a receiving instrument or the integral indicator, and set the optimum damping time constant. See Subsection 8.3.3 (3), "Damping Time Constant Setup."
- 4) After confirming the operating status, perform the following.



### IMPORTANT

- Remove the BT200 from the terminal box, and confirm that none of the terminal screws are loosened.
- Close the terminal box cover and the amplifier cover. Screw each cover in tightly until it will not turn further.
- Two covers are required to be locked on the CENELEC and SAA Flameproof type transmitters. An Allen head bolts (shrouding bolts) are provided under edge of the each cover for locking. When a shrouding bolts are driven counterclockwise by an Allen wrench, it is coming out and locks up a cover. (See page 9-3) After locking, the covers should be confirmed not to be opened by hand.
- Tighten the zero-adjustment cover mounting screw to fix the cover in position.

## 7.4 Shutting Down Operation

Shut down the transmitter operation as follows.

- 1) Turn off the power.
- 2) Close the low pressure stop valve.
- 3) Open the equalizing valve.
- 4) Close the high pressure stop valve.
- 5) Close the high pressure and low pressure tap valves.



### NOTE

- Whenever shutting down the transmitter for a long period, remove any process fluid from the transmitter pressure-detector section.
- The equalizing valve must be left OPEN.

## 7.5 Venting or Draining Transmitter Pressure-detector Section

Since this transmitter is designed to be self-draining and self-venting with vertical impulse piping connections, neither draining nor venting will be required if the impulse piping is configured appropriately for self-draining or self-venting operation.

If condensate (or gas) collects in the transmitter pressure-detector section, the measured pressure may be in error. If it is not possible to configure the piping for self-draining (or self-venting) operation, you will need to loosen the drain (vent) screw on the transmitter to completely drain (vent) any stagnated liquid (gas).

However, since draining condensate or bleeding off gas gives the pressure measurement disturbance, this should not be done when the loop is in operation.

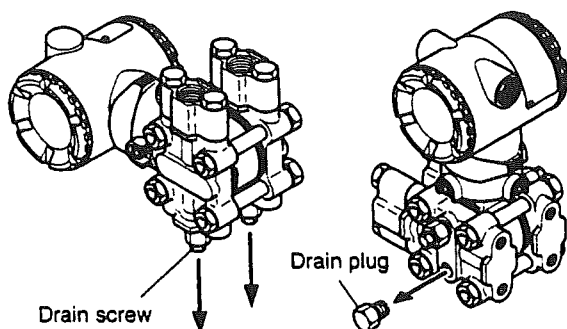


### WARNING

Since the accumulated liquid (or gas) may be toxic or otherwise harmful, take appropriate care to avoid contact with the body, or inhalation of vapors.

### 7.5.1 Draining Condensate

- 1) Gradually open the drain screw or drain plug and drain the transmitter pressure-detector section. (See Figure 7.5.1.)
- 2) When all accumulated liquid is completely removed, close the drain screw or drain plug.
- 3) Tighten the drain screw to a torque of 10 N·m, and the drain plug to a torque of 34 to 39 N·m.



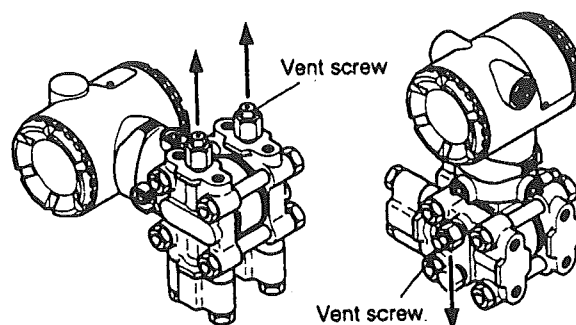
When you loosen the drain screw or drain plug, the accumulated liquid will be expelled in the direction of the arrow.

F0706.EPS

Figure 7.5.1 Draining the Transmitter

### 7.5.2 Venting Gas

- 1) Gradually open the vent screw to vent gas from the transmitter pressure-detector section. (See Figure 7.5.2.)
- 2) When the transmitter is completely vented, close the vent screw.
- 3) Tighten the vent screw to a torque of 10 N·m.



When you loosen the vent screw, the gas escapes in the direction of the arrow.

F0707.EPS

Figure 7.5.2 Venting the Transmitter

## 7.6 Setting the Range Using the Range-setting Switch

With actual pressure being applied to the transmitter, the range-setting switch (push-button) located on the optional integral indicator plate and the external zero-adjustment screw allow users to change (re-range) the low- and high-limit values for the measurement range (LRV and HRV) without using BT200. However, other changes in the display settings (scale range and engineering unit) for the integral indicator requires BT200.

Follow the procedure below to change the LRV and HRV settings.

### [Example]

Rerange LRV to 0 and HRV to 3 MPa.

- 1) Connect the transmitter and apparatus as shown in Figure 9.3.1 and warm up for at least five minutes.
- 2) Press the range-setting push-button.  
The integral indicator then displays "LSET."
- 3) Apply a pressure of 0 kPa (atmospheric pressure) to the transmitter. (Note 1)
- 4) Turn the external zero-adjustment screw in the desired direction. The integral indicator displays the output signal in %. (Note 2)
- 5) Adjust the output signal to 0% (1 V DC) by rotating the external zero-adjustment screw. Doing so completes the LRV setting.



- 6) Press the range-setting push-button. The integral indicator then displays "HSET."
- 7) Apply a pressure of 3 MPa to the transmitter. (Note 1)
- 8) Turn the external zero-adjustment screw in the desired direction. The integral indicator displays the output signal in %. (Note 2)
- 9) Adjust the output signal to 100% (5 V DC) by rotating the external zero-adjustment screw. Doing so completes the HRV setting.
- 10) Press the range-setting push-button. The transmitter then switches back to the normal operation mode with the measurement range of 0 to 3 MPa.

Note 1: Wait until the pressure inside the pressure-detector section has stabilized before proceeding to the next step.

Note 2: If the pressure applied to the transmitter exceeds the previous LRV (or HRV), the integral indicator may display error number "Er.07" (In this case, the output signal percent and "Er.07" are displayed alternately every two seconds). Although "Er.07" is displayed, you may proceed to the next step. However, should any other error number be displayed, take the appropriate measure in reference to Subsection 8.5.2, "Errors and Countermeasures."



### IMPORTANT

- Do not turn off the power to the transmitter immediately after completion of the change in the LRV and/or HRV setting(s). Note that powering off within thirty seconds after setting will cause a return to the previous settings.
- Changing LRV automatically changes HRV to the following value.

$$\text{HRV} = \text{previous HRV} + (\text{new LRV} - \text{previous LRV})$$

- If the range-setting push-button and external zero-adjustment screw are not touched during a range-change operation, the transmitter automatically switches back to the normal operation mode.

Integral indicator



Note : Use a thin bar which has a blunt tip, e.g., a hexagonal wrench, to press the range-setting push-button

Range-setting switch  
(Push-button)

F0708.EPS

Figure 7.6 Range-setting Switch

## 8. BRAIN TERMINAL BT200 OPERATION

The DPharp is equipped with BRAIN communications capabilities, so that range changes, Tag No. setup, monitoring of self-diagnostic results, and zero point adjustment can be handled by remote control via BT200 BRAIN TERMINAL or CENTUM CS console. This section describes procedures for setting parameters using the BT200. For details concerning the BT200, see IM 01C00A11-01E, "BT200 User's Manual."

### 8.1 BT200 Operation Precautions

#### 8.1.1 Connecting the BT200

Connection to the transmitter with the BT200 can be made by either connecting to the BT200 connection hooks in the transmitter terminal box or by connecting to a relaying terminal board.

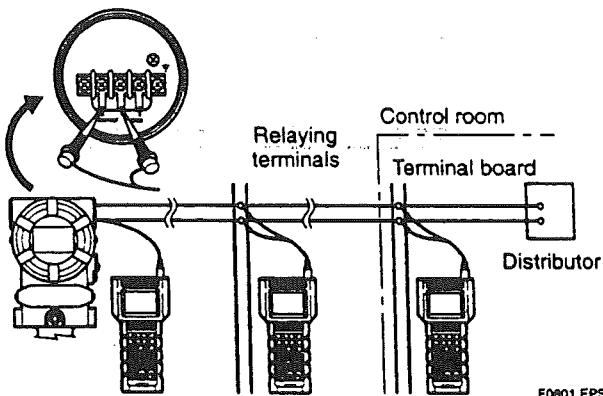


Figure 8.1.1 Connecting the BT200

#### 8.1.2 Conditions of Communication Line

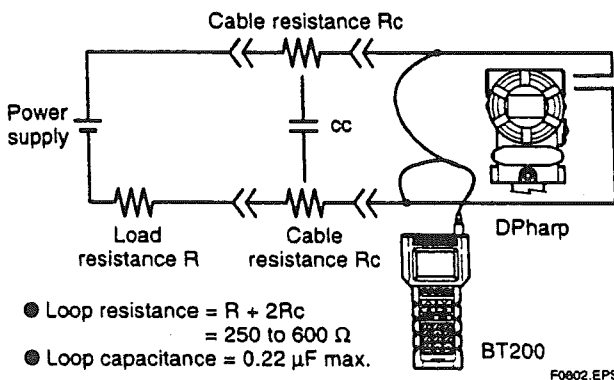


Figure 8.1.2 Conditions of Communication Line

### 8.2 BT200 Operating Procedures

#### 8.2.1 Key Layout and Screen Display

Figure 8.2.1a shows the arrangement of the operating keys on the BT200 keypad, and Figure 8.2.1b shows the BT200 screen component.

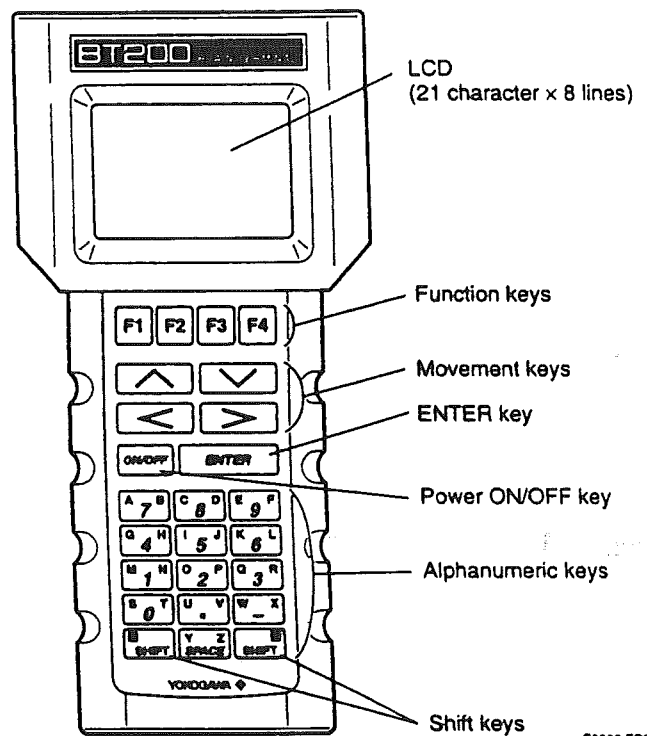


Figure 8.2.1a BT200 Key Layout

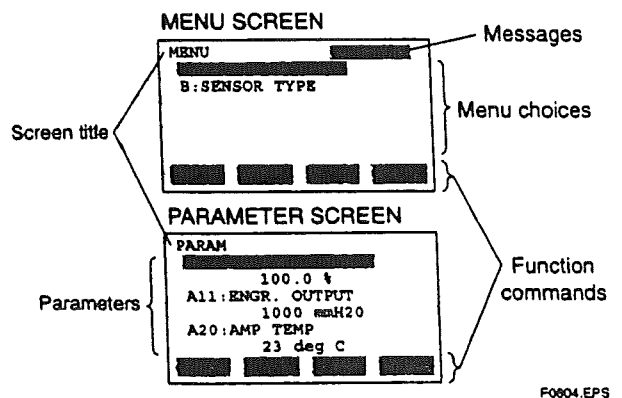
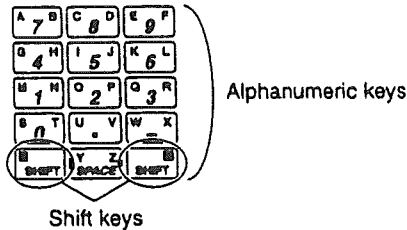


Figure 8.2.1b BT200 Screen Component

## 8.2.2 Operating Key Functions

### (1) Alphanumeric Keys and Shift Keys

You can use the alphanumeric keys in conjunction with the shift keys to enter symbols, as well as alphanumeric keys.



F0805.EPS

#### a. Entering Digits, Symbols, and Spaces

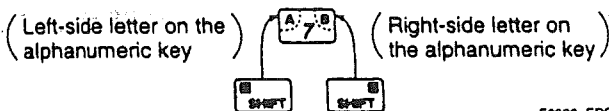
Simply press the alphanumeric keys.

Entry	Key-In Sequence
-4	[W X] [0 4]
0.3	[0 0] [U V] [0 3]
1 _ -9	[M 1] [Y Z] [W X] [0 9]

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#### b. Entering Letters (A through Z)

Press an alphanumeric key following a shift key to enter the letter shown on that side which the shift key represents. You must press the shift key before entering each letter.

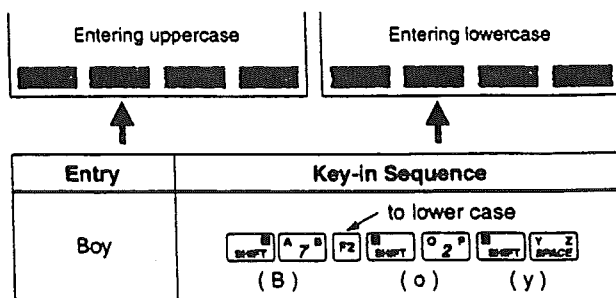


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Entry	Key-In Sequence
W	[SHIFT] [W X]
IC	[SHIFT] [I J] [SHIFT] [C D]
J. B	[SHIFT] [J K] [U V] [SHIFT] [A B]

T0802.EPS

Use the function key [F2] to select between uppercase and lowercase (for letters only). The case toggles between uppercase and lowercase each time you press [F2] CAPS.



F0807.EPS

Use the function key [F1] to enter symbols. The following symbols will appear in sequence, one at a time, at the cursor each time you press [F1] CODE:

/ . - , + \* ) ( ' & % \$ # " !

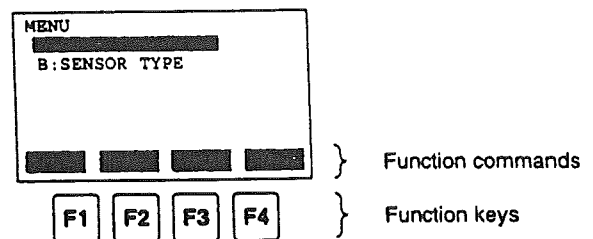
To enter characters next to these symbols, press [ > ] to move the cursor.

Entry	Key-In Sequence
I/m	symbol command [F2] [SHIFT] [K L] [F1] [ > ] [SHIFT] [M N] (I) (/) (m)

T0803.EPS

### (2) Function Keys

The functions of the function keys depend on the function commands on display.



F0808.EPS

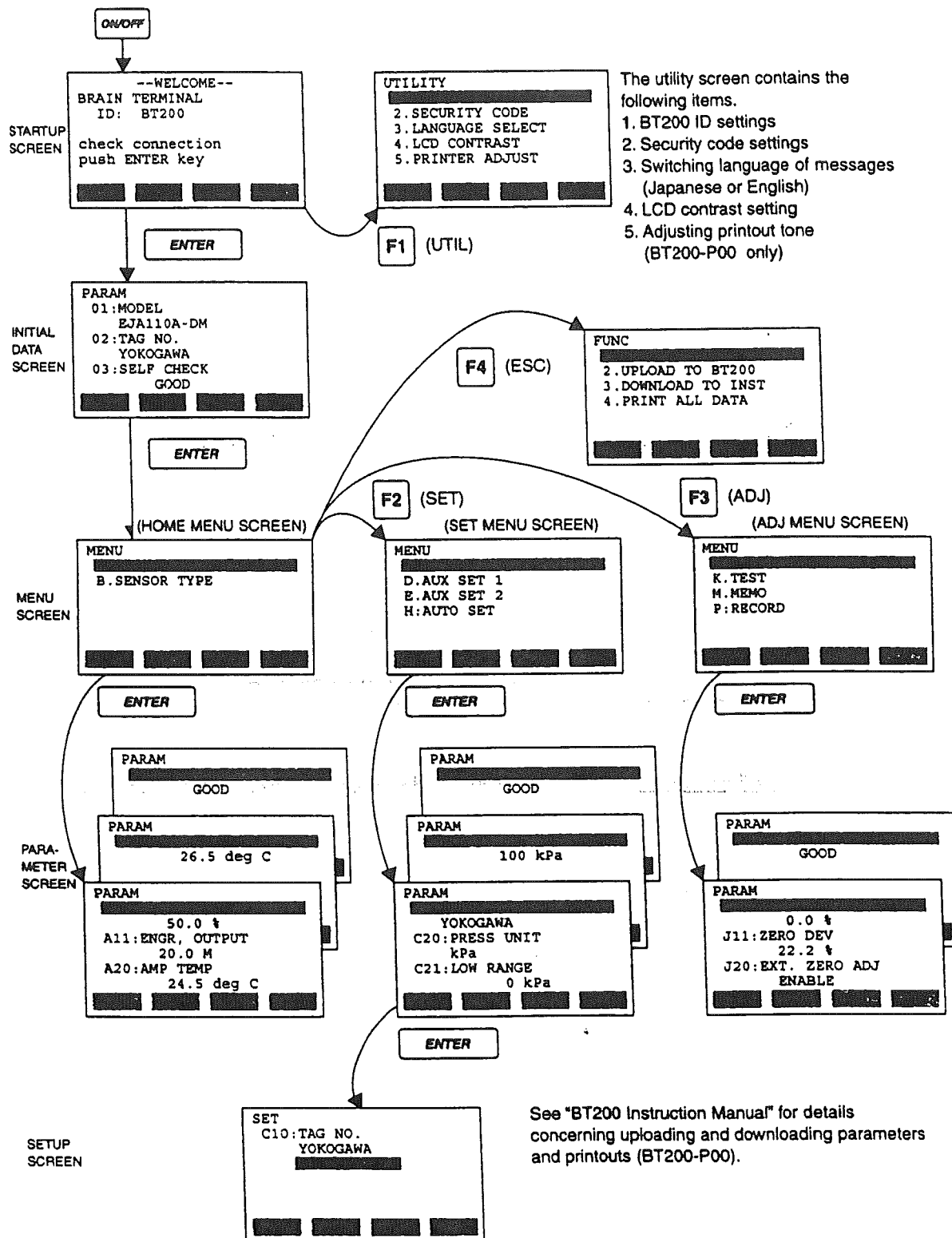
### Function Command List

Command	Function
ADJ	Displays the ADJ menu
CAPS/caps	Selects uppercase or lowercase
CODE	Selects symbols
CLR	Erases input data or deletes all data
DATA	Updates parameter data
DEL	Deletes one character
DIAG	Calls the self-check panel
ESC	Returns to the most recent display
HOME	Displays the menu panel
NO	Quits setup and returns to the previous display
OK	Proceeds to the next panel
PARM	Enters the parameter number setup mode
SET	Displays the SET menu
SLOT	Returns to the slot selection panel
UTIL	Calls the utility panel
*COPY	Prints out parameters on display
*FEED	Paper feed
*LIST	Lists all parameters in the menu
*PON/POFF	Automatic printout mode on or off
*PRNT	Changes to the print mode
*GO	Starts printing
*STOP	Cancels printing

\* Available on BT200-P00 (with printer).

T0804.EPS

## 8.2.3 Calling Up Menu Addresses Using the Operating Keys



F0809.EPS

38

## 8.3 Setting Parameters Using the BT200

### 8.3.1 Parameter Summary

Instruments to which applicable:

F: Differential pressure transmitters EJA110A, EJA120A, and EJA130A  
 P: Pressure transmitters EJA310A, EJA430A, EJA440A, EJA510A, and EJA530A  
 L: Liquid level transmitters EJA210A and EJA220A

No.	Item	Description	Rewritability	Remarks	Default Value	Applicability		
						F	P	L
01	MODEL	Model+capsule type	-			o	o	o
02	TAG NO.	Tag number	-	16 alphanumerics		o	o	o
03	SELF CHECK	Self-diagnostic result	-	GOOD/ERROR		o	o	o
A	DISPLAY	Measured data display	-	Menu name		o	o	o
A10	OUTPUT (%)	Output (in %)	-	-5 to 110%*3		o	o	o
A11	ENGR. OUTPUT	Output (in engineering units)	-	-19999 to 19999		o	o	o
A20	AMP TEMP	Amplifier temperature	-	Unit specified in D30		o	o	o
A21	CAPSULE TEMP	Capsule temperature	-	Unit specified in D30		o	o	o
A30	STATIC PRESS	Static pressure	-	Unit specified in D31*1		o	-	o
A40	INPUT	Input (indicated in engineering DP unit)	-	-32000 to 32000		o	o	o
A60	SELF CHECK	Self-diagnostic messages	-	GOOD/ERROR, CAP MODULE FAULT, AMP MODULE FAULT, OUT OF RANGE, OUT OF SP RANGE*1, OVER TEMP (CAP), OVER TEMP (AMP), OVER OUTPUT, OVER DISPLAY, ILLEGAL LRV, ILLEGAL HRV, ILLEGAL SPAN, and ZERO ADJ OVER		o	o	o
B	SENSOR TYPE	Sensor type	-	Menu name		o	o	o
B10	MODEL	Model+span	-	16 uppercase alphanumerics		o	o	o
B11	STYLE NO.	Style number	-			o	o	o
B20	LRL	Lower range-limit	-	-32000 to 32000		o	o	o
B21	URL	Upper range-limit	-	-32000 to 32000		o	o	o
B30	MIN SPAN	Minimum span	-	-32000 to 32000		o	o	o
B40	MAX STAT.P.	Maximum static pressure*4	-			o	-	o
B60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
C	SETTING	Setting data	-	Menu name		o	o	o
C10	TAG. NO.	Tag number	o	16 alphanumerics	As specified when ordered.	o	o	o
C20	PRESS UNIT	Measurement range units	o	Selected from mmH <sub>2</sub> O, mmAq, mmWG, mmHg, Torr, Pa, hPa, kPa, MPa, mbar, bar, gf/cm <sup>2</sup> , kgf/cm <sup>2</sup> , inH <sub>2</sub> O, inHg, ftH <sub>2</sub> O, psi, or atm	As specified when ordered.	o	o	o
C21	LOW RANGE	Measurement range, lower range value	o	-32000 to 32000 (but within measurement range)	As specified when ordered.	o	o	o
C22	HIGH RANGE	Measurement range, higher range value	o	-32000 to 32000 (but within measurement range)	As specified when ordered.	o	o	o
C30	AMP DAMPING	Damping time constant	o	Selected from 0.2*2, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, 32.0, or 64.0 sec.	2.0 s	o	o	o
C40	OUTPUT MODE	Output mode and integral indicator mode	o	Selected from OUT:LIN; DSP:LIN, OUT:LIN; DSP:SQR, OUT:SQR; DSP:SQR	As specified when ordered. If not specified, OUT: LIN; DSP: LIN.	o	-	-
C60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
D	AUX SET 1	Auxiliary setting data 1	-	Menu name		o	o	o
D10	LOW CUT	Low cut	o	0.0 to 20.0%	10.0%	o	o	o
D11	LOW CUT MODE	Low cut mode	o	LINEAR/ZERO	LINEAR	o	o	o
D20	DISP SELECT	Display selection	o	NORMAL %/USER SET, USER & %/INP PRES, PRES & %	As specified when ordered.	o	o	o
D21	DISP UNIT	Engineering unit for display	o	8 uppercase alphanumerics		o	o	o
D22	DISP LRV	Engineering range, lower range value	o	-19999 to 19999	As specified when ordered.	o	o	o
D23	DISP HRV	Engineering range, higher range value	o	-19999 to 19999	As specified when ordered.	o	o	o

T0805.EPS

No.	Item	Description	Rewritability	Remarks	Default Value	Applicability		
						F	P	L
D	AUX SET 1	Auxiliary setting data 1	-	Menu name		o	o	o
D30	TEMP UNIT	Temperature setting units	o	deg C/deg F	deg C	o	o	o
D31	STAT. P. UNIT	Static pressure setting units	o	Selected from mmH <sub>2</sub> O, mmAq, mmWG, mmHg, Torr, Pa, hPa, kPa, MPa, mbar, bar, gf/cm <sup>2</sup> , kgf/cm <sup>2</sup> , inH <sub>2</sub> O, inHg, ftH <sub>2</sub> O, psi, or atm	As specified when ordered. If not specified, MPa.	o	-	o
D40	REV OUTPUT	Output reversal	o	NORMAL/REVERSE	If not specified, NORMAL.	o	o	o
D45	H/L SWAP	Impulse piping accessing direction	o	NORMAL/REVERSE	NORMAL	o	-	-
D52	BURN OUT	CPU error	-	HIGH/LOW, -5 to 110%* <sup>3</sup>	HIGH	o	o	o
D53	ERROR OUT	Hardware error	o	HOLD/HIGH/LOW, -5 to 110%* <sup>3</sup>	HIGH	o	o	o
D60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
E	AUX SET 2	Auxiliary setting data 2	-	Menu name		o	o	o
E30	BI DIRE MODE	Bidirectional mode	o	OFF/ON	OFF	o	-	-
E60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
H	AUTO SET	Automatic setup	-	Menu name		o	o	o
H10	AUTO LRV	Automatic measurement range lower range value setup	o	-32000 to 32000	Displays the same data as C21.	o	o	o
H11	AUTO HRV	Automatic measurement range higher range value setup	o	-32000 to 32000	Displays the same data as C22.	o	o	o
H60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
J	ADJUST	Adjustment data	-	Menu name		o	o	o
J10	ZERO ADJ	Automatic zero adjustment	o	-5 to 110.0%* <sup>3</sup>		o	o	o
J11	ZERO DEV.	Manual zero adjustment	o			o	o	o
J20	EXT. ZERO ADJ	External zero-adjustment screw permission	o	ENABLE/INHIBIT		o	o	o
J60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
K	TEST	Tests	-	Menu name		o	o	o
K10	OUTPUT in %	Test output % setting	o	-5 to 110.0%* <sup>3</sup> Displays 'ACTIVE' while executing		o	o	o
K60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
M	MEMO	Memo	-	Menu name		o	o	o
M10	MEMO 1	Memo	o	8 uppercase alphanumerics		o	o	o
M20	MEMO 2	Memo	o	8 uppercase alphanumerics		o	o	o
M30	MEMO 3	Memo	o	8 uppercase alphanumerics		o	o	o
M40	MEMO 4	Memo	o	8 uppercase alphanumerics		o	o	o
M50	MEMO 5	Memo	o	8 uppercase alphanumerics		o	o	o
M60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o
P	RECORD	History of the errors	-			o	o	o
P10	ERROR REC 1	Last error	o	Display the error		o	o	o
P11	ERROR REC 2	One time before	o	Display the error		o	o	o
P12	ERROR REC 3	Two time before	o	Display the error		o	o	o
P13	ERROR REC 4	Three time before	o	Display the error		o	o	o
P60	SELF CHECK	Self-diagnostic messages	-	Same as A60		o	o	o

\*1: In case of Model EJA120A, static pressure cannot be measured. The display is always 0 MPa, but this is not a measured value.

\*2: When Optional code /F1 is specified, substitute the value with 0.1.

\*3: When Optional code /F1 is specified, substitute the value -5 with -2.5.

\*4: See MWP(max. working pressure) on the nameplate. B40 shows an approximate value of maximum pressure for the capsule.

T0900.EPS

40

### 8.3.2 Parameter Usage and Selection

Before describing the procedure for setting parameters, we present the following table showing how the parameters are used and in what case.



#### IMPORTANT

If the transmitter is turned off within 30 seconds after parameters have been set, the set data will not be stored and the terminal returns to previous settings.

Table 8.3.1 Parameter Usage and Selection

Setup Item	Description
Tag No. setup ▶ P.8-7	Sets the Tag No. (using 16 alphanumeric characters). Note: Up to 8 alphanumerics (upper case letters) can be used in the BT100.
Calibration range setup ▶ P.8-7	Sets the calibration range for 4 to 20 mA DC. Sets three data items: range unit, input value at 4 mA DC (LRV), and input value at 20 mA DC (HRV). Note: LRV and HRV can be specified with range value specifications up to 5 digits (excluding any decimal point) within the range of -32000 to 32000.
Damping time constant setup ▶ P.8-8	Adjusts the output response speed for 4 to 20 mA DC. Can be set in 9 increments from 0.2 to 64 s.
Output and integral indicator display mode setup ▶ P.8-9	Sets modes for output signal and integral indicator to "Linear mode" (proportional to input differential pressure) or to "Square root mode" (proportional to flow).
Output signal low cut mode setup ▶ P.8-9	Used mainly to stabilize output near 0% if output signal is the square root mode. Two modes are available: forcing output to 0% for input below a specific value, or changing to proportional output for input below a specific value.
Integral indicator scale range and unit setup ▶ P.8-10	Sets the following 5 types of integral indicator scale ranges and units: % scale indicator, user set scale indicator, alternate indication of user set scale and % scale, input pressure display, alternate indication of input pressure and % scale When using the user set scale, 4 types of data can be set: user set scale setting, unit (BT200 only), display value at 4 mA DC (LRV), and display value at 20 mA DC (HRV). Note: LRV and HRV can be specified with range value specifications up to 5 digits (excluding any decimal point) within the range of -19999 to 19999.
Unit setup for displayed temperature ▶ P.8-11	Sets a unit for temperatures displayed on the BT200.
Unit setup for displayed static pressure ▶ P.8-11	Sets a unit for static pressure displayed on the BT200.
Operation mode (normal/reverse signal) setup ▶ P.8-12	Reverses the direction for 4 to 20 mA DC output relative to input. Reverse mode is used for applications in which safety requires that output be driven toward 20 mA if input is lost.
Impulse line connection orientation (higher pressure on right/left side) setup ▶ P.8-12	Used where installation conditions make it imperative to connect high pressure side impulse line to low pressure side of transmitter. Reversal of orientation should be dealt with by reversing impulse line wherever possible. Use this function only where there is no alternative.
Output status display/setup when a CPU failure ▶ P.8-12	Displays the status of 4 to 20 mA DC output when a CPU failure. The parameter of the standard unit is fixed to the high limit value.
Output status setup when a hardware error occurs ▶ P.8-12	Sets the status of the 4 to 20 mA DC output when an abnormal status is detected with the capsule or the amplifier as the result of self-diagnosis. One of the following statuses; last held, high limit, and low limit values, can be selected.
Bi-directional flow measurement ▶ P.8-13	Used to measure bi-directional flows. Output at zero flow is 12 mA DC, with output range equally divided between forward and reverse flow. Can be used with square root mode.
Range change (while applying actual inputs) ▶ P.8-13	Range for 4 to 20 mA DC signal is set with actual input applied. Sets 20 mA DC output precisely with respect to user's reference instrument output. Note that DPharp is calibrated with high accuracy before shipment, so span should be set using the normal range setup.
Zero point adjustment ▶ P.8-14	Adjusts zero point. This can be done either using the external zero-adjustment screw on the transmitter or using the BT200.
Test output (fixed current output) setup ▶ P.8-15	Used for loop checks. Output can be set freely from -5% to 110% in 1% steps.
User memo fields ▶ P.8-15	Allows user to enter up to 5 items of any desired text in up to 8 uppercase alphanumeric characters per item.

T0907.EPS

41

## 8. BRAIN TERMINAL BT200 OPERATION

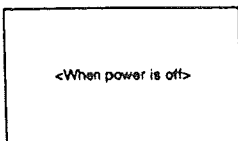
### 8.3.3 Setting Parameters

Set or change the parameters as necessary. After completing these, do not fail to use the "DIAG" key to confirm that "GOOD" is displayed for the self-diagnostic result at **\_60: SELF CHECK**.

#### (1) Tag No. Setup (C10: TAG NO)

Use the procedure below to change the Tag No. Up to 16 alphanumeric characters can be entered.

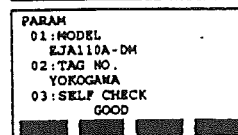
##### • Example: Set a Tag No. to FIC-1a



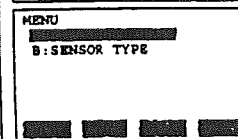
Press the **ON/OFF** key to turn on the BT200.



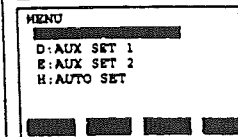
Connect DPharp and BT200 using a communication cable and press the **ENTER** key.



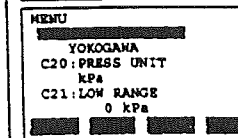
Displays the name of connected DPharp model, TAG NO. and diagnostics information. Press the **F4** (OK) key after confirmation.



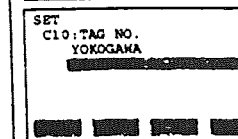
Press the **F2** (SET) key to display the SET menu panel.



Select C: SETTING and press the **ENTER** key.



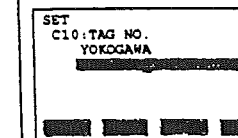
Select C10: TAG NO. and press the **ENTER** key.



Set the new TAG NO. (FIC-1a).

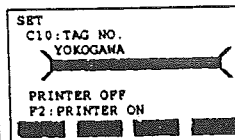
SHIFT	9	F	OKOGAWA
SHIFT	5	J	FIKOGAWA
SHIFT	8	D	FICOGAWA
W	X		FIC-GAWA
M	N		FIC-1AWA
F2	SHIFT	A	FIC-1aWA
Y	Z	Y	FIC-1a
SPACE	SPACE		FIC-1a

Set TAG NO. and press the **ENTER** key.

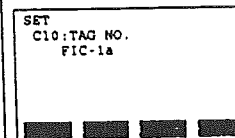


When you have made an entry mistake, return the cursor **<** using the key, then reenter.

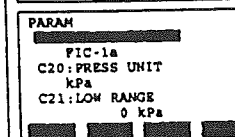
F0610.EPS



This is the panel for confirming set data. The set data items flash. When all items have been confirmed, press the **ENTER** again. (To go back to the setting panel, press the **F3** (NO) key.



The DPharp TAG NO. was overwritten. Press the **F4** (OK) key to return to the parameter panel. Press the **F3** (NO) key to return to the setting panel.



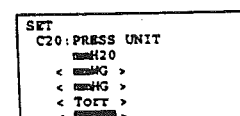
F0611.EPS

#### (2) Calibration Range Setup

##### a. Setting Calibration Range Unit (C20: PRESS UNIT)

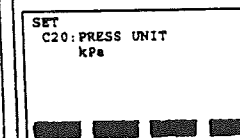
The unit is set at the factory before shipment if specified at the time of order. Follow the procedure below to change the unit.

##### • Example: Change the unit from mmH<sub>2</sub>O to kPa.

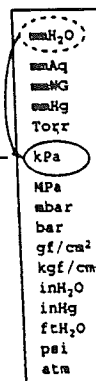


Use the **↑** or **↓** key to select "kPa."

Press the **ENTER** key twice to enter the setting.



Press the **F4** (OK) key.



F0612.EPS



### b. Setting Calibration Range Lower Range Value and Higher Range Value (C21: LOW RANGE, C22: HIGH RANGE)

These range values are set as specified in the order before the instrument is shipped. Follow the procedure below to change the range.

- The measurement span is determined by the high and low range limit values. In this instrument, changing the low range value also automatically changes the high range value, keeping the span constant.

- Example 1: With present settings of 0 to 30 kPa, set the lower range value to 0.5 kPa.

SET  
C21: LOW RANGE  
0 kPa

Set 0.5.

Press the **ENTER** key twice to enter the setting.

SET  
C21: LOW RANGE  
0.5 kPa

Press the **F4** (OK) key.

SET  
C20: PRESS UNIT  
kPa  
0.5 kPa  
C22: HIGH RANGE  
30.5 kPa

The higher range value is changed while the span remains constant.

Span = Higher range value - Lower range value

F0813.EPS

- Note, however, that changing the higher range value does not cause the lower range value to change. Thus, changing the higher range value also changes the span.
- Calibration range can be specified with range value specifications up to 5 digits (excluding any decimal point) for low or high range limits within the range of -32000 to 32000.

- Example 2: With present settings of 0 to 30 kPa, set the Higher range value to 10 kPa.

SET  
C22: HIGH RANGE  
30 kPa

Set 10.

Press the **ENTER** key twice to enter the setting.

SET  
C22: HIGH RANGE  
10 kPa

Press the **F4** (OK) key.

PARAM  
C20: PRESS UNIT  
kPa  
C21: LOW RANGE  
0 kPa  
10 kPa

The low range value is not changed, so the span changes.

F0814.EPS

### (3) Damping Time Constant Setup (C30: AMP DAMPING)

When the instrument is shipped, the damping time constant is set at 2.0 seconds. Follow the procedure below to change the time constant.

- Example: Change from 2.0 sec to 4.0 sec.

SET  
C30: AMP DAMPING  
2.0 sec  
2.0 sec  
8.0 sec  
16.0 sec

Use the **▲** or **▼** key to select 4.0 sec.

Press the **ENTER** key twice to enter the setting.

SET  
C30: AMP DAMPING  
4.0 sec

Press the **F4** (OK) key.

0.2sec  
0.5sec  
1.0sec  
2.0sec  
4.0sec  
8.0sec  
16.0sec  
32.0sec  
64.0sec

F0815.EPS

Note: The damping time constant set here is the damping time constant for the amplifier assembly. The damping time constant for the entire transmitter is the sum of the values for the amplifier assembly and for the capsule assembly. For the capsule assembly damping time constant (fixed), see the "General Specifications" found at the end of this manual. (See Chapter 10.)

#### (4) Output Mode and Integral Indicator Display Mode Setup (C40: OUTPUT MODE)

The mode setting for the output signal and the integral indicator coordinate as shown in the table below.

BT200 Display	Output Mode	Integral Indicator Display Mode
OUT: LIN DSP: LIN	Linear	Linear
OUT: LIN DSP: SQR	Linear	Square root
OUT: SQR DSP: SQR	Square root	Square root

T0808.EPS

This mode is set as specified in the order when the instrument is shipped. Follow the procedure below to change the mode.

If the instrument is equipped with an integral indicator and the display mode is "square root", " $\sqrt{\phantom{x}}$ " is displayed on the integral indicator.

For details, see Chapter 3.

##### • Example: Set output mode to Linear and display mode to Square root.

SET  
C40: OUTPUT MODE  
OUT: LIN DSP: LIN  
<OUT: LIN DSP: LIN>  
<OUT: SQR DSP: SQR>

Use the  $\wedge$  or  $\vee$  key to select "OUT: LIN, DSP: SQR."

Press the **ENTER** key twice to enter the setting.

SET  
C40: OUTPUT MODE  
OUT: LIN DSP: SQR

Press the **F4** (OK) key.

F0816.EPS

##### • Example: Change the low cut setting range from 10% to 20%, and the low cut mode from LINEAR to ZERO.

SET  
D10: LOW CUT  
10.0 %

Set "20."

Press the **ENTER** key twice to enter the setting.

SET  
D10: LOW CUT  
20.0 %

Press the **F4** (OK) key.

Next, the [D11: LOW CUT MODE] setting panel is displayed.

SET  
D11: LOW CUT MODE  
LINEAR  
< LINEAR >

Use the  $\wedge$  or  $\vee$  key to select "ZERO."

Press the **ENTER** key twice to enter the setting.

SET  
D11: LOW CUT MODE  
ZERO

Press the **F4** (OK) key.

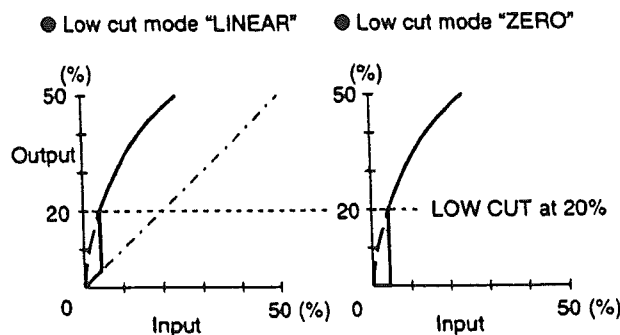
PARAM  
D10: LOW CUT  
20.0 %  
ZERO  
D20: DISP SELECT  
NORMAL

F0818.EPS

#### (5) Output Signal Low Cut Mode Setup (D10: LOW CUT, D11: LOW CUT MODE)

Low cut mode can be used to stabilize the output signal near the zero point. The low cut point can be set in a range from 0 to 20% of output. (Hysteresis of cut point:  $\pm 1\%$ )

Either "LINEAR" or "ZERO" can be selected as the low cut mode.

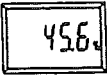

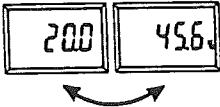
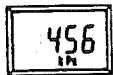
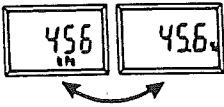


F0817.EPS

44

**(6) Integral Indicator Scale Setup**

The following 5 displays are available for integral indicators.

D20: DISP SELECT and Display	Description and Related parameters
<b>NORMAL %</b> 	Indicates -5 to 110% range depending on the Measurement range (C21, C22). A10: OUTPUT (%) 45.6 %
<b>USER SET</b> 	Indicates values depending on the Engineering range (D22, D23). (Note 1) Units set using Engineering unit (D21) are not indicated. A11: ENGR. OUTPUT 20.0 M
<b>USER &amp; %</b> 	Indicates user set and % alternately in 3 second intervals. A10: OUTPUT (%) 45.6 % A11: ENGR. OUTPUT 20.0 M
<b>INP PRES</b> 	Indicates input pressure. Indication limits -19999 to 19999. A40: INPUT 456 kPa
<b>PRES &amp; %</b> 	Indicates input pressure and % alternately in 3 second intervals. A10: OUTPUT (%) 45.6 % A40: INPUT 456 kPa

(Note 1) Scale range can be specified with range limit specifications up to 5 digits (excluding any decimal point) for low or high range limits within the range of -19999 to 19999.

T0608.EPS

See (a.) through (c.) for each setting procedure.

% indication and input pressure indication

User-set engineering unit display

D20: DISP SELECT  
NORMAL %  
INP PRES  
PRES & %



D20: DISP SELECT  
USER SET  
USER & %

( Transmitter is set for " % display " when shipped. )

Set for user-set engineering unit display.

▼  
D21: DISP UNIT

Set a unit to be displayed on the BT200.

▼  
D22: DISP LRV

Set a numeric value for engineering unit for 4 mA output (LRV).

▼  
D23: DISP HRV

Set a numeric value for engineering unit for 20 mA output (HRV).

F0816.EPS

**a. Display Selection (D20: DISP SELECT)**


Follow the instructions given to the below to change the range of integral indication scales.


When **USER SET** is selected, the user set values of integral indication and **A11: ENGR. OUTPUT** parameter are indicated.

• Example: Set the integral indicator scale to engineering units display.

SET  
D20: DISP SELECT  
NORMAL %  
<NORMAL %>  
<USER %>  
<INP PRES>  
[ ] [ ] [ ] [ ]

SET  
D20: DISP SELECT  
USER SET  
[ ] [ ] [ ] [ ]

Use the  or  key to select "USER SET."

Press the  key twice to enter the setting.

Press the  (OK) key.

( The " %" disappears from the integral indicator display. )

F0820.EPS

45

### b. Setting User-set Engineering Unit (D21: DISP UNIT)

This parameter allows entry of the engineering units to be displayed on the BT200. When the instrument is shipped, this is set as specified in the order.

Follow the procedure below to change this setting.

This parameter need not be set for % display.

#### • Example: Set an engineering unit M.

```

SET
D21:DISP UNIT
  
```

Set "M."

Press the **ENTER** key twice to enter the setting.

```

SET
D21:DISP UNIT
M
  
```

Press the **F4** (OK) key.

F0621.EPS

### c. Lower and Higher Range Value Setup in Engineering Unit (D22: DISP LRV, D23: DISP HRV)

These parameter items are used to set the lower and higher range values for the engineering unit display.

When the instrument is shipped, these are set as specified in the order. Follow the procedure below to change these settings. Note that these parameters need not be set for % display.

#### • Example: Set lower range value (LRV) to -50 and higher range value (HRV) to 50.

##### Setting LRV

```

SET
D22:DISP LRV
  
```

Set "-50."

Press the **ENTER** key twice to enter the setting.

##### Setting HRV

```

SET
D23:DISP HRV
  
```

Set "50."

Press the **ENTER** key twice to enter the setting.

```

SET
D23:DISP HRV
  
```

Press the **F4** (OK) key.

```

PARAM
D21:DISP UNIT
M
D22:DISP LRV
-50M
D23:DISP HRV
50M
  
```

F0622.EPS

### (7) Unit Setup for Displayed Temperature (D30: TEMP UNIT)

When the instrument is shipped, the temperature units are set to **degC**. Follow the procedure below to change this setting. Note that changing the unit here changes the unit for **A20: AMP TEMP** (amplifier temperature) and **A21: CAPSULE TEMP** (capsule temperature).

#### • Example: Change the unit for the temperature display.

```

SET
D30:TEMP UNIT
deg C
< deg C >
< deg F >
  
```

Use the **▲** or **▼** key to select "deg F."

Press the **ENTER** key twice to enter the setting.

F0623.EPS

**(8) Unit Setup for Displayed Static Pressure  
(D31: STAT.P.UNIT)**

Follow the procedure below to change the static pressure units.

Changing this parameter changes the unit for the **A30: STATIC PRESS** (static pressure) display.

**(9) Operation Mode Setup  
(D40: REV OUTPUT)**

This parameter allows the direction of the 4 to 20 mA output to be reversed with respect to input. Follow the procedure below to make this change.

- Example: Change 4 to 20 mA output to 20 to 4 mA output.

Use the or key to select REVERSE.

Press the key twice to enter the setting.

F0825.EPS

**(10) Impulse Line Connection Orientation  
Setup (D45: H/L SWAP)**

This parameter allows the impulse line connections to be reversed at the transmitter. Follow the figure below to make this change.

- Example: Change the impulse line connection from high pressure on right to high pressure on left.

Use the or key to select REVERSE.

Press the key twice to enter the setting.

F0826.EPS

**(11) Output Status Display/Setup when a CPU  
Failure (D52: BURN OUT)**

This parameter displays the status of 4 to 20 mA DC output if a CPU failure occurs. In case of a failure, communication is disabled.

Setting of HIGH or LOW is enabled. This is done with the pin (CN4) on the CPU assembly. See Chapter 3 for details.

**Standard specifications**

The parameter is set to HIGH. If a failure, the transmitter outputs the signal of 110% or higher. The parameter **D53: ERROR OUT** is set to HIGH from the factory.

**Optional code/C1**

The parameter is set to LOW. If a failure, output which is -5% or lower is generated. The parameter **D53: ERROR OUT** is set to LOW from the factory.

- Example: Standard specifications

D52: BURN OUT  
HIGH

pin (CN4) position: H

- Example: Optional code/C1

D52: BURN OUT  
LOW

pin (CN4) position: L

F0827.EPS

**(12) Output Status Setup when a Hardware  
Error Occurs (D53: ERROR OUT)**

This parameter allows the setting of the output status when a hardware error occurs. The following three selections are available.

- HOLD; Outputs the last value held before the error occurred.
- HIGH; Outputs an output of 110% when an error has occurred.
- LOW; Outputs an output of -5% when an error has occurred.

Note: A hardware error means CAP MODULE FAULT of Er.01 or AMP MODULE FAULT of Er. 02 which are shown in 8.5.2 "Errors and Countermeasures."

- Example: Set the output status to LOW when a hardware error occurs.

Use the or key to select "LOW."

Press the key twice to enter the setting.

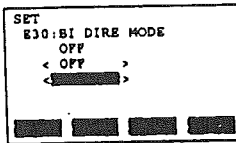
F0828.EPS

47

**(13) Bi-directional Flow Measurement Setup (E30: BI DIRE MODE)**

- (a) This parameter enables selection of 50% output at an input of 0 kPa.  
Procedure is shown in the figure below.
- (b) Combining this with **C40: OUTPUT MODE** provides a square root output computed independently for 0% to 50% output and for 50% to 100% output.

- Example: If measurement range is 0 to 10 kPa (LRV=0 kPa, HRV=10 kPa)



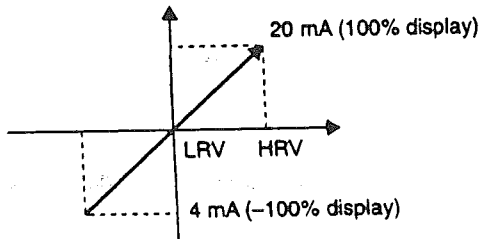
Use the or key to select "ON."  
Press the key twice to enter the setting.

The measurement range changes to -10 to 0 to 10 kPa (output 0% to 50% to 100%).

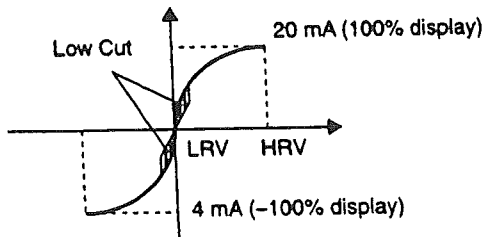
Note that "C21: LOW RANGE" and "C22: HIGH RANGE" are not changed.

F0829.EPS

## ● Output mode "LINEAR"



## ● Output mode "SQUARE ROOT"



F0830.EPS

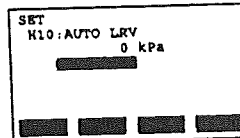
**(14) Range Change while Applying Actual Inputs (H10: AUTO LRV, H11: AUTO HRV)**

This feature allows the lower and higher range values to be set up automatically with the actual input applied. If the lower and higher range values are set, **C21: LOW RANGE** and **C22: HIGH RANGE** are changed at this same time.

Follow the procedure in the figure below.

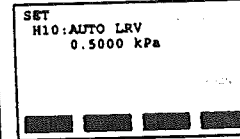
The measurement span is determined by the higher and lower range values. Changing the lower range value results in the higher range value changing automatically, keeping the span constant.

- Example 1: When changing the lower range value to 0.5 kPa for the present setting of 0 to 30 kPa, take the following action with input pressure of 0.5 kPa applied.

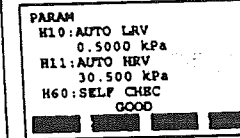


Press the key twice.

The lower range value is changed to 0.5 kPa.



Press the (OK) key.



The higher range value is changed keeping the span constant.

Parameters **C21** and **C22** are changed at the same time.

F0831.EPS

Note that changing the higher range value does not cause the lower range value to change but does change the span.

- Example 2: When the higher range value is to be changed to 10 kPa with the present setting of 0 to 30 kPa, take the following action with an input pressure of 10 kPa applied.

SET  
H11:AUTO HRV  
30 kPa

Press the **ENTER** key twice.  
The higher range value is changed to 10 kPa.

SET  
H11:AUTO HRV  
10.000 kPa

Press the **F4** (OK) key.

PARAM  
H10:AUTO LRV  
0 kPa  
10.000 kPa  
H60:SELF CHECK  
0000

The lower range value is not changed, so the span changes.  
Parameter C22 is changed at the same time.

F0832.EPS

### (15) Zero Point Adjustment (J10: ZERO ADJ, J11: ZERO DEV, J20: EXT ZERO ADJ)

The DPharp supports several adjustment methods. Select the method best suited for the conditions of your application.

Note that output signal can be checked by displaying parameter **A10:OUTPUT (%)** on the BT200.

Adjustment Method	Description
Using the BT200	Set the present input to 0%. Adjust for 0% output at input level of 0%.
	Adjust output to the reference value obtained using other means. If the input level cannot easily be made 0% (because of tank level, etc.), adjust output to the reference value obtained using other means, such as a sight glass.
Using the external zero-adjustment screw	Adjust zero point using the zero-adjustment screw on the transmitter. This permits zero adjustment without using the BT200. Accurately adjust the output current to 4 mA DC or other target output value using an ammeter that accurately reads output currents.

T0810.EPS

- (a) Follow the procedure below when setting the present output to 0% (4 mA).

A10:OUTPUT (%)  
0.5 %

Output is 0.5%.

SET  
J10:ZERO ADJ  
0.0 %

Press the **ENTER** key twice.

SET  
J10:ZERO ADJ  
0.0 %

Zero adjustment is completed.  
Press the **F4** (OK) key.

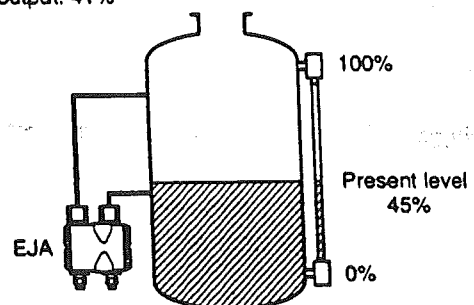
A10:OUTPUT (%)  
0.0 %

Output is 0%.

F0833.EPS

- (b) In tank level measurement, if the actual level cannot be brought to zero for zero adjustment, then the output can be adjusted to correspond to the actual level obtained using another measuring instrument such as a glass gauge.

Present level: 45%  
Present output: 41%



F0834.EPS

- (b)-1 Follow the procedure below to use **J10: ZERO ADJ.**

A10:OUTPUT (%)  
41.0 %

Present output is 41.0%.

SET  
J10:ZERO ADJ  
0.0 %

Enter the present actual level, 40%.  
Press the **ENTER** key twice.

A10:OUTPUT (%)  
40.0 %

The output is changed to 40%.

F0835.EPS

- (b)-2 Follow the procedure below to use J11: ZERO DEV.

A10: OUTPUT (%) 41.0 %	Present output is 41.0%. Output error = $45.0 - 41.0 = 4.0\%$ .
SET J11: ZERO DEV. 2.50 %	Since "J11: ZERO DEV." contains the previous correction, obtain the correction value by adding 4.0% to it. ( $2.50\% + 4.0\% = 6.50\%$ )
SET J11: ZERO DEV. 2.50 %	Set the correction value, 6.50. Press the <b>ENTER</b> key twice.
A10: OUTPUT (%) 45.0 %	The output is changed to 45%.



F0836.EPS

- (c) Zero Point Adjustment Using the External Zero Adjustment Screw

- Enabling/inhibiting of zero point adjustment using the external zero-adjustment screw on the transmitter (J20: EXT ZERO ADJ)

Follow the procedure below to enable or inhibit zero point adjustment from the zero-adjustment screw on the transmitter.

This is set to "ENABLE" when the instrument is shipped.

• Example: Inhibiting zero adjustment by the external zero-adjustment screw	
SET J20: EXT ZERO ADJ ENABLE < ENABLE >	Use the  or  key to select "INHIBIT". Press the <b>ENTER</b> key twice to enter the setting.

F0837.EPS

- Zero point adjustment using external zero-adjustment screw on the transmitter

Turn the zero-adjustment screw on the outside of the transmitter case using a slotted screwdriver. Turn the screw to the right to increase the zero point or to the left to decrease the zero output; the zero adjusts in increments of 0.01% of the range setting.

Note that the amount of adjustment to the zero point changes according to the speed at which the screw is turned. To make fine adjustments, turn the screw slowly; to make coarse adjustments, turn the screw quickly.

Note: When a zero point adjustment has been made, do not turn off the transmitter less than 30 seconds after adjustment.

## (16) Test Output Setup (K10: OUTPUT X%)

This feature can be used to output a fixed current from 3.2 mA (-5%) to 21.6 mA (110%) for loop checks.

- Example: Output 12 mA (50%) fixed current.

SET K10: OUTPUT X % 0.0 %	Set "50.0%". Press the <b>ENTER</b> key twice to output a fixed current at 50%.
SET K10: OUTPUT X % 50.0 % ACTIVE	"Active" is displayed while this is being executed. Press the <b>F4</b> (OK) key to cancel the fixed current output.

F0838.EPS



### IMPORTANT

- Test output is held for approximately 10 minutes, and then released automatically after the time has elapsed. Even if the BT200 power supply is turned off or the communication cable is disconnected during test output, it is held for approximately 10 minutes.
- Press the **F4** (OK) key to release test output immediately.

## (17) User Memo Fields (M: MEMO)

This feature provides 5 user memo fields, each holding up to 8 alphanumeric characters. Up to 5 items such as inspection date, inspector, and other information can be saved in these fields.

- Example: Save an inspection date of January 30, 1995.

PARAM M20: MEMO 2 M30: MEMO 3	Set "95.1.30" in the order of year, month, and day. Press the <b>ENTER</b> key twice to enter the setting.
SET M10: MEMO 1 95.1.30_	

F0839.EPS



## 8.4 Displaying Data Using the BT200

### 8.4.1 Displaying Measured Data

The BT200 can be used to display measured data.

The measured data is updated automatically every 7 seconds. In addition, the display can be updated to the present data value at any time by pressing the **F1** (DATA) key. For parameters associated with the display of measured data, see Subsection 8.3.1, "Parameter Summary."

#### • Example: Display output.

```

MENU
B: SENSOR TYPE
  
```

```

PARAM
XX.X % ←
A11: ENGR. OUTPUT
YY.Y % ←
A20: AMP TEMP
ZZ deg C ←
  
```

Display "A10: OUTPUT (%)."

Data is updated automatically at 7-second intervals.

```

PARAM
A10: OUTPUT (%)
A11: ENGR. OUTPUT
A20: AMP TEMP
  
```

F0640.EPS

### 8.4.2 Display Transmitter Model and Specifications

The BT200 can be used to display the model and specifications of the transmitter.

#### • Example: View transmitter model name.

```

MENU
A: DISPLAY
  
```

Press **ENTER**.

```

PARAM
B10: MODEL
EJA110A-DM
B11: STYLE NO.
S1.01
B20: LRL
- 98.07 kPa
  
```

For the associated parameters, see Subsection 8.3.1, Parameter Summary.

F0841.EPS

## 8.5 Self-Diagnostics

### 8.5.1 Checking for Problems

#### (1) Identifying Problems with BT200

The following four areas can be checked.

- Whether connections are good.
- Whether BT200 was properly operated.
- Whether settings were properly entered.
- History of the errors.

See examples below.

#### • Example 1: Connection errors

```

--WELCOME--
BRAIN TERMINAL
ID: BT200
check connection
push ENTER key
  
```

Press the **ON/OFF** key.

When the panel shown on the left appears, press the **ENTER** key.

```

communication error
  
```

Since communications will be unsuccessful if there is a problem in the connection to the BT200, the display at the left will appear.

Recheck the connection.

Press the **F4** (OK) key.

#### • Example 2: Setting entry errors

```

PARAM
01: MODEL
EJA110A-DM
02: TAG NO.
YOKOGAWA
03: SELF CHECK
ERROR
  
```

The initial data panel shows the result of current transmitter diagnostics.

```

PARAM
C20: PRESS UNIT
kPa
C21: LOW RANGE
600 kPa
C22: HIGH RANGE
600 kPa
  
```

Press the **F2** (DIAG) key in the parameter panel to go to the diagnostics panel (C60: SELF CHECK).

```

DIAG
C60: SELF CHECK
ERROR
< ERROR >
< ILLEGAL LRV >
  
```

An error message is displayed when an error occurs in the diagnostics panel.

F0642.EPS

S1

## • Example 3: Checking the history of the errors

```

MENU
J: ADJUST
K: TEST
H: MEMO
  
```

Connect the BT200 to the transmitter, and call item "P".

```

PARAM
P10: ERROR REC 1
      ERROR
P11: ERROR REC 2
      ERROR
P12: ERROR REC 3
      GOOD
  
```

P10: "ERROR REC 1" displays the last error.

P11: "ERROR REC 2" displays the error one time before the last error occurred.

P12: "ERROR REC 3" displays the error two times before the last error occurred.

P13: "ERROR REC 4" displays the error three times before the last error occurred.

The history of up to four errors can be stored. When the 5th error has occurred, it is stored in "P10". The error stored in "P13" will be deleted, and then, the error in "P12" will be copied to "P13". In this sequence, the history of the most previously occurred error will be removed from memory. "GOOD" will be displayed if there was no previous error.

```

SET
P10: ERROR REC 1
      ERROR
      < ERROR >
      < ILLEGAL LRV >
      < ILLEGAL HRV >
  
```

Select P10: ERROR REC1 and press the **ENTER** key to display the error message.

<(a) SETUP PANEL>

For the details of the messages listed below, see Table 8.5.1 Error Message Summary.

CAP MODULE FAULT	OVER TEMP (CAP)	ILLEGAL LRV
AMP MODULE FAULT	OVER TEMP (AMP)	ILLEGAL HRV
OUT OF RANGE	OVER OUTPUT	ILLEGAL SPAN
OUT OF SP RANGE	OVER DISPLAY	ZERO ADJ OVER

Note 1: Press the **ENTER** key twice in the setting panel (panel 1) to clear all error message (P10 to P13) information.

Note 2: After two hours from when an error occurs, the error message of that error will be recorded. Therefore, if you switch off the transmitter within two hours from when the error occurs, there is no history of that error stored in the transmitter, and this function is meaningless.

F0643.EPS

## (2) Checking with Integral Indicator



## NOTE

If an error is detected in the self-diagnostic, an error number is displayed on the integral indicator. If there is more than one error, the error number changes at two-second intervals. See Table 8.5.1 regarding the error numbers.



F0644.EPS

Figure 8.5.1 Identifying Problems Using the Integral Indicator

52

## 8.5.2 Errors and Countermeasures

The table below shows a summary of error messages.

Table 8.5.1 Error Message Summary

Integral Indicator Display	BT200 Display	Cause	Output Operation during Error	Countermeasure
None	GOOD			
—	ERROR			
Er. 01	CAP MODULE FAULT	Capsule problem.*1	Outputs the signal (Hold, High, or Low) set with parameter D53.	Replace capsule.*2
Er. 02	AMP MODULE FAULT	Amplifier problem.	Outputs the signal (Hold, High, or Low) set with parameter D53.	Replace amplifier.
Er. 03	OUT OF RANGE	Input is outside measurement range limit of capsule.	Outputs high range limit value or low range limit value.	Check input.
Er. 04	OUT OF SP RANGE	Static pressure exceeds specified range.*3	Displays present output.	Check line pressure (static pressure).
Er. 05	OVER TEMP (CAP)	Capsule temperature is outside range (–50 to 130°C).	Displays present output.	Use heat insulation or make lagging to keep temperature within range.
Er. 06	OVER TEMP (AMP)	Amplifier temperature is outside range (–50 to 95°C).	Displays present output.	Use heat insulation or make lagging to keep temperature within range.
Er. 07	OVER OUTPUT	Output is outside high or low range limit value.	Outputs high or low range limit value.	Check input and range setting, and change them as needed.
Er. 08	OVER DISPLAY	Displayed value is outside high or low range limit value.	Displays high or low range limit value.	Check input and display conditions and modify them as needed.
Er. 09	ILLEGAL LRV	LRV is outside setting range.	Holds output immediately before error occurrence.	Check LRV and modify as needed.
Er. 10	ILLEGAL HRV	HRV is outside setting range.	Holds output immediately before error occurrence.	Check HRV and modify as needed.
Er. 11	ILLEGAL SPAN	SPAN is outside setting range.	Holds output immediately before error occurrence.	Check SPAN and change as needed.
Er. 12	ZERO ADJ OVER	Zero adjustment is too large.	Displays present output.	Readjust zero point.

\*1: For Model EJA510A and EJA530A, this error code appears when an illegal overpressure is applied to the pressure sensor in addition to the capsule problem. The Er. 01 will remain even if the normal input pressure is regained.

\*2: For Model EJA510A and EJA530A, restart the power to the transmitter. Then if no error code appears, perform necessary adjustments such as zero-adjustment to continue the operation. If the error code still exists, replace the capsule assembly.

\*3: For Model EJA120A, static pressure cannot be measured. The display is always 0 MPa, but this is not a measured value.

T0811.EPS

## 9. MAINTENANCE

### 9.1 Overview



#### WARNING

Since the accumulated process fluid may be toxic or otherwise harmful, take appropriate care to avoid contact with the body, or inhalation of vapors during draining condensate or venting gas in transmitter pressure-detector section and even after dismounting the instrument from the process line for maintenance.

Maintenance of the transmitter is easy due to its modular construction. This chapter describes the procedures for calibration, adjustment, and the disassembly and reassembly procedures required for component replacement.

Since the transmitters are precision instruments, carefully and thoroughly read the following sections for proper handling during maintenance.



#### IMPORTANT

- As a rule, maintenance of this transmitter should be implemented in a maintenance service shop where the necessary tools are provided.
- The CPU assembly contains sensitive parts that may be damaged by static electricity. Exercise care so as not to directly touch the electronic parts or circuit patterns on the board, for example, by preventing static electrification by using grounded wrist straps when handling the assembly. Also take precautions such as placing a removed CPU assembly into a bag with an antistatic coating.

### 9.2 Calibration Instruments Selection

Table 9.2.1 shows the instruments required for calibration. Select instruments that will enable the transmitter to be calibrated or adjusted to the required accuracy.

The calibration instruments should be handled carefully so as to maintain the specified accuracy.

### 9.3 Calibration

Use the procedure below to check instrument operation and accuracy during periodic maintenance or troubleshooting.

- 1) Connect the instruments as shown in Figure 9.3.1 and warm up the instruments for at least five minutes.



#### IMPORTANT

- To adjust the transmitter for highest accuracy, make adjustments with the power supply voltage and load resistance including leadwire resistances set close to the conditions under which the transmitter is installed.
- If the measurement range 0% point is 0 kPa or shifted in the positive direction (suppressed zero), the reference pressure should be applied as shown in the figure.  
If the measurement range 0% point is shifted in the negative direction (elevated zero), the reference pressure should be applied using a vacuum pump.

- 2) Apply reference pressures of 0%, 50%, and 100% of the measurement range to the transmitter. Calculate the errors (differences between digital voltmeter readings and reference pressures) as the pressure is increased from 0% to 100% and is decreased from 100% to 0%, and confirm that the errors are within the required accuracy.

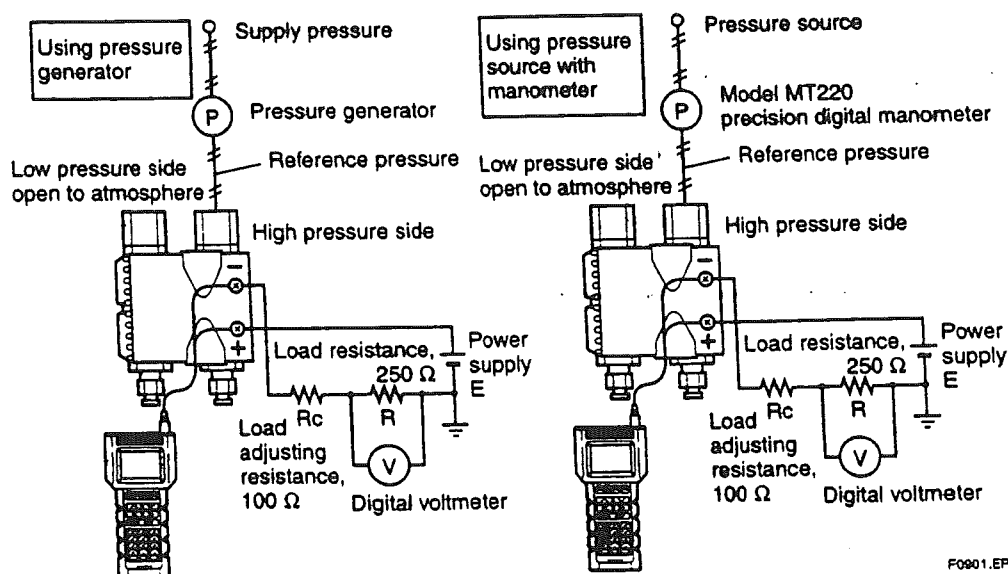
54

Table 9.2.1 Instruments Required for Calibration

Name	Yokogawa-recommended Instrument	Remarks
Power supply	Model SDBT or SDBS distributor	4 to 20 mA DC signal
Load resistor	Model 2792 standard resistor [250 $\Omega$ $\pm$ 0.005%, 3 W]	
	Load adjustment resistor [100 $\Omega$ $\pm$ 1%, 1 W]	
Voltmeter	Model 2501 A digital multimeter Accuracy (10V DC range): $\pm$ (0.002% of rdg + 1 dgt)	
Digital manometer	Model MT220 precision digital manometer 1) For 10 kPa class Accuracy: $\pm$ (0.015% of rdg + 0.015% of F.S.) ..... for 0 to 10 kPa $\pm$ (0.2% of rdg + 0.1% of F.S.) ..... for -10 to 0 kPa 2) For 130 kPa class Accuracy: $\pm$ 0.02% of rdg ..... for 25 to 130 kPa $\pm$ 5 digits ..... for 0 to 25 kPa $\pm$ (0.2% of rdg + 0.1% of F.S.) ..... for -80 to 0 kPa 3) For 700 kPa class Accuracy: $\pm$ (0.02% of rdg + 3 digits) ..... for 100 to 700 kPa $\pm$ 5 digits ..... for 0 to 100 kPa $\pm$ (0.2% of rdg + 0.1% of F.S.) ..... for -80 to 0 kPa 4) For 3000 kPa class Accuracy: $\pm$ (0.02% of rdg + 10 digits) ..... for 0 to 3000 kPa $\pm$ (0.2% of rdg + 0.1% of F.S.) ..... for -80 to 0 kPa 5) For 130 kPa abs class Accuracy: $\pm$ (0.03% of rdg + 6 digits) ..... for 0 to 130 kPa abs	Select a manometer having a pressure range close to that of the transmitter.
Pressure generator	Model 7674 pneumatic pressure standard for 200 kPa (2 kgf/cm <sup>2</sup> ), 25 kPa (2500 mmH <sub>2</sub> O) Accuracy: $\pm$ 0.05% of F.S.	Requires air pressure supply.
	Dead weight gauge tester 25 kPa (2500 mmH <sub>2</sub> O) Accuracy: $\pm$ 0.03% of setting	Select the one having a pressure range close to that of the transmitter.
Pressure source	Model 6919 pressure regulator (pressure pump) Pressure range: 0 to 133 kPa (1000 mmHg)	Prepare the vacuum pump for negative pressure ranges.

T0901.EPS

Note: The above table contains the instruments capable of performing calibration to the 0.2% level. Since special maintenance and management procedures involving traceability of each instrument to higher-level standards are required for calibration to the 0.1% level, there are difficulties in calibration to this level in the field. For calibration to the 0.1% level, contact Yokogawa representatives from which the instrument was purchased or the nearest Yokogawa office.



F0901.EPS

Figure 9.3.1 Instrument Connections

## 9.4 Disassembly and Reassembly

This section describes procedures for disassembly and reassembly for maintenance and component replacement.

Always turn OFF power and shut off and release pressures before disassembly. Use proper tools for all operations. Table 9.4.1 shows the tools required.

Table 9.4.1 Tools for Disassembly and Reassembly

Tool	Quantity	Remarks
Phillips screwdriver	1	JIS B4633, No. 2
Slotted screwdriver	1	
Allen wrenches	2	JIS B4648 One each, nominal 3 and 5 mm Allen wrenches
Wrench	1	Width across flats, 17 mm
Torque wrench	1	
Adjustable wrench	1	
Socket wrench	1	Width across flats, 16 mm
Socket driver	1	Width across flats, 5.5 mm
Tweezers	1	

T0902.EPS

### CAUTION

#### Precautions for CENELEC and SAA Flameproof Type Transmitters

- Flameproof type transmitters must be, as a rule, removed to a non-hazardous area for maintenance and be disassembled and reassembled to the original state.
  - On the flameproof type transmitters the two covers are locked, each by an Allen head bolt (shrouding bolt). When a shrouding bolt is driven clockwise by an Allen wrench, it is going in and cover lock is released, and then the cover can be opened.
- When a cover is closed it should be locked by a shrouding bolt without fail. Tighten the shrouding bolt to a torque of 0.7 N·m.

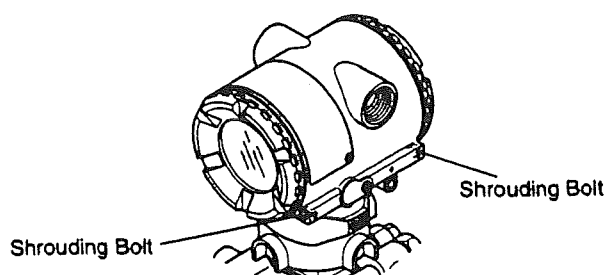


Figure 9.4 Shrouding Bolts

### 9.4.1 Replacing the Integral Indicator

#### CAUTION

#### Cautions for Flameproof Type Transmitters

Users are prohibited by law from modifying the construction of a flameproof type transmitter. This would invalidate the agency approval and the transmitter's use in such rated area. Thus the user is prohibited from using a flameproof type transmitter with its integral indicator removed, or from adding an integral indicator to a transmitter. If such modification is absolutely required, contact Yokogawa.

This subsection describes the procedure for replacing an integral indicator. (See Figure 9.4.1)

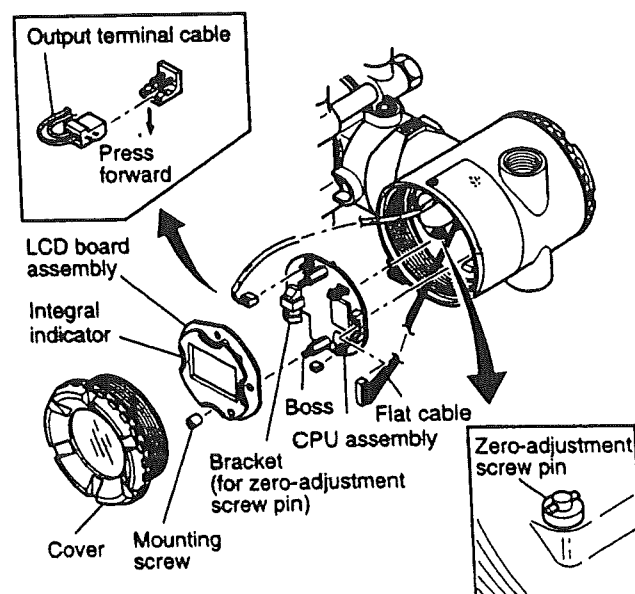
#### ■ Removing the Integral Indicator

- 1) Remove the cover.
- 2) Supporting the integral indicator by hand, loosen its two mounting screws.
- 3) Dismount the LCD board assembly from the CPU assembly.

When doing this, carefully pull the LCD board assembly straight forward so as not to damage the connector pins between it and the CPU assembly.

#### ■ Attaching the Integral Indicator

- 1) Align both the LCD board assembly and CPU assembly connectors and engage them.
- 2) Insert and tighten the two mounting screws.
- 3) Replace the cover.



F0903.EPS

Figure 9.4.1 Removing and Attaching LCD Board Assembly and CPU Assembly

## 9.4.2 Replacing the CPU Board Assembly

This subsection describes the procedure for replacing the CPU assembly. (See Figure 9.4.1)

### ■ Removing the CPU Assembly

- 1) Remove the cover. If an integral indicator is mounted, refer to Subsection 9.4.1 and remove the indicator.
- 2) Turn the zero-adjustment screw to the position (where the screw head slot is horizontal) as shown in Figure 9.4.1.
- 3) Disconnect the output terminal cable (cable with brown connector at the end). When doing this, lightly press the side of the CPU assembly connector and pull the cable connector to disengage.
- 4) Use a socket driver (width across flats, 5.5mm) to loosen the two bosses.
- 5) Carefully pull the CPU assembly straight forward to remove it.
- 6) Disconnect the flat cable (cable with black connector at the end) that connects the CPU assembly and the capsule.



### NOTE

Be careful not to apply excessive force to the CPU assembly when removing it.

### ■ Mounting the CPU Assembly

- 1) Connect the flat cable (with black connector) between the CPU assembly and the capsule.
- 2) Connect the output terminal cable (with brown connector).



### NOTE

Make certain that the cables are free of pinching between the case and the CPU assembly edge.

- 3) Align and engage the zero-adjustment screw pin with the groove on the bracket on the CPU assembly. Then insert the CPU board assembly straight onto the post in the amplifier case.
- 4) Tighten the two bosses. If the transmitter is equipped with an integral indicator, refer to Subsection 9.4.1 to mount the indicator.



### NOTE

Confirm that the zero-adjustment screw pin is placed properly in the groove on the bracket prior to tightening the two bosses. If it is not, the zero-adjustment mechanism will be damaged.

- 5) Replace the cover.

## 9.4.3 Cleaning and Replacing the Capsule Assembly

This subsection describes the procedures for cleaning and replacing the capsule assembly. (See Figure 9.4.2.)



### CAUTION

#### Cautions for Flameproof Type Transmitters

Users are prohibited by law from modifying the construction of a flameproof type transmitter. If you wish to replace the capsule assembly with one of a different measurement range, contact Yokogawa.

The user is permitted, however, to replace a capsule assembly with another of the same measurement range. When doing so, be sure to observe the following.

- The replacement capsule assembly must have the same part number as the one being replaced.
- The section connecting the transmitter and capsule assembly is a critical element in preservation of flameproof performance, and must be checked to verify that it is free of dents, scratches, and other defects.
- After completing maintenance, be sure to securely tighten the Allen screws that fasten the transmitter section and pressure-detector section together.

## ■ Removing the Capsule Assembly



### IMPORTANT

Exercise care as follows when cleaning the capsule assembly.

- Handle the capsule assembly with care, and be especially careful not to damage or distort the diaphragms that contact the process fluid.
- Do not use a chlorinated or acidic solution for cleaning.
- Rinse thoroughly with clean water after cleaning.

- 1) Remove the CPU assembly as shown in Subsection 9.4.2.
- 2) Remove the two Allen screws that connect the transmitter section and pressure-detector section.
- 3) Separate the transmitter section and pressure-detector section.
- 4) Remove the nuts from the four flange bolts.
- 5) Hold the capsule assembly by hand and remove the cover flange.
- 6) Remove the capsule assembly.
- 7) Clean the capsule assembly or replace with a new one.

### ■ Reassembling the Capsule Assembly

- 1) Insert the capsule assembly between the flange bolts, paying close attention to the relative positions of the H (high pressure side) and L (low pressure side) marks on the capsule assembly. Replace the two capsule gaskets with new gaskets.
- 2) Install the cover flange on the high pressure side, and use a torque wrench to tighten the four nuts uniformly to a torque shown below.

Model	EJA110A	EJA120A	EJA130A
Torque(N·m) (kgf·m)	39(4)		147 (15)

- 3) After the pressure-detector section has been reassembled, a leak test must be performed to verify that there are no pressure leaks.
- 4) Reattach the transmitter section to the pressure-detector section.
- 5) Tighten the two Allen screws. (Tighten the screws to a torque of 5 N·m)
- 6) Install the CPU assembly according to Subsection 9.4.2.
- 7) After completing reassembly, adjust the zero point and recheck the parameters.

Pressure-detector section

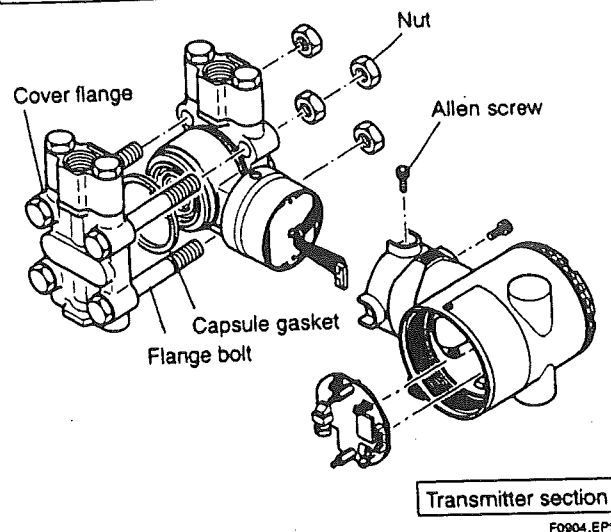


Figure 9.4.2 Removing and Mounting the Pressure-detector Section

### 9.4.4 Replacing the Process Connector Gaskets

This subsection describes process connector gasket replacement. (See Figure 9.4.3.)

- (a) Loosen the two bolts, and remove the process connectors.
- (b) Replace the process connector gaskets.
- (c) Remount the process connectors. Tighten the bolts securely and uniformly to a torque of 39 to 49 N·m (4 to 5 kgf·m), and verify that there are no pressure leaks.

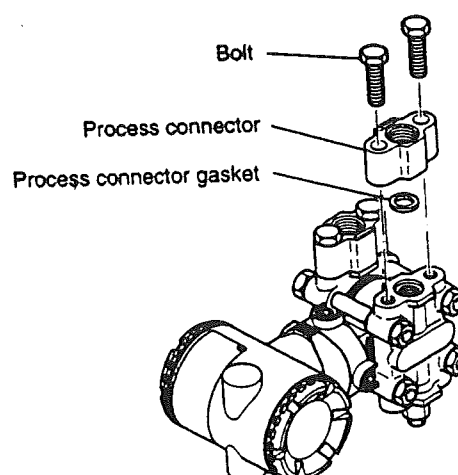


Figure 9.4.3 Removing and Mounting the Process Connector



58

## 9.5 Troubleshooting

If any abnormality appears in the measured values, use the troubleshooting flow chart below to isolate and remedy the problem. Since some problems have complex causes, these flow charts may not identify all. If you have difficulty isolating or correcting a problem, contact Yokogawa service personnel.

### 9.5.1 Basic Troubleshooting

First determine whether the process variable is actually abnormal or a problem exists in the measurement system.

If the problem is in the measurement system, isolate the problem and decide what corrective action to take.

This transmitter is equipped with a self-diagnostic function which will be useful in troubleshooting; see Section 8.5 for information on using this function.

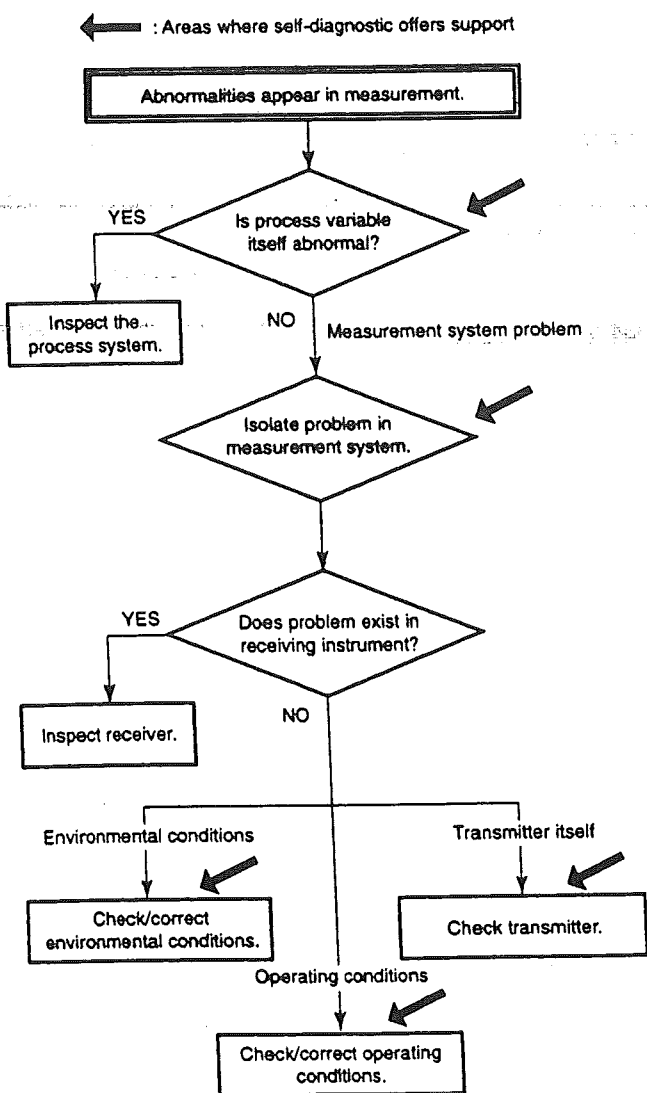
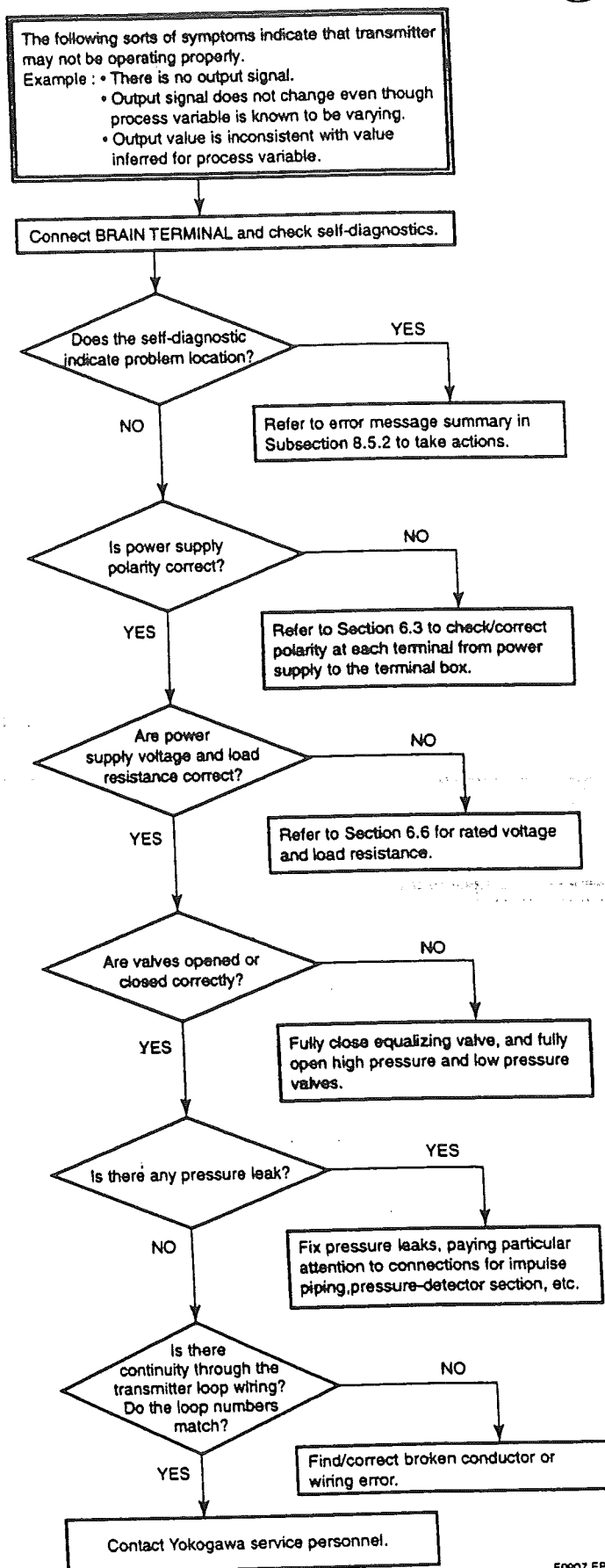


Figure 9.5.1 Basic Flow and Self-Diagnostics

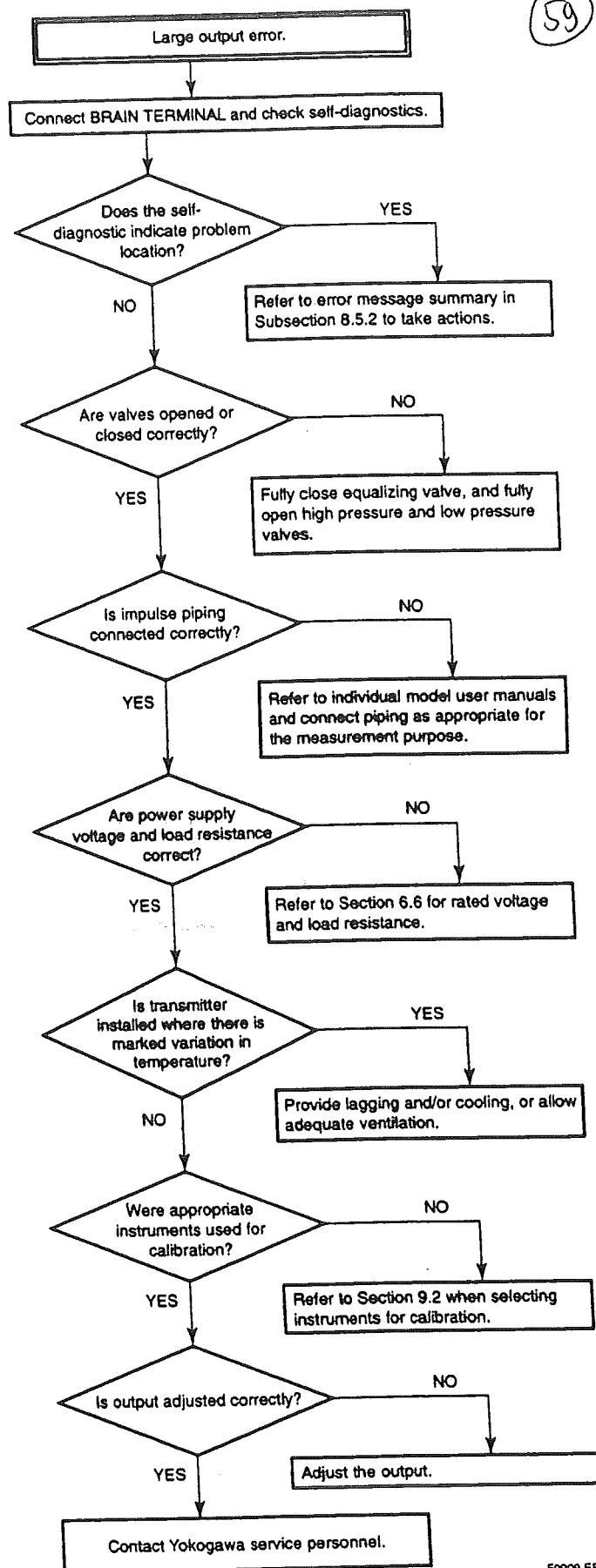
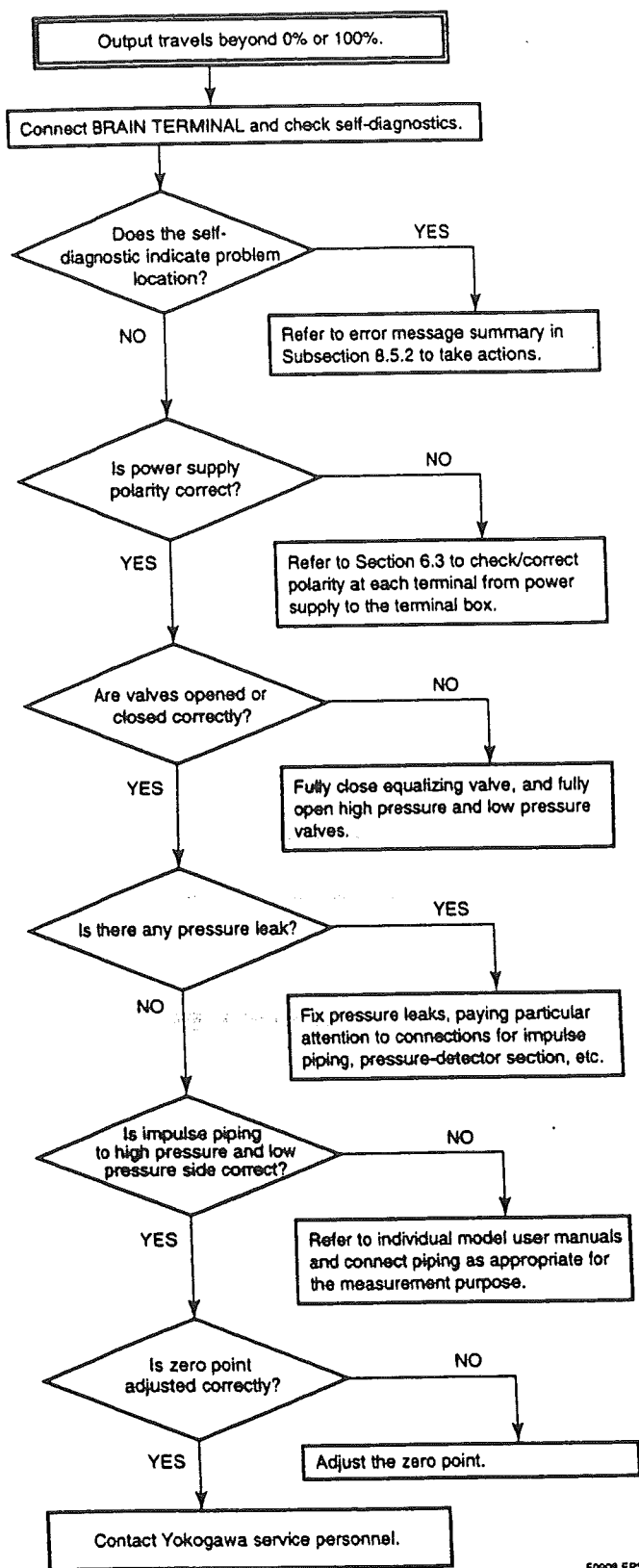
### 9.5.2 Troubleshooting Flow Charts



F0906.EPS

F0907.EPS

59



# 10. GENERAL SPECIFICATIONS

## 10.1 Standard Specifications

Refer to IM 01C22T02-01E for Fieldbus communication type marked with "◇".

### ● Performance Specifications

See General Specifications sheet, GS 01C21B01-00E, GS 01C21B03-00E, and GS 01C21B04-00E.

### ● Functional Specifications

#### Span & Range Limits

##### EJA110A and EJA130A:

Measurement Span and Range	kPa	inH <sub>2</sub> O (D1)	mbar (D3)	mmH <sub>2</sub> O (D4)
L	Span	0.5 to 10	2 to 40	5 to 1000
	Range	-10 to 10	-40 to 40	-1000 to 1000
M	Span	1 to 100	4 to 400	10 to 10000
	Range	-100 to 100	-400 to 400	-10000 to 10000
H	Span	5 to 500	20 to 2000	50 to 5000
	Range	-500 to 500	-2000 to 2000	-5000 to 5000
V	Span	0.14 to 14 MPa	20 to 2000 psi	1.4 to 140 bar
	Range	-0.5 to 14 MPa	-71 to 2000 psi	-5 to 140 bar

T1001.EPS

\* For Wetted parts material code other than S, the ranges are 0 to 14 MPa, 0 to 2000 psi, 0 to 140 bar, and 0 to 140 kgf/cm<sup>2</sup>.

##### EJA120A:

Measurement Span and Range	kPa	inH <sub>2</sub> O (D1)	mbar (D3)	mmH <sub>2</sub> O (D4)
E	Span	0.1 to 1	0.4 to 4	1 to 10
	Range	-1 to 1	-4 to 4	-10 to 10

T1002.EPS

URL is define as the Upper Range Limit from the table above.

#### Zero Adjustment Limits:

Zero can be fully elevated or suppressed, within the Lower and Upper Range Limits of the capsule.

#### External Zero Adjustment "◇":

External zero is continuously adjustable with 0.01% incremental resolution of span. Span may be adjusted locally using the digital indicator with range switch.

#### Output "◇":

Two wire 4 to 20 mA DC output with digital communications, linear or square root programmable. BRAIN or HART FSK protocol are superimposed on the 4 to 20 mA signal.

#### Failure Alarm:

Output status at CPU failure and hardware error;  
Up-scale: 110%, 21.6 mA DC or more(standard)  
Down-scale: -5%, 3.2 mA DC  
Note: Applicable for Output signal code D and E

#### Damping Time Constant (1st order):

The sum of the amplifier and capsule damping time constant must be used for the overall time constant. Amp damping time constant is adjustable from 0.2 to 64 seconds.

Capsule (Silicone Oil)	L	M	H	V	E
Time Constant (approx. sec)	0.4	0.3	0.3	0.3	0.2

T1003.EPS

#### Ambient Temperature Limits:

\* Safety approval codes may affect limits.

EJA110A, EJA130A

-40 to 85°C (-40 to 185°F)

-30 to 80°C (-22 to 176°F) with LCD Display

EJA120A

-25 to 80°C (-13 to 176°F)

#### Process Temperature Limits:

\* Safety approval codes may affect limits.

EJA110A, EJA130A

-40 to 120°C (-40 to 248°F)

EJA120A

-25 to 80°C (-13 to 176°F)

#### Maximum Overpressure:

See General Specifications sheet.

#### Working Pressure Limits (Silicone Oil)

##### Maximum Pressure Limit:

See 'Model and Suffix Codes'

##### Minimum Pressure Limit:

###### Capsule

L, M, H (EJA110A)

M, H (EJA130A)

E (EJA120A)

###### Pressure

See Figure 1.

See Figure 1.

-50 kPa (-7.25 psig)

## ● Installation

### Supply & Load Requirements "◇":

- \* Safety approvals can affect electrical requirements. See Section 6.6, 'Power Supply Voltage and Load Resistance.'

### Supply Voltage "◇":

10.5 to 42 V DC for general use and flameproof type  
10.5 to 32 V DC for lightning protector (Optional code /A)  
10.5 to 30 V DC for intrinsically safe, Type n, nonincendive, or non-sparking type  
Minimum voltage limited at 16.4 V DC for digital communications, BRAIN and HART

**EMC Conformity Standards:** CE, N200  
EN61326, AS/NZS 2064

### Communication Requirements "◇":

#### BRAIN

##### Communication Distance;

Up to 2 km (1.25 miles) when using CEV polyethylene-insulated PVC-sheathed cables.  
Communication distance varies depending on type of cable used.

##### Load Capacitance;

0.22 µF or less (see note)

##### Load Inductance;

3.3 mH or less (see note)

##### Input Impedance of communicating device;

10 kΩ or more at 2.4 kHz.

Note: For general-use and Flameproof type.  
For Intrinsically safe type, please refer to 'Optional Specifications.'

#### HART

##### Communication Distance;

Up to 1.5 km (1 mile) when using multiple twisted pair cables. Communication distance varies depending on type of cable used.  
Use the following formula to determine cable length for specific applications:

$$L = \frac{65 \times 10^6}{(R \times C)} - \frac{(C_1 + 10,000)}{C}$$

Where:

L = length in meters or feet

R = resistance in Ω (including barrier resistance)

C = cable capacitance in pF/m or pF/ft

C<sub>1</sub> = maximum shunt capacitance of receiving devices in pF/m or pF/ft

## ● Physical Specifications

### Wetted Parts Materials:

**Diaphragm, Cover flange, Process connector and Drain/Vent Plug;**

See 'Model and Suffix Codes'

### Capsule Gasket;

Teflon-coated SUS316L

### Process Connector Gasket;

PTFE Teflon (EJA110A and EJA120A)

Fluorinated Rubber (EJA110A and EJA120A with Optional code /N2 and /N3 and EJA130A with Process connection code 3 and 4)

Glass reinforced Teflon (EJA130A with Process connection code 1 and 2)

### Non-wetted Parts Materials:

#### Bolting;

SCM435, SUS630, or SUH660

#### Housing;

Low copper cast-aluminum alloy with polyurethane paint (Munsell 0.6GY3.1/2.0)

#### Degrees of Protection

IP67, NEMA4X, JIS C0920 immersion proof

#### Cover O-rings;

Buna-N

#### Data plate and tag;

SUS304

#### Fill Fluid;

Silicone or Fluorinated oil (optional)

#### Weight:

3.9 kg (8.6 lb) without mounting bracket or process connector (EJA110A)

#### Connections:

Refer to the 'Model and Suffix Codes' to specify the process and electrical connection type.

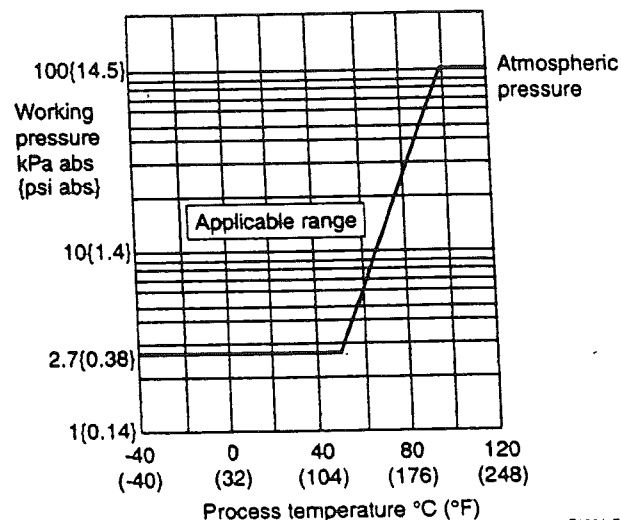
### < Settings When Shipped > "◇"

Tag Number	As specified in order *1
Output Mode	'Linear' unless otherwise specified in order
Display Mode	'Linear' unless otherwise specified in order
Operation Mode	'Normal' unless otherwise specified in order
Damping Time Constant *2	'2 sec.'
Calibration Range Lower Range Value	As specified in order
Calibration Range Higher Range Value	As specified in order
Calibration Range Units	Selected from mmH <sub>2</sub> O, mmHg, mmWG, mmHg, Pa, hPa, kPa, MPa, mbar, bar, gf/cm <sup>2</sup> , kgf/cm <sup>2</sup> , inH <sub>2</sub> O, inHg, ftH <sub>2</sub> O, or psi. (Only one unit can be specified)

T1004.EPS

\*1: Up to 16 alphanumeric characters (including - and .) will be entered in the amplifier memory.

\*2: If using square root output, set damping time constant to 2 sec. or more.



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Figure 1. Working Pressure and Process Temperature

## 10.2 Model and Suffix Codes

### ● Model EJA110A

Model	Suffix Codes	Description
EJA110A	.....	Differential pressure transmitter
Output Signal	-D .....	4 to 20 mA DC with digital communication (BRAIN protocol)
	-E .....	4 to 20 mA DC with digital communication (HART protocol, see IM 01C22T01-01E)
	-F .....	Digital communication (FOUNDATION Fieldbus protocol, see IM 01C22T02-01E)
Measurement span(capsule)	L .....	0.5 to 10 kPa (50 to 1000 mmH <sub>2</sub> O)
	M .....	1 to 100 kPa (100 to 10000 mmH <sub>2</sub> O)
	H .....	5 to 500 kPa (0.05 to 5 kgf/cm <sup>2</sup> )
	V .....	0.14 to 14 MPa (1.4 to 140 kgf/cm <sup>2</sup> )
Wetted parts material	S .....	[Body] (Note 3) SCS14A [Capsule] SUS316L (Note 1) [Vent plug] SUS316
	H .....	SCS14A Hastelloy C-276 (Note 2) SUS316
	M .....	SCS14A Monel (Note 3) SUS316
	T .....	SCS14A Tantalum (Note 3) SUS316
	A .....	Hastelloy C-276 equiv. (Note 4) Hastelloy C-276 (Note 2) Hastelloy C-276
	D .....	Hastelloy C-276 equiv. (Note 4) Tantalum (Note 2) Hastelloy C-276
	B .....	Monel equivalent (Note 5) Monel Monel
Process connections	0 .....	without process connector (Rc1/4 female on the cover flanges)
	1 .....	with Rc1/4 female process connector
	2 .....	with Rc1/2 female process connector
	3 .....	with 1/4 NPT female process connector
	4 .....	with 1/2 NPT female process connector
	5 .....	without process connector (1/4 NPT female on the cover flanges)
Bolts and nuts material	A .....	SCM435 [Maximum working pressure] 16 MPa (160 kgf/cm <sup>2</sup> ) (Note 6)
	B .....	SUS630 16 MPa (160 kgf/cm <sup>2</sup> ) (Note 6)
	C .....	SUH660 16 MPa (160 kgf/cm <sup>2</sup> ) (Note 6)
Installation	-2 .....	Vertical impulse piping type, right side high pressure, process connector upside
	-3 .....	Vertical impulse piping type, right side high pressure, process connector downside
	-6 .....	Vertical impulse piping type, left side high pressure, process connector upside
	-7 .....	Vertical impulse piping type, left side high pressure, process connector downside
	-8 .....	Horizontal impulse piping type, right side high pressure
	-9 .....	Horizontal impulse piping type, left side high pressure
Electrical connection	0 .....	G1/2 female, one electrical connection
	2 .....	1/2 NPT female, two electrical connections without blind plug
	3 .....	Pg 13.5 female, two electrical connections without blind plug
	4 .....	M20 female, two electrical connections without blind plug
	5 .....	G1/2 female, two electrical connections and a blind plug
	7 .....	1/2 NPT female, two electrical connections and a blind plug
	8 .....	Pg 13.5 female, two electrical connections and a blind plug
	9 .....	M20 female, two electrical connections and a blind plug
Integral indicator	D .....	Digital indicator
	E .....	Digital indicator with the range setting switch
	N .....	(None)
Mounting bracket	A .....	SECC Carbon steel 2-inch pipe mounting (flat type)
	B .....	SUS304 2-inch pipe mounting (flat type)
	C .....	SECC Carbon steel 2-inch pipe mounting (L type)
	D .....	SUS304 2-inch pipe mounting (L type)
	N .....	(None)
Optional codes		/ <input type="checkbox"/> Optional specification

T1005.EPS

Example: EJA110A-DMS5A-92NN/□

Note 1: Diaphragm; Hastelloy C-276. Other wetted parts materials; SUS316L

Note 2: Diaphragm and other wetted parts.

Note 3: Body; Material of cover flanges and process connectors.

Note 4: Indicated material is equivalent to ASTM CW-12MW.

Note 5: Indicated material is equivalent to ASTM M35-2.

Note 6: For Capsule code L when combined with Wetted parts material code H, M, T, A, D, and B, the maximum working pressure is 3.5 MPa(35 kgf/cm<sup>2</sup>).

## ● Model EJA120A

Model	Suffix Codes	Description
<b>EJA120A</b>	.....	Differential pressure transmitter (for draft application)
Output Signal	-D .....	4 to 20 mA DC with digital communication (BRAIN protocol)
	-E ..... (Note 1)	4 to 20 mA DC with digital communication (HART protocol)
	-F ..... (Note 4)	Digital communication (FOUNDATION Fieldbus protocol)
Measurement span (capsule)	E .....	0.1 to 1 kPa (10 to 100 mmH <sub>2</sub> O)
Wetted parts material	S .....	[Body] (Note 3) [Capsule] [Vent plug] SCS14A SUS316L (Note 2) SUS316
Process connections	0 .....	without process connector (Rc1/4 female on the cover flanges)
	1 .....	with Rc1/4 female process connector
	2 .....	with Rc1/2 female process connector
	3 .....	with 1/4 NPT female process connector
	4 .....	with 1/2 NPT female process connector
	5 .....	without process connector (1/4 NPT female on the cover flanges)
Bolts and nuts material	A .....	[Maximum working pressure] SCM435 50 kPa {0.5 kgf/cm <sup>2</sup> }
	B .....	SUS630 50 kPa {0.5 kgf/cm <sup>2</sup> }
	C .....	SUH660 50 kPa {0.5 kgf/cm <sup>2</sup> }
Installation	-2 .....	Vertical impulse piping type, right side high pressure, process connector upside
	-3 .....	Vertical impulse piping type, right side high pressure, process connector downside
	-6 .....	Vertical impulse piping type, left side high pressure, process connector upside
	-7 .....	Vertical impulse piping type, left side high pressure, process connector downside
	-8 .....	Horizontal impulse piping type, right side high pressure
	-9 .....	Horizontal impulse piping type, left side high pressure
Electrical connection	0 .....	G1/2 female, one electrical connection
	2 .....	1/2 NPT female, two electrical connections without blind plug
	3 .....	Pg 13.5 female, two electrical connections without blind plug
	4 .....	M20 female, two electrical connections without blind plug
	5 .....	G1/2 female, two electrical connections and a blind plug
	7 .....	1/2 NPT female, two electrical connections and a blind plug
	8 .....	Pg 13.5 female, two electrical connections and a blind plug
	9 .....	M20 female, two electrical connections and a blind plug
Integral indicator	D .....	Digital indicator
	E .....	Digital indicator with the range setting switch
	N .....	(None)
Mounting bracket	A .....	SECC Carbon steel 2-inch pipe mounting (flat type)
	B .....	SUS304 2-inch pipe mounting (flat type)
	C .....	SECC Carbon steel 2-inch pipe mounting (L type)
	D .....	SUS304 2-inch pipe mounting (L type)
	N .....	(None)
Optional codes		/ <input type="checkbox"/> Optional specification

T1006.EPS

Example: EJA120A-DES5A-92NN/□

Note 1: Refer to IM 01C22T01-01E for HART Protocol version.

Note 2: Diaphragm; Hastelloy C-276. Other wetted parts materials; SUS316L.

Note 3: Body; Material of cover flanges and process connectors.

Note 4: Refer to IM 01C22T02-01E for Fieldbus communication.

64

## ● Model EJA130A

Model	Suffix Codes	Description
EJA130A	.....	Differential pressure transmitter
Output Signal	-D .....	4 to 20 mA DC with digital communication (BRAIN protocol)
	-E ..... (Note 1)	4 to 20 mA DC with digital communication (HART protocol)
	-F ..... (Note 4)	Digital communication (FOUNDATION Fieldbus protocol)
Measurement span(capsule)	M .....	1 to 100 kPa (100 to 10000 mmH <sub>2</sub> O)
	H .....	5 to 500 kPa (0.05 to 5 kgf/cm <sup>2</sup> )
Wetted parts material	[Body] (Note 3)	[Capsule] [Vent plug]
	S .....	SUS316 SUS316L (Note 2) SUS316
Process connection	0 .....	without process connector (Rc1/4 female on the cover flange)
	1 .....	with Rc1/4 female process connector
	2 .....	with Rc1/2 female process connector
	3 .....	with 1/4 NPT female process connector (Note 5)
	4 .....	with 1/2 NPT female process connector (Note 5)
	5 .....	without process connector (1/4 NPT female on the cover flanges)
Bolts and nuts material	A .....	SCM435 32 MPa (320 kgf/cm <sup>2</sup> )
	B .....	SUS630 32 MPa (320 kgf/cm <sup>2</sup> )
	C .....	SUH660 32 MPa (320 kgf/cm <sup>2</sup> )
		[Maximum working pressure]
Installation	-2 .....	Vertical impulse piping type, right side high pressure, process connector upside
	-3 .....	Vertical impulse piping type, right side high pressure, process connector downside
	-6 .....	Vertical impulse piping type, left side high pressure, process connector upside
	-7 .....	Vertical impulse piping type, left side high pressure, process connector downside
	-8 .....	Horizontal impulse piping type, right side high pressure
	-9 .....	Horizontal impulse piping type, left side high pressure
Electrical connection	0 .....	G1/2 female, one electrical connection
	2 .....	1/2 NPT female, two electrical connections without blind plug
	3 .....	Pg 13.5 female, two electrical connections without blind plug
	4 .....	M20 female, two electrical connections without blind plug
	5 .....	G1/2 female, two electrical connections and a blind plug
	7 .....	1/2 NPT female, two electrical connections and a blind plug
	8 .....	Pg 13.5 female, two electrical connections and a blind plug
	9 .....	M20 female, two electrical connections and a blind plug
Integral indicator	D .....	Digital indicator
	E .....	Digital indicator with the range setting switch
	N .....	(None)
Mounting bracket	A .....	SECC Carbon steel 2-inch pipe mounting (flat type)
	B .....	SUS304 2-inch pipe mounting (flat type)
	C .....	SECC Carbon steel 2-inch pipe mounting (L type)
	D .....	SUS304 2-inch pipe mounting (L type)
	N .....	(None)
Optional codes		/ <input type="checkbox"/> Optional specification

T1007.EPS

Example: EJA130A-DMS5A-92NN/☐

Note 1: Refer to IM 01C22T01-01E for HART Protocol version.

Note 2: Diaphragm; Hastelloy C-276. Other wetted parts materials; SUS316L.

Note 3: Body; Material of cover flanges: SUS316, Process connectors: SCS14A.

Note 4: Refer to IM 01C22T02-01E for Fieldbus communication.

Note 5: Lower limit of ambient and process temperature is -15°C.

## 10.3 Optional Specifications

Item	Description	Code
Factory Mutual (FM)	FM Explosionproof Approval Explosionproof for Class I, Division 1, Groups B, C and D Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G Hazardous (classified) locations, indoors and outdoors ( NEMA 4X ) Temperature class: T6 Amb. Temp.: -40 to 60 °C (-40 to 140 °F)	FF1
	FM Intrinsically safe Approval Intrinsically Safe for Class I, Division 1, Groups A, B, C & D, Class II, Division 1, Groups E, F & G and Class III, Division 1 Hazardous Locations. Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division. 2, Groups E, F & G, and Class III, Division 1 Hazardous Locations. Enclosure: "NEMA 4X", Temp. Class: T4, Amb. Temp.: -40 to 60 °C (-40 to 140 °F) Intrinsically Safe Apparatus Parameters [Groups A, B, C, D, E, F and G] Vmax=30 V, Imax=165 mA, Pmax=0.9 W, Ci=22.5 nF, Li=730 µH [Groups C, D, E, F and G] Vmax=30 V, Imax=225 mA, Pmax=0.9 W, Ci=22.5 nF, Li=730 µH	FS1
	Combined FF1 and FS1	FU1
CENELEC ATEX	CENELEC ATEX (KEMA) Flameproof Approval II 2G EExd IIC T4, T5, T6 Amb. Temp.: T5: -40 to 80 °C (-40 to 176 °F), T4 and T6: -40 to 75 °C (-40 to 176 °F) Max. process Temp.: T4; 120 °C (248 °F), T5; 100 °C (212 °F), T6; 85 °C (185 °F)	KF2
	CENELEC ATEX (KEMA) Intrinsically safe Approval II 1G EEx ia IIC T4, Amb. Temp.: -40 to 60 °C (-40 to 140 °F) Ui=30 V, Ii=165 mA, Pi=0.9 W, Ci=22.5 nF, Li=730 µH	KS2
	Combined KF2, KS2, Type n, and Dust Approval Type n: II 3G Ex nL IIC T4, Amb. Temp.: -40 to 60 °C (-40 to 140 °F) Ui=30 V, Ci=22.5 nF, Li=730 µH Dust: II 1D Maximum surface temperature T65 °C (Tamb.: 40 °C), T85 °C (Tamb.: 60 °C), and T105 °C (Tamb.: 80 °C)	KU2
Canadian Standards Association (CSA)	CSA Explosionproof Approval Explosionproof for Class I, Division 1, Groups B, C and D Dustignitionproof for Class II/III, Division 1, Groups E, F and G Division 2 'SEALS NOT REQUIRED', Temp. Class : T4, T5, T6 Encl Type 4x Max. Process Temp.: T4; 120 °C (248 °F), T5; 100 °C (212 °F), T6; 85 °C (185 °F) Amb. Temp.: -40 to 80 °C (-40 to 176 °F)	CF1
	CSA Intrinsically safe Approval Class I, Groups A, B, C and D Class II and III, Groups E, F and G Encl Type 4x, Temp. Class: T4, Amb. Temp.: -40 to 60 °C (-40 to 140 °F) Vmax=30 V, Imax=165 mA, Pmax=0.9 W, Ci=22.5 nF, Li=730 µH	CS1
	Combined CF1 and CS1	CU1
Standards Association of Australia (SAA)	SAA Flameproof, Intrinsically safe and Non-sparking Approval Ex d IIC T4/T5/T6, IP67 class I, Zone 1, Amb. Temp.: -40 to 80 °C (-40 to 176 °F) Max. Process Temp.: T4; 120 °C (248 °F), T5; 100 °C (212 °F), T6; 85 °C (185 °F) Ex ia IIC T4, IP67 class I, Zone 0 Ex ia I, IP67 class I, Zone 0 Ex n IIC T4, IP67 class I, Zone 2 Ui=30 V DC, Ii=165 mA DC, Wi=0.9 W, Amb. Temp.: -40 to 60 °C (-40 to 140 °F)	SU1

T1008.EPS



Item		Description	Code	
Painting	Color change	Amplifier cover only	P□	
	Coating change	Epoxy resin-baked coating	X1	
Lightning protector		Transmitter power supply voltag: 10.5 to 32 V DC (10.5 to 30 V DC for intrinsically safe type, 9 to 32 V DC for Fieldbus communication type.) Allowable current: Max. 6000 A (1×40 μs), Repeating 1000 A (1×40 μs) 100 times	A	
Oil-prohibited use		Degrease cleansing treatment	K1	
		Degrease cleansing treatment and with fluorinated oilfilled capsule. Operating temperature -20 to 80 °C	K2	
Oil-prohibited use with dehydrating treatment		Degrease cleansing treatment and dehydrating treatment	K5	
		Degrease cleansing treatment and dehydrating treatment with fluorinated oilfilled capsule. Operating temperature -20 to 80 °C	K6	
Calibration units	P calibration ( psi unit )	( See Table for Span and Range Limits.)	D1	
	bar calibration ( bar unit )		D3	
	M calibration (kgf/cm <sup>2</sup> unit )		D4	
Sealing treatment to SUS630 nuts		Sealant ( liquid silicone rubber ) is coated on surfaces of SUS630 nuts used for cover flange mounting.	Y	
Long vent		Total vent plug Length: 112 mm (standard, 32 mm), Material: SUS316	U	
Fast response		Update time: 0.125 sec or less, see GS for response time	F1	
Failure alarm down-scale *1		Output status at CPU failure and hardware error is -5%, 3.2 mA or less.	C1	
NAMUR NE43 compliant *1	Output signal limits: 3.8 mA to 20.5 mA	Failure alarm down-scale: output status at CPU failure and hardware error is -5%, 3.2 mA or less.	C2	
		Failure alarm up-scale: output status at CPU failure and hardware error is 110%, 21.6 mA or more.	C3	
Stainless steel amplifier housing		Amplifier housing material: SCS14A stainless steel (equivalent to SUS316 cast stainless steel or ASTM CF-8M)	E1	
Gold-plate		Gold-plated diaphragm	A1	
Configuration		Custom software configuration (Applicable for Model EJA110A and EJA130A)	R1	
Body option		Without drain and vent plugs	N1	
		N1 and Process connection on both sides of cover flange with blind kidney flanges on back	N2	
		N1, N2, and Mill certificate for cover flange, diaphragm, capsule body, and blind kidney flange	N3	
Stainless steel tag plate		JIS SUS 304 stainless steel tag plate wired onto transmitter	N4	
High Accuracy type		High Accuracy (Applicable for Model EJA120A)	HAC	
European Pressure Equipment Directive *2		PED 97/23/EC (Applicable for Model EJA130A) CATEGORY: III, Module: H, Type of Equipment: Pressure Accessory - Vessel, Type of Fluid: Liquid and Gas, Group of Fluid: 1 and 2	PE3	
Mill Certificate		Cover flange	M01	
		Cover flange, Process connector	M11	
Pressure test/Leak test Certificate	Test Pressure: 3.5 MPa(35 kgf/cm <sup>2</sup> )		Nitrogen(N <sub>2</sub> ) Gas *3 Retention time: 10 minutes	T01
	Test Pressure: 16 MPa(160 kgf/cm <sup>2</sup> )			T12
	Test Pressure: 50 kPa(0.5 kgf/cm <sup>2</sup> )			T04
	Test Pressure: 32 MPa(320 kgf/cm <sup>2</sup> )			T09

T1009.EP

\*1: Applicable for Output signal code D and E. The hardware error indicates faulty amplifier or capsule. When combining with Optional code F1, output status for down-scale is -2.5%, 3.6 mA DC or less.

\*2: Lower limit of process temperature is -30°C when Bolts and nuts material code A is selected.

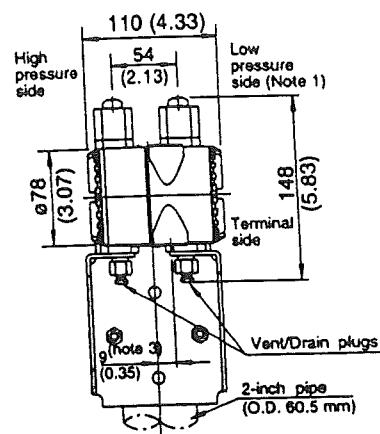
\*3: Applicable for EJA110A and EJA120A. For EJA130A, the test fluid is water or Nitrogen (N<sub>2</sub>) gas.

T1009.EPS

● Model EJA110A and EJA120A

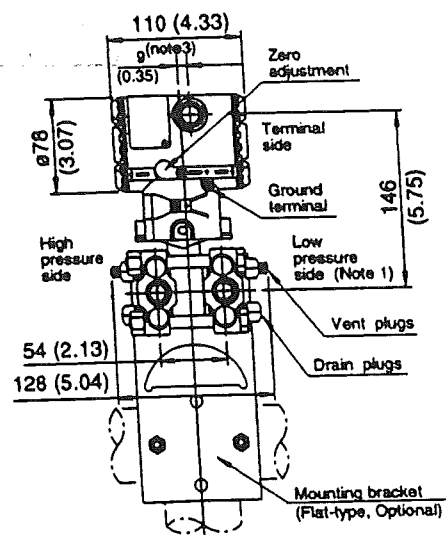
**Vertical Impulse Piping Type**  
**Process connector upside (INSTALLATION CODE '6') (For CODE '2', '3' or '7',**  
**refer to the notes below.)**

Unit: mm (approx. inch)



F1002.EPS

**Horizontal Impulse Piping Type**  
(INSTALLATION CODE '9') (For CODE '8', refer to the notes below.)



F1003.EPS

Note 2: When INSTALLATION CODE '3' or '7' is selected, process connection and mounting bracket on above figure are reversed.

Note 3: 15 mm (0.59 inch) for right side high pressure. (for CODE '2', '3' or '8')  
12 mm (0.47 inch) for EJA120A.

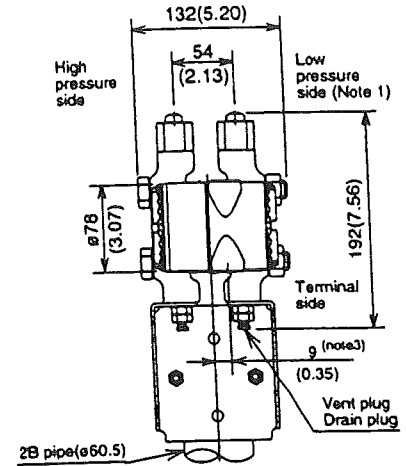
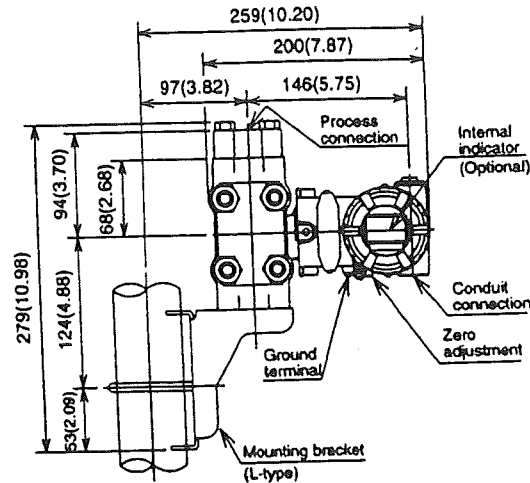
68

## ● Model EJA130A

**Vertical Impulse Piping Type**

**Process connector upside (INSTALLATION CODE '6') (For CODE '2', '3' or '7', refer to the notes below.)**

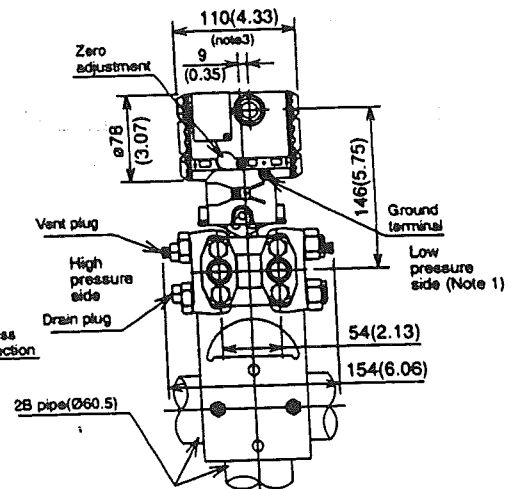
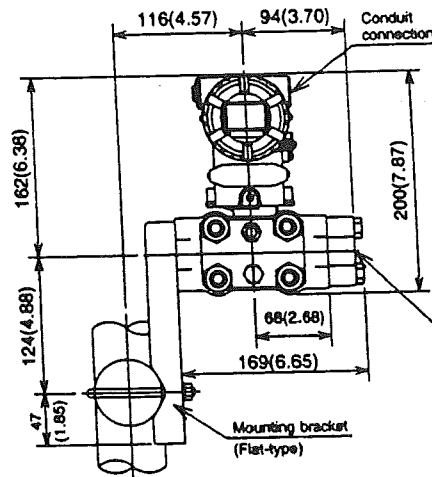
Unit: mm (approx. inch)



F1004.EPS

**Horizontal Impulse Piping Type**

**(INSTALLATION CODE '9') (For CODE '8', refer to the notes below)**



F1005.EPS

Note 1: When INSTALLATION CODE '2', '3' or '8' is selected, high and low pressure side on above figure are reversed.

(i. e. High pressure side is on the right side.)

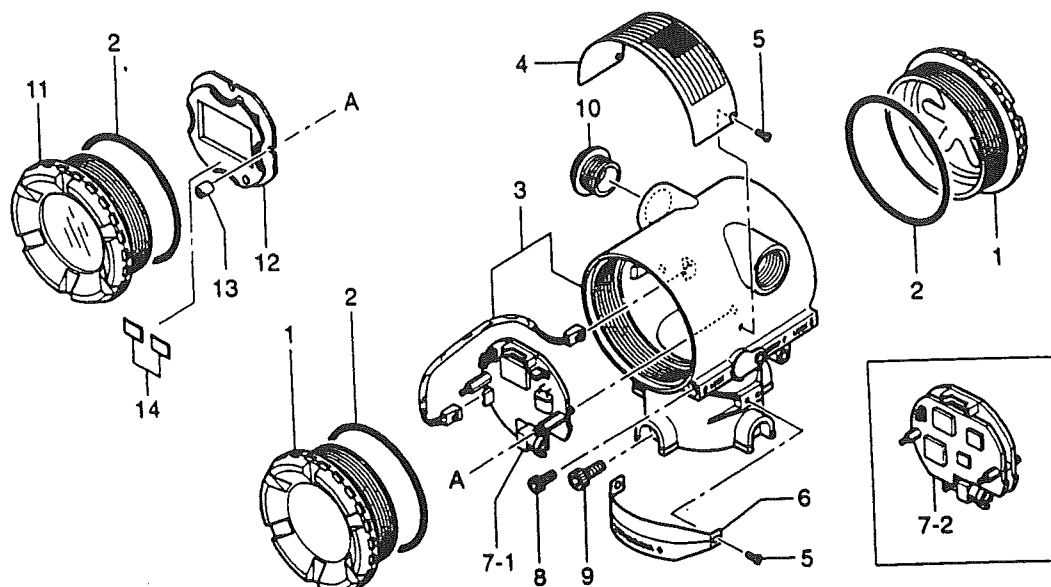
Note 2: When INSTALLATION CODE '3' or '7' is selected, process connection and mounting bracket on above figure are reversed.

Note 3: 9 mm (0.35 inch) for right side high pressure type. (CODE '2', '3' or '8').

# Customer Maintenance Parts List

## DPharp EJA Series Transmitter Section

DPharp



Item	Part No.	Qty	Description
1	Bellow F9341RA F9341RJ	2	Cover Cast-aluminum alloy SCS14A stainless steel
2	F9341JP	2	O-ring
3	Below	1	Case Assembly (Note 1)
	F9341AA F9341AC F9341AE F9341AH F9341AJ		Cast-aluminum alloy for G1/2 Cast-aluminum alloy for G1/2 (two electrical connections) Cast-aluminum alloy for 1/2 NPT (two electrical connections) Cast-aluminum alloy for M20 (two electrical connections) Cast-aluminum alloy for Pg13.5 (two electrical connections)
	F9341AR		SCS14A stainless steel for 1/2 NPT (two electrical connections)
4	—	1	Name Plate
5	Bellow F9300AG Y9303JU	4	Screw For cast-aluminum alloy case assembly For SCS14A stainless steel case assembly
6	F9341KL	1	Tag Plate
7-1	Below F9342AB F9342AL F9342AF	1	CPU Assembly For BRAIN protocol version For HART protocol version For BRAIN protocol version(Optional code /F1)
	F9342AM F9342BF F9342BG		For HART protocol version with write protection switch (Optional code /F1) For FOUNDATION Fieldbus protocol version
7-2	F9342BG	1	For FOUNDATION Fieldbus protocol version with PID/LM function (Optional code /LC1)
8	Y9406ZU	2	Cap Screw
9	Y9612YU	2	Screw
10	Below F9340NW F9340NX G9330DP G9612EB	1	Plug For Pg13.5 For M20 For G1/2 For 1/2 NPT
11	Bellow F9341FM F9341FJ	1	Cover Assembly Cast-aluminum alloy SCS14A stainless steel
12	Below F9342BL	1	LCD Board Assembly Without range-setting switch
	F9342BM F9342MK F9300PB		With range-setting switch Mounting Screw Label

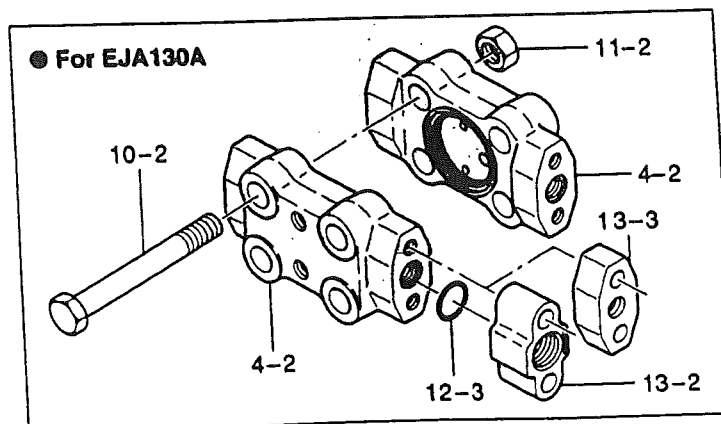
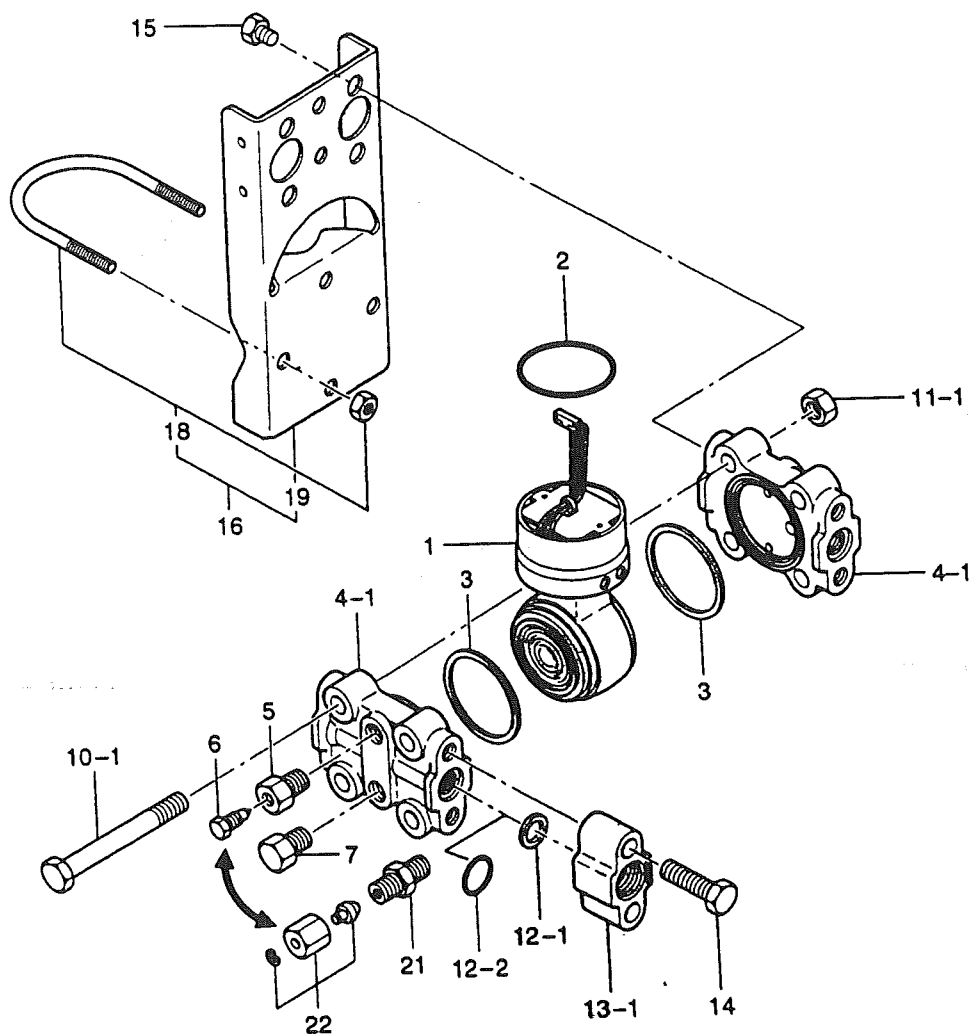
For integral indicator

(Note 1) Applicable for BRAIN and HART protocol versions (Output signal code D and E). For FOUNDATION Fieldbus protocol version (Output signal code F), consult Yokogawa local office.

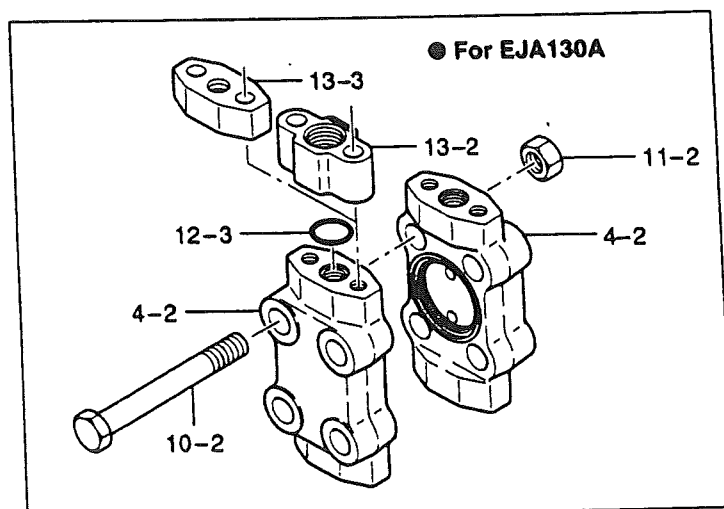
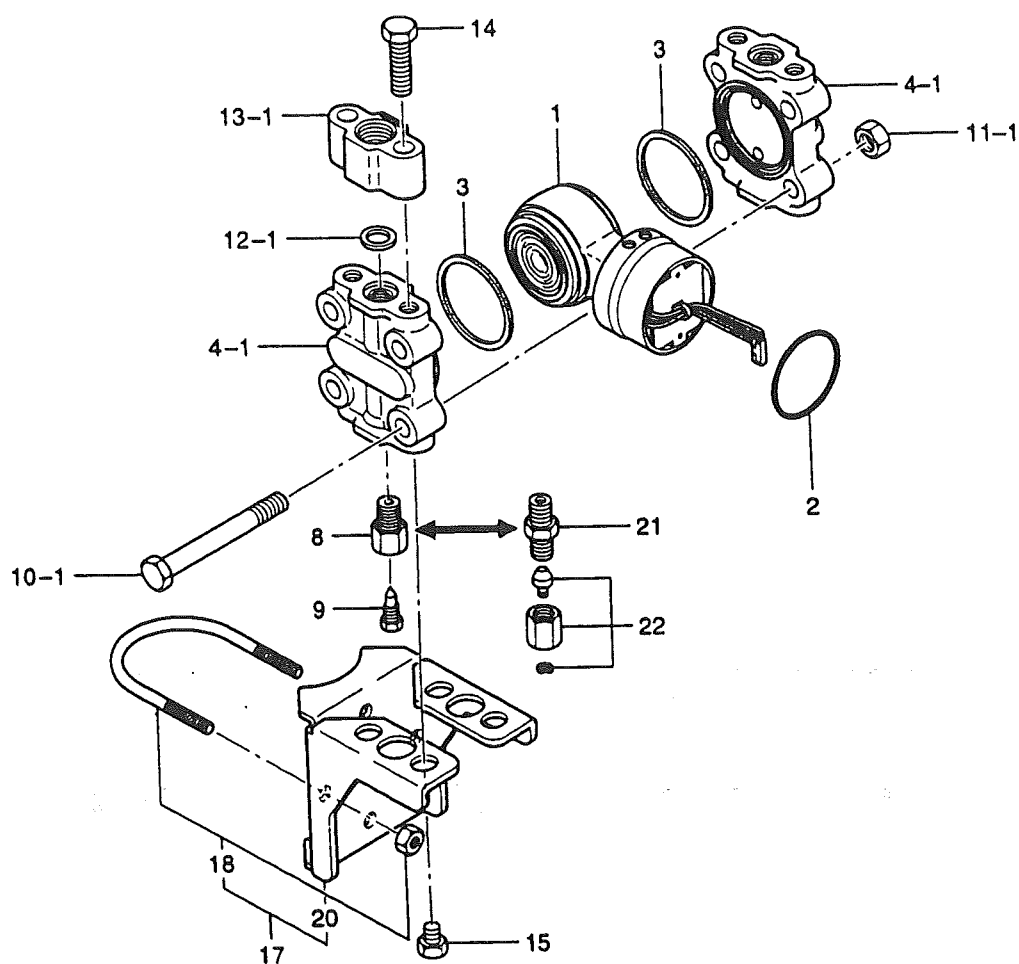
# Customer Maintenance Parts List

Model EJA110A, EJA120A and EJA130A *DP*<sub>HERP</sub>  
Differential Pressure Transmitter  
(Pressure-detector Section)

## Horizontal Impulse Piping Type



# Vertical Impulse Piping Type



Item	Part No.	Qty	Description
1	—	1	Capsule Assembly (see Table 1, Table 2 and Table 3 on page 5) (Note 1)
2	F9300AJ	1	O-Ring
3	Below	2	Gasket
	F9340GA		Teflon-coated SUS316L Stainless Steel
	F9340GC		Teflon-coated SUS316L Stainless Steel (degreased) } (for EJA110A with Wetted Parts Material code S)
	F9340GE		PTFE Teflon } (for EJA110A with Wetted Parts Material
	F9340GF		PTFE Teflon (degreased) } code H, M, T, A, D and B and EJA120A)
	F9300FD		Teflon-coated SUS316L Stainless Steel
	F9300FR		Teflon-coated SUS316L Stainless Steel (degreased) } (for EJA130A)
4-1	Below	2	Cover Flange for EJA110A and EJA120A (Note 2)
	F9340VA		Rc 1/4 } SCS14A Stainless Steel (for EJA110A with Wetted Parts Material code S)
	F9340VB		1/4 NPT } For Horizontal Impulse Piping Type
	F9340VC		Rc 1/4 } SCS14A Stainless Steel (for EJA110A with Wetted Parts Material code S)
	F9340VD		1/4 NPT } For Vertical Impulse Piping Type
	F9340VP		Rc 1/4 } SCS14A Stainless Steel (for EJA110A with Wetted Parts Material code H, M and T and EJA120A) For Horizontal Impulse Piping Type
	F9340VR		1/4 NPT } SCS14A Stainless Steel (for EJA110A with Wetted Parts Material code H, M and T and EJA120A) For Vertical Impulse Piping Type
	F9340VN		Rc 1/4 } SCS14A Stainless Steel (for EJA110A with Wetted Parts Material code H, M and T and EJA120A) For Horizontal Impulse Piping Type
	F9340VQ		1/4 NPT } Hastelloy C-276 equivalent (for EJA110A with Wetted Parts Material code A and D)
	F9340VS		Rc 1/4 } For Horizontal Impulse Piping Type
	F9340VT		1/4 NPT } For Horizontal Impulse Piping Type
	F9340VU		Rc 1/4 } Hastelloy C-276 equivalent (for EJA110A with Wetted Parts Material code A and D)
	F9340VV		1/4 NPT } For Vertical Impulse Piping Type
	F9340TP		Rc 1/4 } Monel equivalent (for EJA110A with Wetted Parts Material code B)
	F9340TR		1/4 NPT } For Horizontal Impulse Piping Type
	F9340TN		Rc 1/4 } Monel equivalent (for EJA110A with Wetted Parts Material code B)
	F9340TQ		1/4 NPT } For Vertical Impulse Piping Type
4-2	Below	2	Cover Flange for EJA130A (Note 2)
	F9340UA		Rc 1/4 SUS316 Stainless Steel (for Horizontal Impulse Piping Type)
	F9340UC		Rc 1/4 SUS316 Stainless Steel (for Vertical Impulse Piping Type)
	F9340UH		1/4 NPT SUS316 Stainless Steel (for Horizontal Impulse Piping Type)
	F9340UJ		1/4 NPT SUS316 Stainless Steel (for Vertical Impulse Piping Type)
5	Below	2	Vent Plug
	F9340SA		R 1/4 } SUS316 Stainless Steel (for EJA110A with Wetted Parts
	F9340SB		1/4 NPT } Material code S, H, M and T, EJA120A and EJA130A)
	F9340SE		R 1/4 } Hastelloy C-276 (for EJA110A with Wetted Parts Material code A and D)
	F9340SF		1/4 NPT } Monel (for EJA110A with Wetted Parts Material code B)
	F9340SS		R 1/4 }
	F9340ST		1/4 NPT }
6	Below	2	Vent Screw
	D0114PB		SUS316 Stainless Steel (for Models except EJA110A with Wetted Parts Material codes A, D and B)
	F9340SK		Hastelloy C-276 (for EJA110A with Wetted Parts Material code A and D)
	F9270HG		Monel (for EJA110A with Wetted Parts Material code B)
7	Below	2	Drain Plug (Note 2)
	F9200CS		R 1/4 } SUS316 Stainless Steel (for EJA110A with Wetted Parts
	D0114RZ		1/4 NPT } Material code S, H, M and T, EJA120A and EJA130A)
	F9340SL		R 1/4 } Hastelloy C-276 (for EJA110A with Wetted Parts Material code A and D)
	F9340SM		1/4 NPT }
	F9340SW		R 1/4 }
	D0117MS		1/4 NPT } Monel (for EJA110A with Wetted Parts Material code B)
8	Below	2	Drain/Vent Plug
	F9340SC		R 1/4 } SUS316 Stainless Steel (for EJA110A with Wetted Parts
	F9340SD		1/4 NPT } Material code S, H, M and T, EJA120A and EJA130A)
	F9340SG		R 1/4 } Hastelloy C-276 (for EJA110A with Wetted Parts Material code A and D)
	F9340SH		1/4 NPT }
	F9340SU		R 1/4 }
	F9340SV		1/4 NPT } Monel (for EJA110A with Wetted Parts Material code B)
9	Below	2	Drain/Vent Screw
	F9270HE		SUS316 Stainless Steel (for Models except EJA110A with Wetted Parts Material code A, D and B)
	F9340SJ		Hastelloy C-276 (for EJA110A with Wetted Parts Material code A and D)
	D0117MR		Monel (for EJA110A with Wetted Parts Material code B)
10-1	Below	4	Bolt (for EJA110A and EJA120A)
	F9340AB		SCM435 Chrome Molybdenum Steel
	F9340AC		SUS630 Stainless Steel
	F9340AQ		SUH660 Stainless Steel
10-2	Below	4	Bolt (for EJA130A)
	F9340AF		SCM435 Chrome Molybdenum Steel
	F9340AG		SUS630 Stainless Steel
	F9340AS		SUH660 Stainless Steel
11-1	Below	4	Nut (for EJA110A and EJA120A)
	F9275KL		SCM435 Chrome Molybdenum Steel
	F9275KH		SUS630 Stainless Steel
	F9340BQ		SUH660 Stainless Steel
11-2	Below	4	Nut (for EJA130A)
	F9300GB		SCM435 Chrome Molybdenum Steel
	F9300GD		SUS630 Stainless Steel
	F9340BS		SUH660 Stainless Steel

Item	Part No.	Qty	Description
12-1	Below D0114RB U0102XC	2	Gasket (for EJA110A and EJA120A) PTFE Teflon
12-2	Below F9340GN	2	PTFE Teflon (degreased) Gasket (for EJA110A and EJA120A with Optional code /N2 and /N3) Fluorinated Rubber
12-3	F9340GP Below F9340GN F9340GP F9202FJ	2	Fluorinated Rubber (degreased) Gasket (for EJA130A) Fluorinated Rubber Fluorinated Rubber (degreased) } For Process connection code 3 and 4 Glass Reinforced Teflon } For Process connection code 1 and 2
13-1	F9201HA Below F9340XY F9340XW F9340XZ  F9340XX F9340WY F9340WW F9340WZ F9340WX  F9340TY F9340TW F9340TZ F9340TX Below	2	Glass Reinforced Teflon (degreased) Process Connector (for EJA110A and EJA120A)(Note 2) Rc 1/4 Rc 1/2 1/4 NPT } SCS14A Stainless Steel (for EJA110A with Wetted Parts Material code S, H, M and T and EJA120A) 1/2 NPT Rc 1/4 Rc 1/2 1/4 NPT } Hastelloy C-276 equivalent (for EJA110A with Wetted Parts Material code A and D) 1/2 NPT Rc 1/4 Rc 1/2 1/4 NPT 1/2 NPT } Monel equivalent (for EJA110A with Wetted Parts Material code B)
13-2	Below F9340XT F9340XS	2	Process Connector (for EJA130A with Process connection code 3 and 4)(Note 2) 1/4 NPT } SCS14A Stainless Steel 1/2 NPT }
13-3	Below F9271FD F9271FC	2	Process Connector (for EJA130A with Process connection code 1 and 2)(Note 2) Rc 1/4 } SUS316 Stainless Steel Rc 1/2 }
14	Below X0100MN F9273DZ F9340AZ	4	Bolt SCM435 Chrome Molybdenum Steel SUS630 Stainless Steel SUH660 Stainless Steel
15	Below F9270AY F9273CZ	4	Bolt
16	Below F9270AW F9300TJ	1	S15C Carbon Steel SUS XM7 Stainless Steel Bracket Assembly (Flat type) SECC Carbon Steel SECC Carbon Steel (for Epoxy resin-baked coating)
17	F9300TA Below F9340EA F9340EB F9340EC	1	SUS304 Stainless Steel Bracket Assembly (L type) SECC Carbon Steel SECC Carbon Steel (for Epoxy resin-baked coating) SUS304 Stainless Steel
18	D0117XL-A	1	U-Bolt/Nut Assembly, SUS304 Stainless Steel
19	Below F9270AX F9300TN F9300TE	1	Bracket (Flat type) SECC Carbon Steel SECC Carbon Steel (for Epoxy resin-baked coating) SUS304 Stainless Steel
20	Below F9340EF F9340EG F9340EM	1	Bracket (L type) SECC Carbon Steel SECC Carbon Steel (for Epoxy resin-baked coating) SUS304 Stainless Steel
21	Below F9275EC F9275ED F9275EE	2	Vent Plug (degreased), SUS316 Stainless Steel R 1/4 1/4 NPT
22		2	Needle Assembly (degreased), SUS316 Stainless Steel

(Note 1) In case of degrease cleansing treatment (Optional code/K1 or K5), consult YOKOGAWA local office.  
(However, see Table 1, Table 2 and Table 3 in case of Optional code/K2 or K6)

(Note 2) In case of degrease cleansing treatment (Optional code/K1, K2, K5 or K6), consult YOKOGAWA local office.



## ■ Capsule Assembly Part Number

### ● EJA110A

Table 1. Capsule Assembly Part Number (Item 1)

For General-use type, Flameproof type and Intrinsically safe type

Installation of Transmitter	High Pressure Side	Capsule Code	Wetted Parts Material Code				
			S(*1)	S(*2)	H, A	T, D	M, B
Horizontal Impulse Piping Type	Right	L	F9349AA	F9352AA	F9349AE	F9349AJ	F9349AN
		M	F9349BA	F9352BA	F9349BE	F9349BJ	F9349BN
		H	F9349CA	F9352CA	F9349CE	F9349CJ	F9349CN
		V	F9349DA	F9352DA	F9349DE	F9349DJ	F9349DN
	Left	L	F9349AB	F9352AB	F9349AF	F9349AK	F9349AP
		M	F9349BB	F9352BB	F9349BF	F9349BK	F9349BP
		H	F9349CB	F9352CB	F9349CF	F9349CK	F9349CP
		V	F9349DB	F9352DB	F9349DF	F9349DK	F9349DP
Vertical Impulse Piping Type	Right	L	F9349AC	F9352AC	F9349AG	F9349AL	F9349AQ
		M	F9349BC	F9352BC	F9349BG	F9349BL	F9349BQ
		H	F9349CC	F9352CC	F9349CG	F9349CL	F9349CQ
		V	F9349DC	F9352DC	F9349DG	F9349DL	F9349DQ
	Left	L	F9349AD	F9352AD	F9349AH	F9349AM	F9349AR
		M	F9349BD	F9352BD	F9349BH	F9349BM	F9349BR
		H	F9349CD	F9352CD	F9349CH	F9349CM	F9349CR
		V	F9349DD	F9352DD	F9349DH	F9349DM	F9349DR

### ● EJA120A

Table 2. Capsule Assembly Part Number (Item 1)

For General-use type, Flameproof type and Intrinsically safe type

Installation of Transmitter	High Pressure Side	Capsule Code	Part No. (*1)	Part No. (*2)
Horizontal Impulse Piping Type	Right	E	F9349EA	F9352EA
	Left	E	F9349EB	F9352EB
Vertical Impulse Piping Type	Right	E	F9349EC	F9352EC
	Left	E	F9349ED	F9352ED

### ● EJA130A

Table 3. Capsule Assembly Part Number (Item 1)

For General-use type, Flameproof type and Intrinsically safe type

Installation of Transmitter	High Pressure Side	Capsule Code	Part No. (*1)	Part No. (*2)
Horizontal Impulse Piping Type	Right	M	F9359AA	F9359EA
		H	F9359BA	F9359FA
	Left	M	F9359AB	F9359EB
		H	F9359BB	F9359FB
Vertical Impulse Piping Type	Right	M	F9359AC	F9359EC
		H	F9359BC	F9359FC
	Left	M	F9359AD	F9359ED
		H	F9359BD	F9359FD

\*1. Silicone oil filled capsule (Standard)

\*2. Fluorinated oil filled capsule (for oil-prohibited use: Optional code /K2 or K6)

# REVISION RECORD

Title: Model EJA110A, EJA120A and EJA130A Differential Pressure Transmitter  
Manual No.: IM 01C21B01-01E

Edition	Date	Page	Revised Item
1st	Jun. 1997	—	New publication
2nd	Mar. 1998	CONTENTS 1-1 5-3 6-1 11-1 11-3 11-7 2-9+ CMPL	Page 3 • Add REVISION RECORD. 1 • Add 'NOTE' notice for FOUNDATION Fieldbus and HART protocol versions. 5.1.1 • Correct the mounting procedure for Direct-Mounting Type 3-valve Manifold. 6.1 • Add item to the Wiring Precautions. 11.1 • Add FOUNDATION Fieldbus protocol. 11.2 • Add Output signal code F and Wetted parts material code A and D. 11.3 • Add Optional code A1. • Change the figure of terminal configuration. CMPL 1C21A1-02E 1st ⇒ 2nd Page 2 • Add Item 7-2. CMPL 1C21B1-01E 1st ⇒ 2nd Page 3 • Add Part No. to Item 3, 4, 5, 6, 7, 8, 9, and 13. Page 4 • Add Wetted parts material code A and D. CMPL 1C21B3-01E 1st ⇒ 2nd Page 3, 4 • Add Optional code K5 and K6. CMPL 1C21B4-01E 1st ⇒ 2nd Page 3, 4 • Delete Optional code K5 and K6.
3rd	Sep. 1998	2-13 8-18 11-1 11-3 11-4 11-5 CMPL	2.10 • Delete EMC Conformity Standards Tables. 8.3.2(11) • Correction made in BURN OUT figure. 11.1 • Add Capsule code V. 11.2 • Add Capsule code V. • Add Wetted parts material code M. • Add Electrical connection code 7, 8, and 9. • Add Electrical connection code 7, 8, and 9. • Add Electrical connection code 7, 8, and 9. CMPL 1C21A1-02E 2nd ⇒ 3rd Page 2 • Add Part No. to Item 3 (For PG13.5 and M20). • Add Part No. to Item 10 (For 1/2NPT, PG13.5, and M20). CMPL 1C21B1-01E 2nd ⇒ 3rd Page 4 • Add Capsule code V and Wetted parts material code M to Table 1. CMPL 1C21B4-01E 2nd ⇒ 3rd Page 3 • Add Part No. to Item 13 (For Rc1/4 and Rc1/2). • Add Part No. to Item 4, 5, 7, and 8 (For Rc1/4).
4th	Oct. 1999	— 2-8 8-4 10-3 CMPL	Revised a book in a new format. (The location of contents and the associated page numbers may not coincide with the one in old editions.) 2.10 • Add AS/NZS 2064 1/2 to EMI, EMC Conformity Standards. 8.3.1 • Move Parameter Summary table to Chapter 8. 10.2 • Add Wetted parts material code B. CMPL 1C21A1-02E 3rd ⇒ 4th • Change a format. CMPL 1C21B0-01E 1st • Combine CMPL 1C21B1-01E, 1C21B3-01E, and 1C21B4-01E.
5th	Sep. 2000	2-8 8-5 9-5 10-2 10-3 10-4 10-5 10-6 10-7	2.9.4b • Change contents of NOTE 1 and 4. 8.3.1 • Add footnote 2 and 3. 9.4.3 • Add table for tightening torque for cover flange bolts. 10.1 • Add calibration units of Pa and hPa. 10.2 • Add Bolts and nuts material code C. • Add Bolts and nuts material code C. • Add Bolts and nuts material code C and footnote 5. 10.3 • Add Amb. Temp. for T6: -40 to 75°C under /KF1. • Add Optional code /F1, /N1, /N2, /N3, /N4, and /R1

REVISION RECORD

IM 01C21B01-01E

Edition	Date	Page	Revised Item
5th (Continued)	Sep. 2000	CMPL	<p>CMPL 1C21A1-02E 4th ⇒ 5th(Manual Change)</p> <ul style="list-style-type: none"> <li>• Add part numbers to 7-1 CPU Assembly. F9342AF and F9342AM</li> </ul> <p>CMPL 1C21A1-02E 5th ⇒ 6th</p> <ul style="list-style-type: none"> <li>• Add part numbers to 7-2 CPU Assembly. F9342BG</li> <li>• Change part number of 7-1 CPU Assembly. F9342BC → F9342BB</li> <li>• Change part number of 10 Plug G9330DK → G9330DP</li> </ul> <p>CMPL 1C21B0-01E 1st ⇒ 2nd(Manual Change)</p> <p>Page 3</p> <ul style="list-style-type: none"> <li>• Add part number to 10-1 and 10-2 Bolt. F9340AQ and F9340AS</li> <li>• Add part number to 11-1 and 11-2 Nut. F9340BQ and F9340BS</li> </ul> <p>CMPL 1C21B0-01E 2nd ⇒ 3rd</p> <p>Page 4</p> <ul style="list-style-type: none"> <li>• Add part number to 14 Bolt. F9340AZ</li> </ul>
6th	July 2001	<p>2-10 8-4, 8-5</p> <p>10-3 CMPL</p>	<p>2.10</p> <ul style="list-style-type: none"> <li>• Change EMC Conformity number.</li> </ul> <p>8.3.1</p> <ul style="list-style-type: none"> <li>• Add footnote (*4) to B40, Maximum static pressure in Parameter Summary.</li> </ul> <p>10.2</p> <ul style="list-style-type: none"> <li>• Change the maximum working pressure to 16 MPa.</li> </ul> <p>CMPL 1C21A1-02E 6th ⇒ 7th(Manual Change)</p> <ul style="list-style-type: none"> <li>• Change Part No. of 7-1 CPU Assembly for BRAIN protocol. F9342BB → F9342AB</li> </ul> <p>CMPL 1C21A1-02E 7th ⇒ 8th(Manual Change)</p> <ul style="list-style-type: none"> <li>• Change Part No. of 7-1 CPU Assembly for HART protocol. F9342BH → F9342AL</li> </ul> <p>CMPL 1C21A1-02E 8th ⇒ CMPL 01C21A01-02E 9th</p> <ul style="list-style-type: none"> <li>• Delete Part No. of 4 Name Plate.</li> <li>• Change Part No. of 5 Screw. F9303JU → Y9303JU</li> </ul> <p>CMPL 1C21B0-01E 3rd ⇒ CMPL 01C21B00-01E 4th</p>
7th	May 2002	<p>1-2</p> <p>2-7</p> <p>10-6</p> <p>10-7</p>	<p>1.1</p> <ul style="list-style-type: none"> <li>• Add "1.1 For Safety Using."</li> </ul> <p>2.9.4</p> <ul style="list-style-type: none"> <li>• Add descriptions based on ATEX directive.</li> </ul> <p>10.3</p> <ul style="list-style-type: none"> <li>• Add Optional code K□2.</li> <li>• Add Optional code C2 and C3.</li> </ul>
8th	Apr. 2003	<p>2-8</p> <p>2-10</p> <p>10-6</p> <p>10-7</p>	<p>2.9.4</p> <ul style="list-style-type: none"> <li>• Add Option code KU2.</li> </ul> <p>2.11</p> <ul style="list-style-type: none"> <li>• Add PED (Pressure Equipment Directive).</li> </ul> <p>10.3</p> <ul style="list-style-type: none"> <li>• Add Option code KU2.</li> </ul> <p>10.3</p> <ul style="list-style-type: none"> <li>• Add Option code PE3.</li> </ul>

REVISION RECORD2.EPS

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**User's  
Manual**

***DP*harp**

**Model EJA Series  
HART Protocol**

IM 01C22T01-01E

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**User's  
Manual**

***DP*harp**

**Model EJA Series  
HART Protocol**

IM 01C22T01-01E

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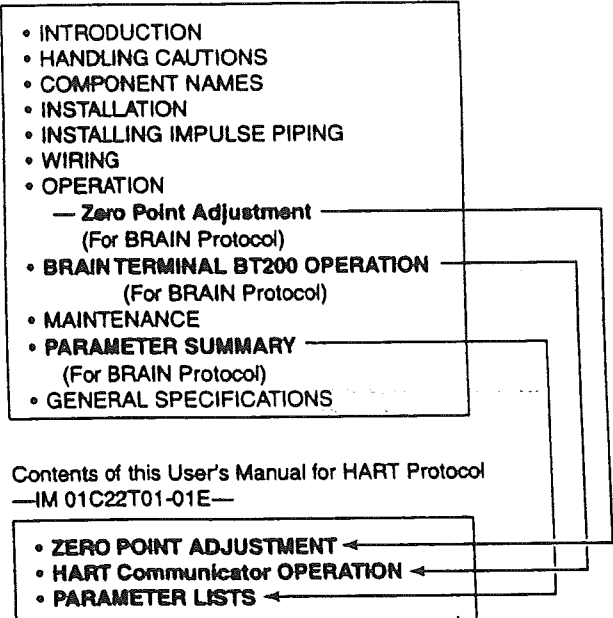
# CONTENTS

<b>PRELIMINARY .....</b>	<b>ii</b>
<b>1. ZERO POINT ADJUSTMENT .....</b>	<b>1-1</b>
1.1 Zero Point Adjustment .....	1-1
1.1.1 Using the HART Communicator .....	1-2
1.1.2 Using the Transmitter Zero-adjustment Screw .....	1-2
1.2 Auto LRV (Change Low Range Value) .....	1-3
1.2.1 Using Model 275 — Apply Values .....	1-3
1.2.2 Setting the Range Using the Range-setting Switch .....	1-3
<b>2. HART COMMUNICATOR OPERATION .....</b>	<b>2-1</b>
2.1 Conditions of Communication Line .....	2-1
2.1.1 Interconnection Between DPharp and HART Communicator .....	2-1
2.1.2 Communication Line Requirements .....	2-1
2.2 Basic Operation of the HART Communicator (Model 275) .....	2-2
2.2.1 Keys and Functions .....	2-2
2.2.2 Display .....	2-3
2.2.3 Calling Up Menu Addresses .....	2-3
2.2.4 Entering, Setting, and Sending Data .....	2-4
2.3 Parameters .....	2-5
2.3.1 Parameter Usage and Selection .....	2-5
2.3.2 Menu Tree .....	2-6
2.3.3 Setting Parameters .....	2-7
(1) Tag No. ....	2-7
(2) Unit .....	2-7
(3) Range Change .....	2-7
(4) Output Mode (Linear/Sq root) .....	2-8
(5) Damping Time Constants .....	2-9
(6) Output Signal Low Cut Mode Setup .....	2-9
(7) Bi-directional Flow Measurement .....	2-10
(8) Integral Indicator Display Mode .....	2-10
(9) Integral Indicator Scale .....	2-10
(10) Unit for Displayed Temperature .....	2-12
(11) Unit for Displayed Static Pressure .....	2-12
(12) Test Output .....	2-12
(13) Sensor Trim .....	2-13
(14) Trim Analog Output .....	2-14
(15) Burst Mode .....	2-16
(16) Multidrop Mode .....	2-16
(17) External Switch Mode .....	2-17
(18) Software Write Protect .....	2-17
(19) Hardware Write Protect and Burnout Direction (with Optional code /F1) .....	2-19
(20) H <sub>2</sub> O Unit Select .....	2-19
2.4 Self-Diagnostics .....	2-19
2.4.1 Checking for Problems .....	2-19
(1) Identify Problems with HART Communicator .....	2-19
(2) Checking with Integral Indicator .....	2-20
<b>3. PARAMETER LISTS .....</b>	<b>3-1</b>
<b>REVISION RECORD</b>	

# PRELIMINARY

This manual describes the function, performance, and operating procedures of the DPharp EJA Series with HART protocol. The DPharp EJA Series with HART protocol uses the same pressure sensing element as in DPharp EJA with BRAIN protocol. Therefore, this manual describes only the functions unique to HART Communicator operating procedures which are not covered in the DPharp EJA with BRAIN protocol instruction manual. For the items listed below which are common to both the HART protocol and BRAIN protocol, see the applicable user's manuals listed in Table 1.

## Contents of Individual User's Manuals



Contents of this User's Manual for HART Protocol  
—IM 01C22T01-01E—

Figure 1. Relationship between Individual Manuals and HART Manual Contents

Table 1. Individual User's Manuals

Model	Manual No.
EJA110A, EJA120A, EJA130A	IM 01C21B01-01E
EJA210A, EJA220A	IM 01C21C01-01E
EJA310A, EJA430A, EJA440A	IM 01C21D01-01E
EJA510A, EJA530A	IM 01C21F01-01E
EJA110, EJA120	IM 01C22B01-01E
EJA210, EJA220	IM 01C22C01-01E
EJA310, EJA430	IM 01C22D01-01E
EJA118W, EJA118N, EJA118Y	IM 01C22H01-01E
EJA438W, EJA438N	IM 01C22J01-01E
EJA115	IM 01C22K01-01E

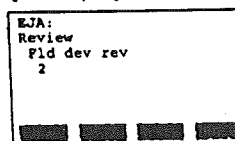


## CAUTION

Matching of communicator DD and instrument DD  
Before using model 275 HART communicator, check that the DD(Device Description) installed in the communicator matches to that of instruments to set up. To check the DD in the instrument or the HART communicator, follow the steps below. If the correct DD is not installed in the communicator, you must upgrade the DD at the HART official programming sites. For communication tools other than Model 275 HART communicator, contact vendors of each for upgrade information.

1. Checking the DD in the instrument
  - 1) Connect the communicator to the instrument to set up.
  - 2) Call "Device setup" and press [→].
  - 3) Call "Review" and press [→].
  - 4) By pressing [NEXT] or [PREV], find "Fld dev rev" to show the DD of the instrument.

[Example]

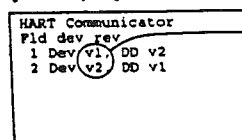


"The instrument DD is Version 2."

F02.EPS

2. Checking the DD in Model 275 HART communicator
  - 1) Turn on the communicator alone.
  - 2) Call "Utility" from main menu and press [→].
  - 3) Call "Simulation" and press [→].
  - 4) Select "YOKOGAWA" from manufacturers list by pressing [↓] and press [→].
  - 5) Select the model name of the instrument(i.e. EJA) by pressing [↓] and press [→] to show the DD of the communicator.

[Example]



Version 1 and 2.

"The communicator DD supports Version 1 and 2."

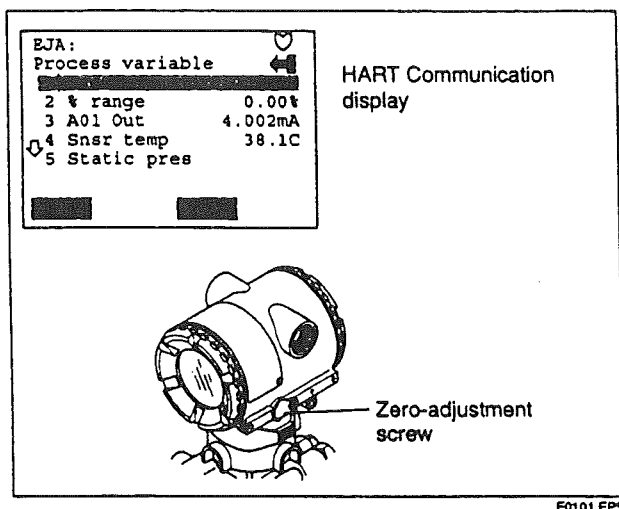
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# 1. ZERO POINT ADJUSTMENT

After operating preparation is completed, adjust the zero point. The zero point adjustment can be made using either of the following two methods.

For output signal checking, display the parameter % range in the HART Communicator.



## ■ Using the Transmitter Zero-adjustment Screw

Before using the zero-adjustment screw outside the transmitter case, confirm the following.

- **Ext SW mode** must be **ENABLE**. See Subsection 2.3.3 (17) for the setting procedure.
- Use a slotted screwdriver to turn the zero-adjustment screw. Turn the screw clockwise to increase the output or counterclockwise to decrease the output, the zero point adjustment can be adjusted with a resolution of 0.01% of the setting range. The degree of zero adjustments varies with the screw turning speed. Therefore, turn the screw slowly for fine adjustment and quickly for coarse adjustment.

## ⚠ CAUTION

Do not turn off the power to the transmitter immediately after a zero adjustment. Powering off within 30 seconds after a zero adjustment will return the adjustment back to the previous settings.

## ■ Using the HART Communicator

Zero point can be adjusted by simple key operation of the HART Communicator.

Select parameter **Zero Trim**, and press the **OK (F4)** key twice. The zero point will be adjusted automatically to the output signal 0% (4 mA DC). Confirm that the setting value displayed for the parameter % range is **0.0%** before pressing the **OK (F4)** key. See Subsection for HART Communicator operating procedures.

## 1.1 Zero Point Adjustment

The DPharp supports several adjustment methods.

Select the method best suited for conditions matching the state of the site.

Note that output signal can be checked by HART Communicator.

Adjustment Method	Description	
Zero adjustment using the HART Communicator	Set the present input to 0%. P.1-2 'Zero trim'	Adjust for 0% output at input level of 0%.
	Adjust output to the reference value obtained using other means. P.1-3 'Lower sensor trim'	If the input level cannot easily be made 0% (because of tank level, etc.), adjust output to the reference value obtained using other means, such as a glass gauge.
Zero adjustment using the external zero-adjustment screw	Adjust zero point using the zero-adjustment screw on the transmitter. This permits zero adjustment without using the HART Communicator. Accurately adjust the output current to 4mA DC or other target output value using an ammeter that accurately reads output currents.	

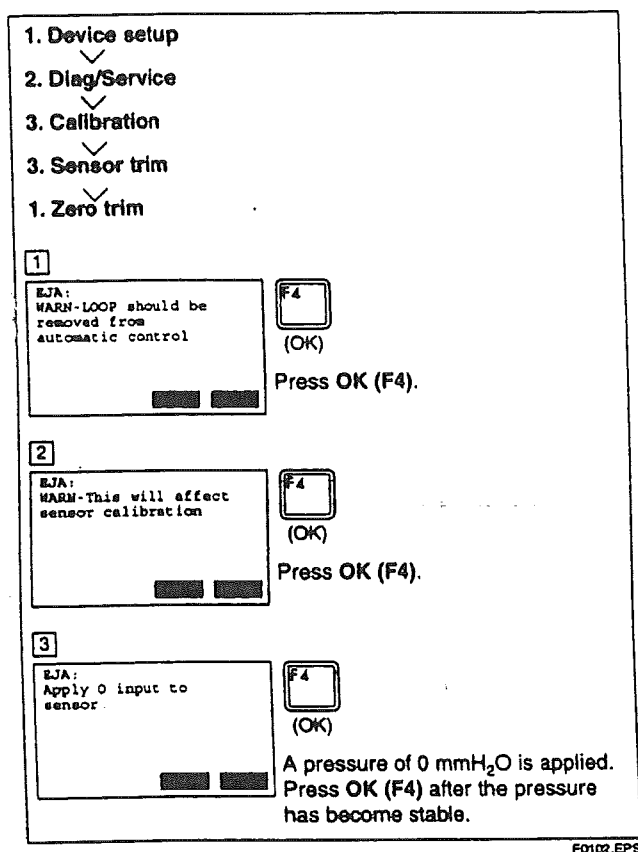
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## 1.1.1 Using the HART Communicator

## (1) Zeroing — Zero trim

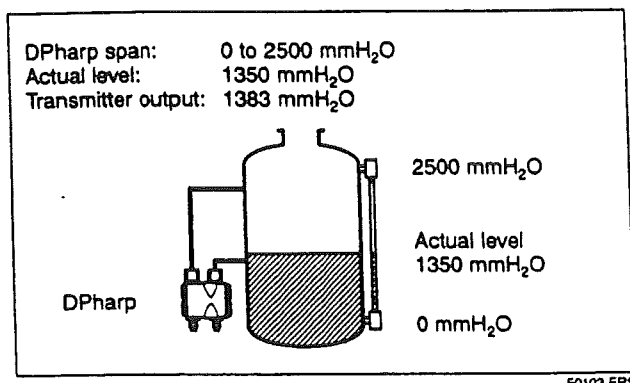
**NOTE**

Zero trim carries out the zero adjustment and sets the input values at present, equal to 0 mmH<sub>2</sub>O. Use this setting to set LRV = 0 mmH<sub>2</sub>O.

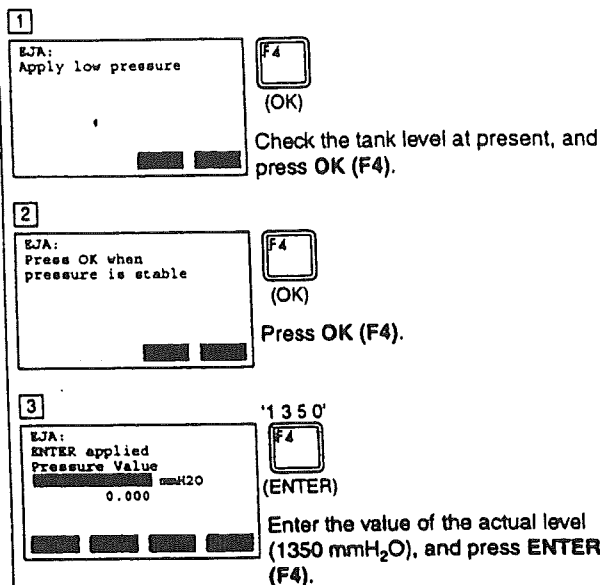


## (2) Arbitrary Level Adjustment — Lower Sensor Trim

This zero adjustment applies to tank level measurements, etc. where the actual tank level cannot be set to zero. For this adjustment, use the actual tank level obtained with a glass gauge or the like to meet the DPharp output.



1. Device setup
2. Diag/Service
3. Calibration
3. Sensor trim
2. Lower Sensor Trim

**NOTE**

Lower Sensor trim adjusts the input value at present. See Fine Input Adjustment for detail.

## 1.1.2 Using the Transmitter Zero-adjustment Screw

Turn the zero-adjustment screw on the outside of the transmitter case using a slotted screwdriver. Turn the screw to the right to increase the zero point or to the left to decrease the zero output; the zero adjusts in increments of 0.01% of the range setting.

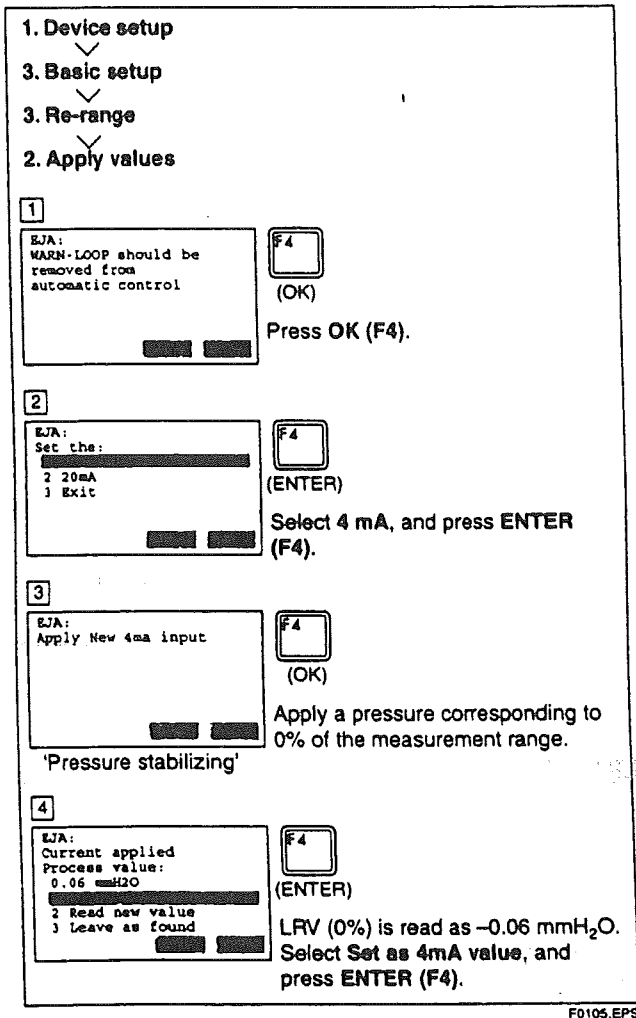
Note that the amount of adjustment to the zero point changes according to the speed at which the screw is turned. To make fine adjustments, turn the screw slowly; to make coarse adjustments, turn the screw quickly.

Note: When a zero point adjustment has been made do not turn of the transmitter less than 30 seconds after adjustment.

## 1.2 Auto LRV (Change Low Range Value)

### 1.2.1 Using Model 275 — Apply Values

Display the Apply Values display, and adjust the zero point as follows:



### 1.2.2 Setting the Range Using the Range-setting Switch

With actual pressure(s) being applied to the transmitter, the range-setting switch (push-button) attached to the integral indicator plate and the external zero-adjustment screw allow users to change the lower- and upper-range values for the measurement range (LRV and URV) without the use of a HART Communicator. However, a change in the display settings (scale range and engineering unit) for the integral indicator requires a HART Communicator.

Follow the procedure below to change the LRV and URV settings.

Example: Rerange LRV to 0 and HRV to 20 kPa.

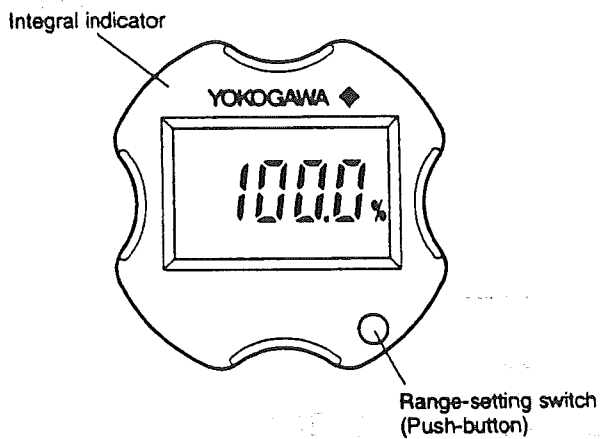
- 1) Connect the transmitter and allow them to warm up for at least five minutes.
- 2) Press the range-setting push-button.  
The integral indicator then displays **LSET**.
- 3) Apply a pressure of 0 kPa (atmospheric pressure) to the high-pressure side of the transmitter. (Note 1)
- 4) Turn the external zero-adjustment screw (either in the output-increase or -decrease direction).  
The integral indicator displays the output signal (in %). (Note 2)
- 5) Adjust the output signal to 0% (1 V DC) by rotating the external zero-adjustment screw. Doing so completes the LRV setting.
- 6) Press the range-setting pushbutton.  
The integral indicator then displays **USET**.
- 7) Apply a pressure of 20 kPa to the high-pressure side of the transmitter. (Note 1)
- 8) Turn the external zero-adjustment screw (either in the output-increase or -decrease direction).  
The integral indicator displays the output signal (in %). (Note 2)
- 9) Adjust the output signal to 100% (5 V DC) by rotating the external zero-adjustment screw. Doing so completes the URV setting.
- 10) Press the range-setting pushbutton.  
The transmitter then switches back to the normal operation mode while maintaining the measurement range at 0 to 20 kPa.

Note 1: Wait until the pressure inside the pressure-detector section has stabilized before proceeding to the next step.

Note 2: If the pressure applied to the transmitter exceeds the previous LRV (or URV), the integral indicator may display error number "Er.07" (In this case, the output signal percent and "Er.07" are displayed alternately every two seconds). Although "Er.07" is displayed, there is no need to worry and you may proceed to the next step. However, should any other error number be displayed, take the appropriate measure in reference to Section 2.4 Self-Diagnostics, "Errors Messages."

**IMPORTANT**

1. Do not turn off the power to the transmitter immediately after completion of the change in the LRV (and/or URV) setting(s). Note that powering off within thirty seconds after setting will cause a return to the previous settings.
2. Changing LRV automatically changes URV to the following value.  
$$\text{URV} = \text{previous URV} + (\text{new LRV} - \text{previous LRV})$$
3. If the range-setting push-button and external zero-adjustment screw are not touched during a range-change operation, the transmitter automatically switches back to the normal operation mode.



Note: Use a thin bar which has a blunt tip, e.g., a hexagonal wrench, to press the range-setting push-button.

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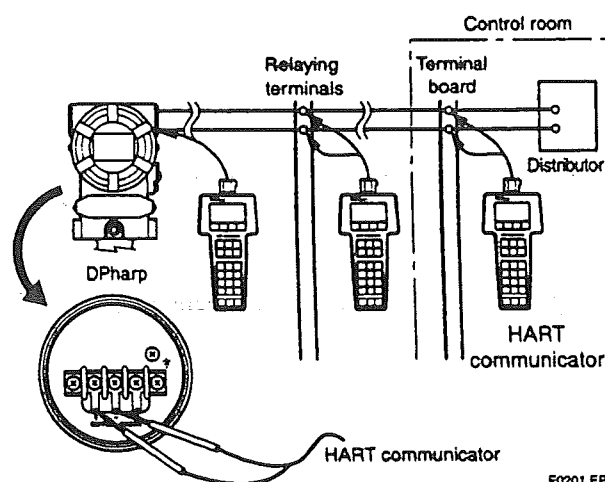
**Figure 1.2.1 Range-setting Switch**

## 2. HART COMMUNICATOR OPERATION

### 2.1 Conditions of Communication Line

#### 2.1.1 Interconnection Between DPharp and HART Communicator

The HART Communicator can interface with the transmitter from the control room, the transmitter site, or any other wiring termination point in the loop, provided there is a minimum of 250  $\Omega$  between the connection and the power supply. To communicate, it must be connected in parallel with the transmitter; the connections are non-polarized. Figure 2.1.1 illustrates the wiring connections for direct interface at the transmitter site for the DPharp. The HART Communicator can be used for remote access from any terminal strip as well.



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Figure 2.1.1 Interconnection Diagram

#### 2.1.2 Communication Line Requirements

##### Specifications for Communication Line:

Supply voltage (general use type); 16.4 to 42 V DC

Load resistance; 250 to 600  $\Omega$  (Including cable resistance)

Minimum cable size; 24 AWG, (0.51 mm diameter)

Cable type; Single pair shielded or multiple pair with overall shield

Maximum twisted-pair length; 10,000 ft (3,048 m)

Maximum multiple twisted-pair length; 5,000 ft (1,524 m)

Use the following formula to determine cable length for a specific application;

$$L = \frac{65 \times 10^6}{(R \times C)} - \frac{(C_r + 10,000)}{C}$$

Where: L = length in feet or meters.

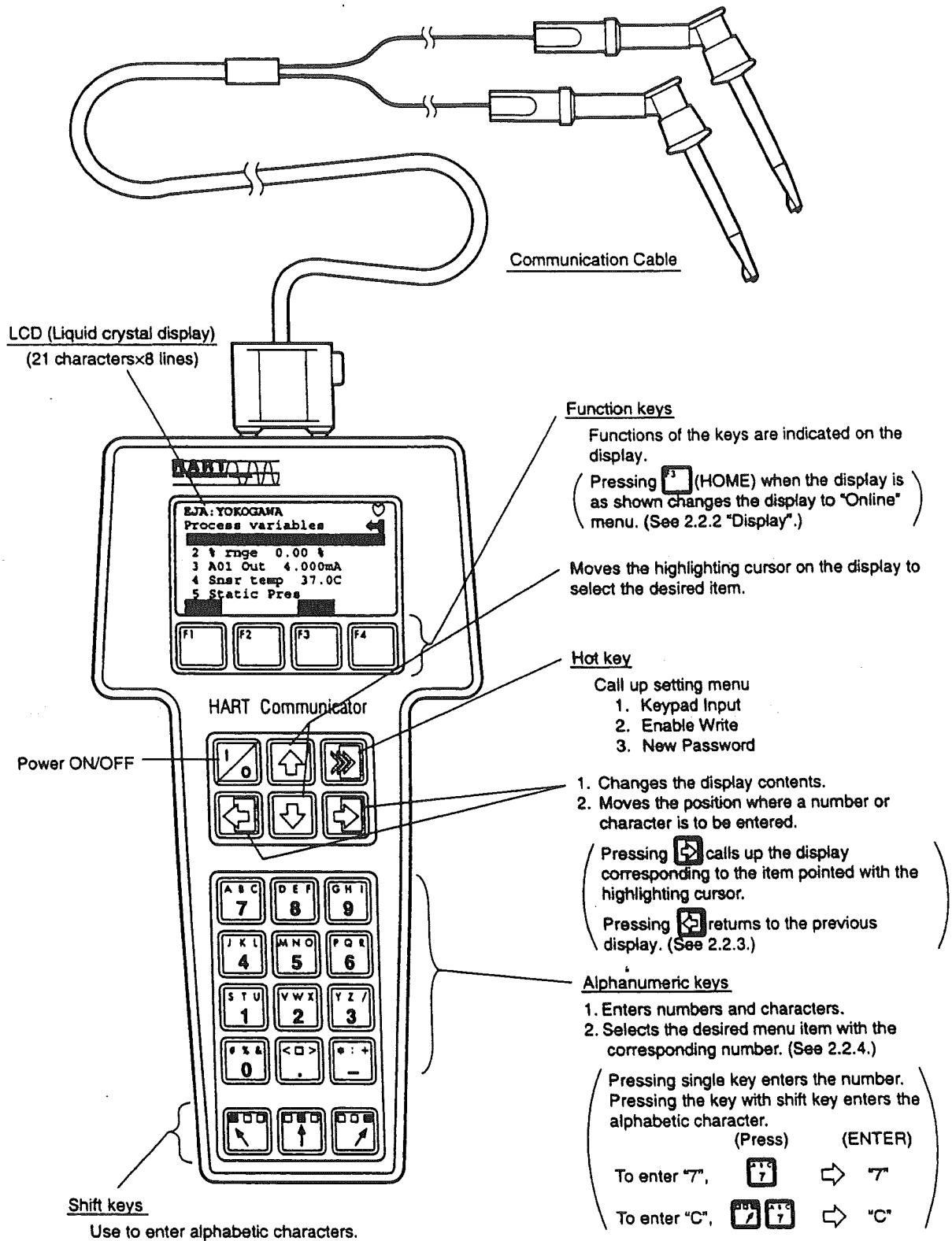
R = resistance in ohms, current sense resistance plus barrier resistance.

C = cable capacitance in pF/ft, or pF/m.

$C_r$  = Maximum shunt capacitance of field devices in pF.

## 2.2 Basic Operation of the HART Communicator (Model 275)

### 2.2.1 Keys and Functions



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Figure 2.2.1 The HART Communicator

## 2.2.2 Display

The HART communicator searches for a transmitter on the 4 to 20mA loop when it is turned on. When the HART communicator is connected to the transmitter, **Online** menu (Top menu) is started automatically and the following display appears. If no transmitter is found, you select **Online** menu.

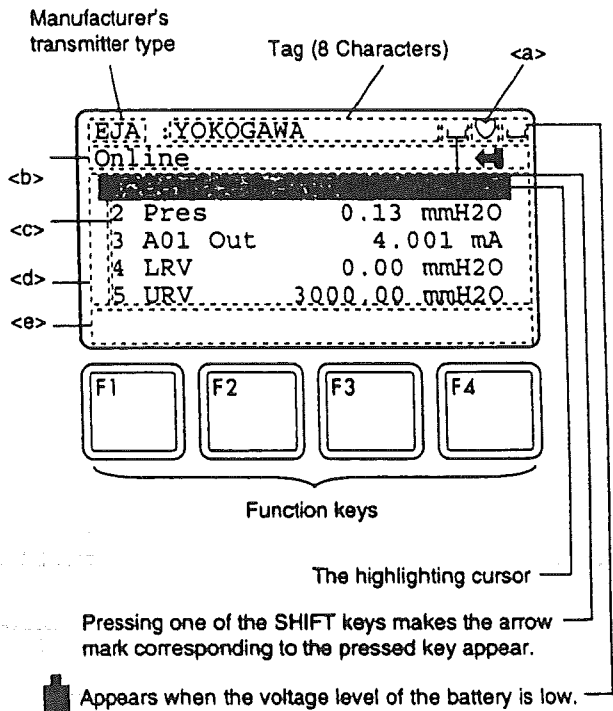


Figure 2.2.2 Display

- <a> ♥ appears and flashes during communication between the HART communicator and the transmitter. At Burst mode, ♥ appears.
- <b> The menu items selected from the previous menu.
- <c> The items to be used from the menu of <b>.
- <d> ↑ or ↓ appears when the item is scrolled out of the display.
- <e> The labels of function corresponding to each function key appears. These labels reflect currently available choices.

## 2.2.3 Calling Up Menu Addresses

Subsection 2.3.2 shows the configuration of all menu items available with the HART communicator. The desired item can be displayed with ease by understanding the menu configuration.

When the HART communicator is connected to the transmitter, **Online** menu will be displayed after power is turned on. Call up the desired item as follows:

## Function Key Labels

<b>HELP</b> access on-line help	<b>ON/OFF</b> activates or deactivates a binary variable	<b>ABORT</b> terminate current task	<b>OK</b> acknowledge information on screen
<b>RETRY</b> try to re-establish communication	<b>DEL</b> delete current character or Hot Key Menu item	<b>ESC</b> leave value unchanged	<b>ENTER</b> accept user-entered data
<b>EXIT</b> leave the current menu	<b>SEND</b> send data to device, or mark data to send	<b>QUIT</b> terminate session because of a communication error	<b>NEXT</b> leave the current menu
<b>YES</b> answer to yes/no question	<b>PGUP</b> move up one help screen	<b>PGDN</b> move down one help screen	<b>NO</b> answer to yes/no question
<b>ALL</b> include current Hot Key item on Hot Key Menu for all devices	<b>PREV</b> go to previous message in a list of messages	<b>NEXT</b> go to next message in the list of messages	<b>SKIP</b> do not mark variable to be sent in off-line configuration
<b>SAVE</b> save information to communicator	<b>EDIT</b> edit a variable value	<b>HOME</b> go to the top menu in the device description	<b>ONE</b> include Hot Key item for one device
<b>SEND</b> send data to device, or mark data to send	<b>ADD</b> add current item to Hot Key Menu	<b>BACK</b> go back to menu from which HOME was pressed	

F0204.EPS

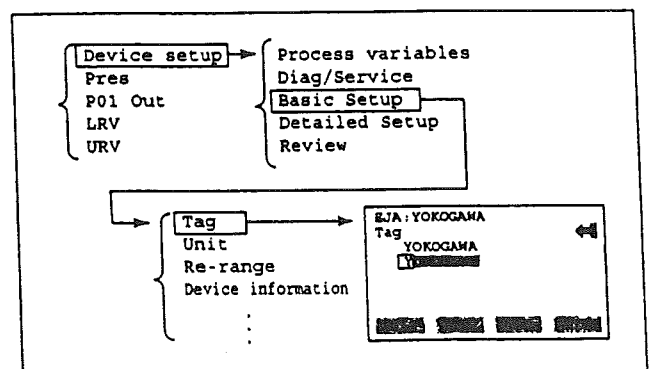
## Key Operation

There are two choices to select the desired menu item.

- Use the or key to select the desired item, and then press the key.
- Press the number displayed for the desired item.
  - To return to the previous display, press the key.
  - \* If **ABORT**, **ESC** and **EXIT** are displayed, press the desired function key.

Example: Call up the **Tag** item, to change the tag.

Check to see where item **Tag** is located in the menu configuration. Then, call up **Tag** item on the display according to the menu configuration.



11

Display	Operation
<b>1</b> 	or Display <b>1</b> appears when the HART Communicator is turned on. Select <b>Device setup</b> .
<b>2</b> 	x2 or  Select <b>Basic setup</b> .
<b>3</b> 	 Select <b>Tag</b> .
<b>4</b> 	The display for Tag setting appears.

F0205.EPS

## 2.2.4 Entering, Setting, and Sending Data

The data input using the keys are set in the HART communicator by pressing **ENTER (F4)**. Then, by pressing **SEND (F2)**, the data is sent to the transmitter. Note that the data is not set in the transmitter if **SEND (F2)** is not pressed. All the data set with the HART communicator is held in memory unless power is turned off, every data can be sent to the transmitter at once.

### Operation

Entering data on the **Tag** setting display.

Example: To change from Tag YOKOGAWA to FIC-1A.

Call up the **Tag** setting display.

1. Device setup  
 3. Basic setup  
 1. Tag

F0206.EPS

When the setting display shown above appears, enter the data as follows:

Character to be entered	Operation	Display
F		F O
I		F I K
C		F I C O
-		F I C - G
1		F I C - 1 A
A		F I C - 1 A W
Deletes characters.		F I C - 1 A

F0207.EPS

Display	Operation
<b>5</b> 	 (ENTER) After entering the data, set the HART communicator with the data entered by pressing <b>ENTER (F4)</b> .
<b>6</b> 	 (SEND) Send the data to the transmitter by pressing <b>SEND (F2)</b> .
<b>7</b> 	* ♥ is flashed during communication. <b>SEND</b> disappears, and the transmission is complete.

F0208.EPS



## 2.3 Parameters



### NOTE

Do not turn off the transmitter as soon as HART Communicator settings (sending) have been made. If the transmitter is turned off less than 30 seconds after parameters have been set, the set data will not be stored and the terminal returns to previous settings.

### 2.3.1 Parameter Usage and Selection

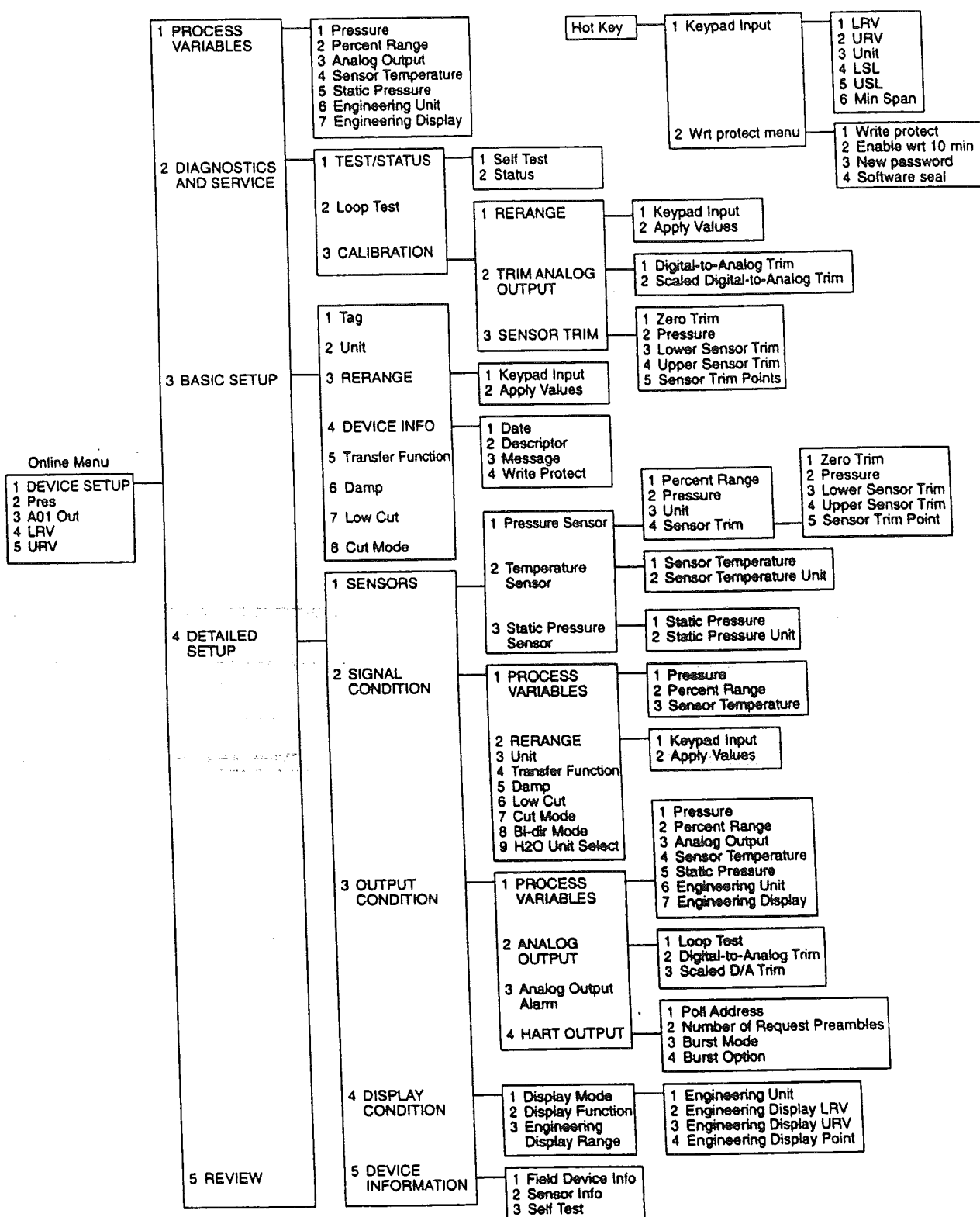
Before describing the procedure for setting parameters, we present the following table showing how the parameters are used and in what case.

Table 2.3.1 Parameter Usage and Selection

Item		HART Communicator	Description	Page
Memory		Tag	Tag number, Up to 8 characters	P.2-7
		Descriptor	Up to 16 characters	
		Message	Up to 32 characters	
		Date	xx/yy/zz	
Transmitter	Engineering unit	Unit	inH <sub>2</sub> O, inHG, ftH <sub>2</sub> O, mmH <sub>2</sub> O, mmHG, psi, bar, mbar, g/cm <sup>2</sup> , kg/cm <sup>2</sup> , Pa, kPa, MPa, torr, atm	P.2-8
	Range	LRV/URV	Set the calibration range by the keypad	
		Apply values	Range for 4 to 20 mA DC signal is set with actual input applied.	
	Output mode	Xfcr frctn	Sets mode for output signal to "linear mode" (proportional to input differential pressure) or to "Square root mode" (proportional to flow).	P.2-9
	Damping time constant	Damp	Adjust the output response speed for 4 to 20 mA DC. 0.2, 0.5, 1, 1.5, 2, 4, 6, 8, 16, 32 (sec)	
	Output signal low cut mode	Low cut	Used mainly to stabilize output near 0 if output signal is the square root mode. Two modes are available: forcing output to 0% for input below a specific value, or changing to proportional output for input below a specific value.	P.2-10
		Cut mode	Linear or Zero	
	Bi-direction flow measurement mode	Bi-dire mode	Used to measure bi-directional flows.	P.2-10
	H <sub>2</sub> O unit selection	H <sub>2</sub> O Unit select	at 4°C (39.2°F)/at 20°C (68°F)	P.2-19
	Unit for displayed temperature	Snsr temp unit	Sets a unit for temperature displayed on the model 275.	P.2-12
	Unit for displayed static pressure	Static pres unit	Sets a unit for static pressure displayed on the model 275.	
Display	Integral indicator display mode	Display frctn	Sets mode for integral indicator to "linear mode" (proportional to input differential pressure) or to "Square root mode" (proportional to flow).	P.2-10
		Display mode	Set the following 5 types of integral indicator scale ranges and unit: "% scale indicator", "use set scale indicator", "alternate indication of user set scale and % scale", "input pressure display" and "alternate indication of input pressure and % scale".	P.2-11
	Integral indicator scale	Engr disp range	Engr unit/Engr disp LRV/Engr disp URV/Engr disp point.	P.2-10
HART output	Burst mode	Burst option	Selection of the data to be sent continuously (Pres/% mge/A01 out).	P.2-16
		Burst mode	ON/OFF switching of burst mode.	
	Multi-drop mode	Poll addr	Setting the polling address (1 to 15).	
		Auto poll	ON/OFF switching of multi-drop mode.	
Monitoring		Pres	Pressure variable	—
		% mge	% output variable	
		A01 out	4 to 20 mA output variable	
		Snsr temp	Sensor temperature	
		Static pres	Static pressure	
		Engr display	Displays output as on an LCD, settable in the engr disp range.	
Maintenance	Test output	Loop test	Used for loop checks. Output can be set freely from -5% to 110% in 1% step.	P.2-12
	Self-diagnostics	Self test	Check using the self-test command. If an error is detected, the corresponding message is displayed.	P.2-19
		Status	Display of the result of self-test, calibration of transmitter.	
	Output when CPU error has occurred	A01 Alarm typ	Display the status of 4 to 20 mA DC output when a failure	—
	External volume protect/permit	Ext SW mode	Display/set the external volume protect/permit for LRV (URV) setting.	P.2-17
	Software Write Protect	Write protect	Displays the permit/protect status of setting changes depending on communications.	
		Enable write	Write protect status is released for 10 minutes when the password is entered.	
		New password	Setting a new password.	
Adjustment	Zeroing	Zero trim	Set the current input value to 0 kPa.	P.1-2
	Sensor trim	Lower/Upper sensor trim	Adjust only measured pressure variable.	P.2-13
	Analog output trim	D/A trim, Scaled D/A trim	Adjust the output value at the points of 4 mA and 20 mA.	P.2-14

T0201.EPS

## 2.3.2 Menu Tree



F0209.EPS

### 2.3.3 Setting Parameters

#### (1) Tag No.

To change the Tag No., see section 2.2.4 Entering, Setting, and Sending Data.

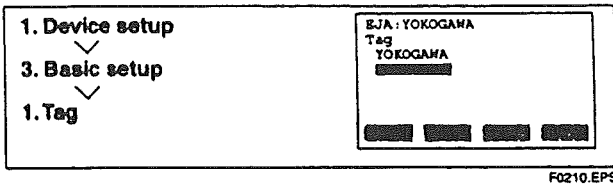
Up to 8 characters can be set with **Tag**. The maximum number of characters to be set for other items is as shown below. With Option code /CA, the Descriptor is filled in at the factory as specified in the order.

Item	The Number of Characters
Tag	8
Descriptor	16
Message	32
Date	2/2/2

T0202.EPS

Example: To change from Tag YOKOGAWA to FIC-1A.

Call up the **Tag** setting display.



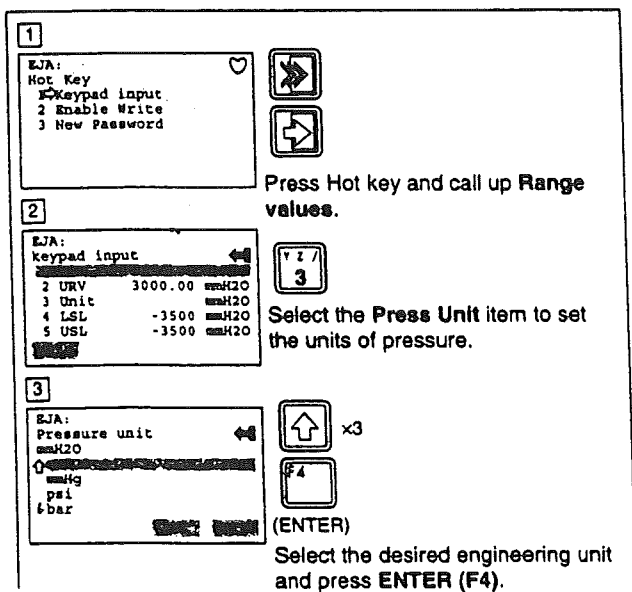
F0210.EPS

See Section 2.2.4.

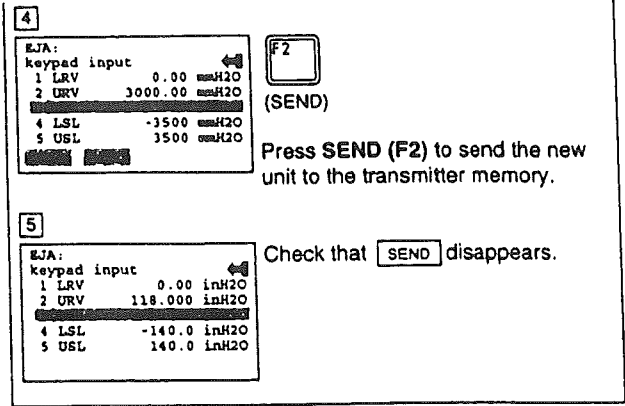
#### (2) Unit

The unit is set at the factory before shipment if specified at the time of order. Follow the procedure below to change the unit.

Example: To change the unit from mmH<sub>2</sub>O to InH<sub>2</sub>O



F0211.EPS



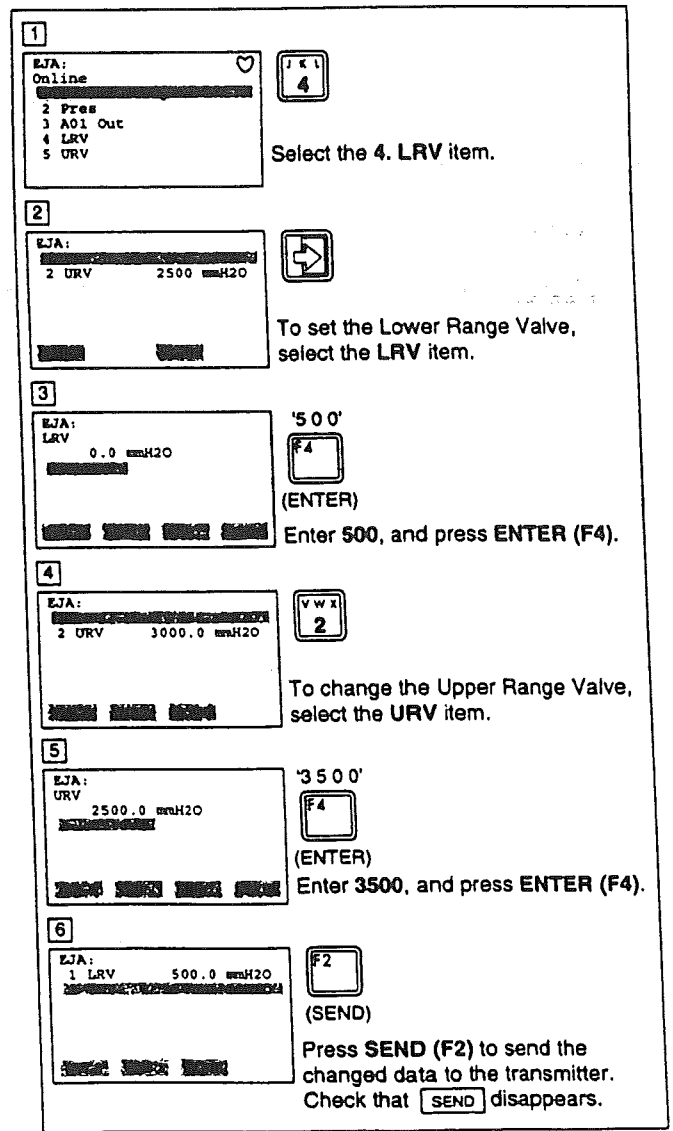
F02111.EPS

#### (3) Range Change

Ranges are factory-set as specified by the customer. To rerange, change the settings as follows:

##### (a) Keypad — LRV, URV

Example: To change the range from 0 to 2500 mmH<sub>2</sub>O to 500 to 3500 mmH<sub>2</sub>O



F0212.EPS

**NOTE**

It is possible to set  $LRV > URV$ . This setting reverses the 4 to 20 mA output signal.

Conditions:  $LSL \leq LRV \leq USL$

$LSL \leq URV \leq USL$

$|URV - LRV| \geq \text{Min. Span}$

The 4 to 20 mA output does not correspond to the scale of the indicator under the following conditions in which;

- the equipment with standard specification is used with the setting changed to the above setting.
- the customer specified equipment (with the above factory-setting) is used with the setting changed to the normal (standard) setting.

In the cases above, replace the scale with one which corresponds correctly to the 4 to 20 mA.

### (b) Changing the Ranges While Applying an Actual Input — Apply values

This feature allows the lower and upper range values to be setup automatically with the actual input applied. If the upper and lower range values are set, "URV" and "LRV" are changed at the same time.

The measurement span is determined by the upper and lower range valves. Changing the lower range value results in the upper range value change automatically, keeping the span constant.

Example: To change the range from 0 to 2500 mmH<sub>2</sub>O to 500 to 3000 mmH<sub>2</sub>O

Call up the **Apply Values** display.

1. Device setup  
 3. Basic setup  
 3. Re-range  
 2. Apply values

1

EJA:  
 WARN-Loop should be removed from automatic control

(F4)  
 (OK)  
 Press OK (F4).

2

EJA:  
 Set the:  
 2 20mA  
 3 Exit

(F4)  
 (ENTER)  
 To set the lower range value, select 4mA and press ENTER (F4).

3

EJA:  
 Apply new 4ma input

(F4)  
 (OK)  
 Apply the pressure of 500mmH<sub>2</sub>O. After obtaining a stable pressure, press OK (F4).

F0213.EPS

4

EJA:  
 Current applied process value:  
 500.01 mmH<sub>2</sub>O

2 Read new value  
 3 Leave as found

(F4)  
 (ENTER)  
 The LRV to be changed is 500.01 mmH<sub>2</sub>O.

- Selecting item 1 sets LRV to 500.01 mmH<sub>2</sub>O.
- Selecting item 2 reads LRV again.

To set LRV = 500.01, select item 1 and press ENTER (F4).

5

EJA:  
 Set the:  
 2 20mA  
 3 Exit

(F4)  
 (ENTER)  
 Select Exit and press ENTER (F4). Check the value after completing the range change with URV and LRV.

- The span is maintained the same as when changing LRV with Apply values. In this case, if LRV is changed from 0 to 500, URV is changed automatically to 3000.

F02131.EPS

### (4) Output Mode (Linear/Sq root)

The output mode has already been set to a Linear output (Linear). Follow the procedure below to change the mode.

Example: To change the mode from Linear to Sq root.

Call up the **Xfer fnctn** display.

1. Device setup  
 3. Basic setup  
 5. Xfer fnctn

1

EJA:  
 Transfer function  
 Linear  
 Sq root

(F4)  
 (ENTER)  
 (F2)  
 (SEND)

[1] Select Sq root, and press ENTER (F4).  
 [2] Press SEND (F2) to send the data to the transmitter, then check to confirm that SEND disappears.

F0214.EPS

The output mode is set as specified in the order when the instrument is shipped.

If the instrument is equipped with an integral indicator and Transfer function is sq root, "√" is displayed on the integral indicator.

### (5) Damping Time Constants

The damping constant is set to 2.0 seconds at the factory. When changing the damping constant, proceed as follows:

Example: To change from 2.0 seconds to 0.2 seconds

Call up the **Damp** display.

1. Device setup  
3. Basic setup  
6. Damp

1

EJA:  
Damping  
2.00 s

'0.2'  
F4  
(ENTER)

Enter 0.2 and press ENTER (F4).

2

EJA:  
Basic Setup  
1 Unit kPa  
2 Re-range  
3 Device information  
4 Xfer fnctn Linear

F2

Press SEND (F2) to send the data to the transmitter.

3

EJA:  
Set to nearest possible value occurred writing Press damping Press OK...

F4  
(OK)

A confirmation display appears. Press OK (F4), then check to confirm that SEND disappears.

F0215.EPS



#### NOTE

- Only the damping constants listed in Table 2 are available. When a value not listed in Table 2 is entered, the value in Table 2 nearest the entered value is set.
- The damping constant set with the procedure here is of the damping constant in the transmission part (electric circuit). The damping constant of the capsule assembly shall be added to obtain the overall damping constant of the transmitter.

Table 2

0.2 Sec
0.5 Sec
1.0 Sec
2.0 Sec
4.0 Sec
8.0 Sec
16.0 Sec
32.0 Sec
64.0 Sec

T0203.EPS

### (6) Output Signal Low Cut Mode Setup

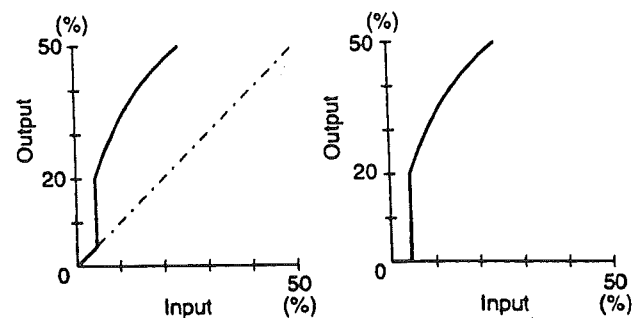
Low cut can be used on the output signal to stabilize the output near the zero point.

The low cut point can be set in a range from 0 to 20% of output. (Hysteresis of cut point:  $\pm 1\%$ )

Either **LINEAR** or **ZERO** can be selected as the low cut mode.

Unless otherwise specified, the cut mode is set to **LINEAR** at the factory.

Example: To set the low cut range to 20% and the cut mode to ZERO, proceed as follows:



For low cut in linear mode → For low cut in zero mode

F0216.EPS

Figure 2.2.2 Low Cut Mode

1. Device setup  
3. Basic setup  
7. Low Cut, 8. Cut mode

EJA:  
Low cut  
10.00%

'2.0'  
F4  
(ENTER)

Call up the Low cut, and set to 20%.

EJA:  
Cut mode  
Linear  
Zero

F4  
(ENTER)

Select the Cut mode, and set to Zero.

EJA:  
Basic Setup  
4 Device information  
5 Xfer fnctn Linear  
6 Damp 0.50s  
7 Low cut 20.00 %  
8 Cut mode Zero

F2  
(SEND)

Press SEND (F2) to send the date, then check to confirm that SEND disappears.

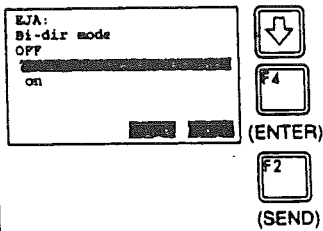
F0217.EPS

**(7) Bi-directional Flow Measurement**

- (a) **Bi-dir mode** enables selection of 50% output at an input of 0 mmH<sub>2</sub>O.

Example: If measurement range is 0 to 3000mmH<sub>2</sub>O  
(LRV = 0 mmH<sub>2</sub>O, URV = 3000 mmH<sub>2</sub>O)

1. Device setup
4. Detailed setup
2. Signal condition
8. Bi-dir mode



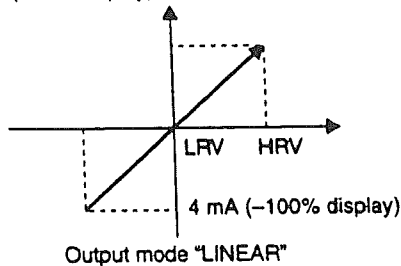
Call up the **Bi-dir mode** Display  
Select **on**, and press **ENTER (F4)**.  
Press **SEND (F2)** to send the data  
to the transmitter, then check to  
confirm that **SEND** disappears.

Note: The measurement range changes to -3000 to 0 to  
3000mmH<sub>2</sub>O (output 0% to 50% to 100%).  
Note that **LRV** and **URV** are not changed.

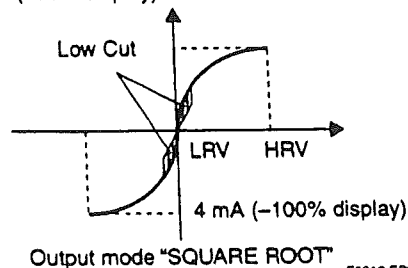
F0218.EPS

- (b) Combining **Bi-dir mode** with **Xfer fnctn** provides  
a square root output computed independently for  
0% to 50% output and for 50% to 100% output.

20 mA (100% display)



20 mA (100% display)

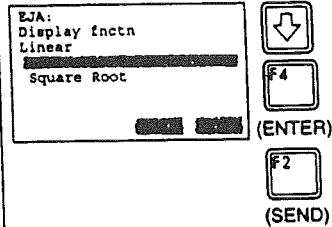


F0219.EPS

**(8) Integral Indicator Display Mode**

Example: Change from **Linear** to **Sq root**

1. Device setup
4. Detailed setup
4. Display condition
2. Display fnctn



Select **Square Root** and press  
**ENTER (F4)**.  
Press **SEND (F2)** to send data.

F0220.EPS

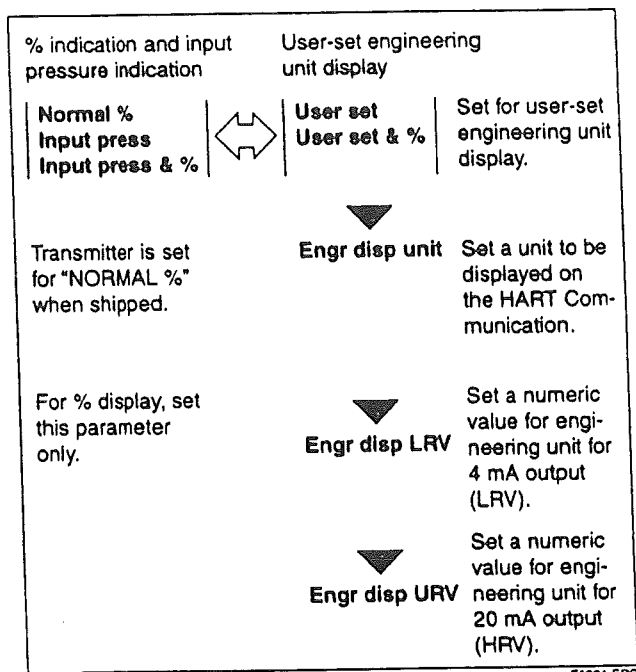
**(9) Integral Indicator Scale**

Display Mode	Display	Related Parameters	Description
NORMAL %	45.6	range 45.6%	Indicates -5 to 110% range depending on the set range (LRV, URV).
USER SET	200	Engr disp range 20.0M	Displays values depending on engr disp LRV and engr disp URV Units set using engr disp unit are not indicated.
USER & %	45.6 200	range 45.6% Engr disp range 20.0M	Indicates user set and % alternately in 3 second intervals.
INP PRES	456 in	Pres 456 kPa	Indicates input pressure.
PRES & %	45.6 200 in	range 45.6% Pres 456 kPa	Indicates input pressure and % alternately in 3 second intervals.

\* The number of lines displayed on the LCD is determined by the number of LRV and URV lines set on the brain terminal.

T0204.EPS

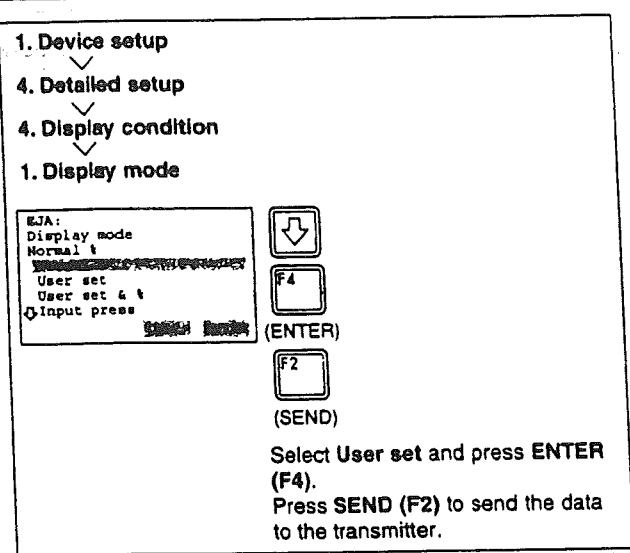
See (a) through (c) for each setting procedure.

**(a) Display Mode**

Follow the instructions given to the below to change the range of integral indication scale.

When **USER SET** is selected, the user set values of integral indication.

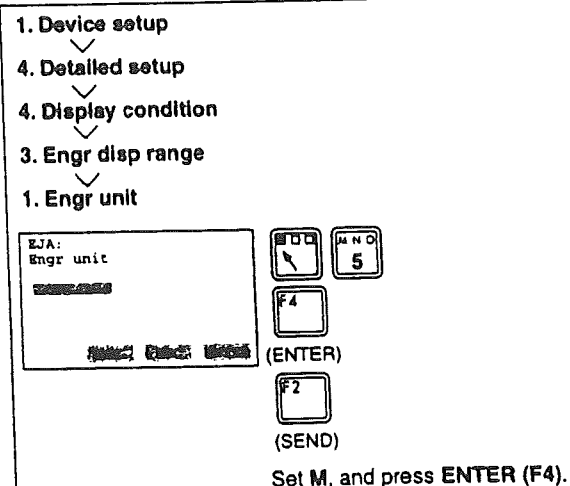
Example: Set the integral indicator scale to engineering units display

**(b) Setting User-set Engineering Unit**

**Engr unit** allows entry of the engineering units to be displayed on the HART communicator. When the instrument is shipped, this is set as specified in the order. Follow the procedure below to change this setting.

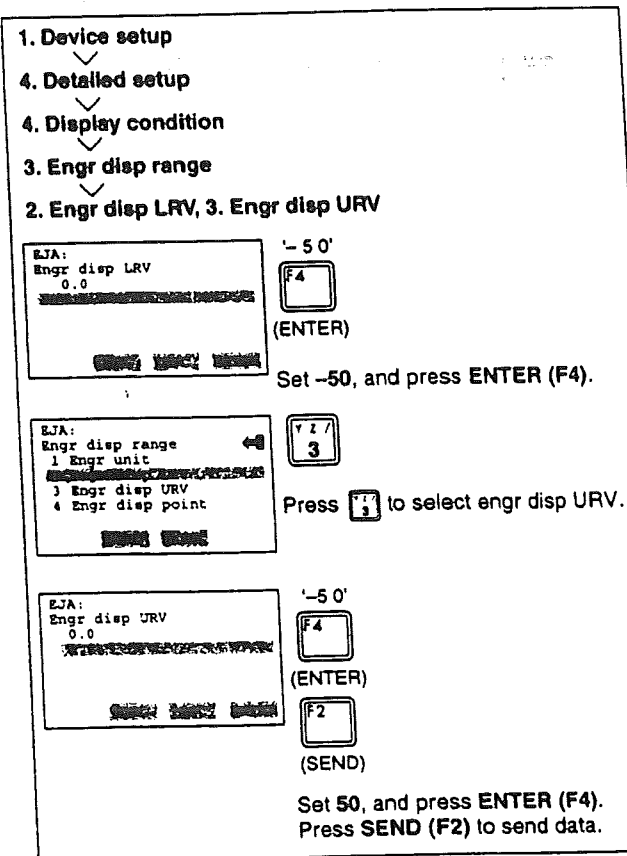
Since these units are not displayed on the integral indicator, use the adhesive labels provided **Engr unit** need not be set for % display.

Example: Set an engineering unit M.

**(c) Lower and Upper Range Value Setup in Engineering Unit**

**Engr disp LRV** and **Engr disp URV** are used to set the lower and higher range values for the engineering unit display. When the instrument is shipped, these are set as specified in the order. Note that these items need not be set for % display.

Example: Set low range value (LRV) to -50 and upper range value (URV) to 50.



**(10) Unit for Displayed Temperature**

When the instrument is shipped, the temperature units are set to C (Centigrade). Follow the procedure below to change this setting.

The unit changed here corresponds the unit for **Snsr temp**.

Example: Change the unit for the temperature display.

1. Device setup
4. Detailed setup
1. Sensors
2. Temp sensor
2. Snsr temp unit

EJA:  
Snsr temp unit  
C  
F  
[ENTER]

Select F (Fahrenheit), and Press ENTER (F4).

F0225.EPS

**(11) Unit for Displayed Static Pressure**

Follow the procedure to change the static pressure unit.

Changing this parameter also changes the unit for the static pressure display.

Example: Change the static pressure unit from mmH<sub>2</sub>O to kPa.

1. Device setup
4. Detailed setup
1. Sensors
3. Static Pres sensor
2. Static Pres unit

EJA:  
Static Pres unit  
mmH<sub>2</sub>O  
mmHg  
psi  
bar  
[ENTER]

inH<sub>2</sub>O  
inHg  
ftH<sub>2</sub>O  
mmH<sub>2</sub>O  
mmHg  
psi  
bar  
mbar  
g/cm<sup>2</sup>  
kg/cm<sup>2</sup>  
Pa  
kPa  
torr  
atm

Select kPa and Press ENTER (F4).  
Select SEND (F2) to send the data.

F0226.EPS

**(12) Test Output**

This feature can be used to output a fixed current from 3.2 mA (-5%) to 21.6 mA (110%) for loop checks.

Example: To output 12 mA (50%)

1. Device setup
2. Diag/Service
2. Loop test

1  
EJA:  
WARN-loop should be removed from automatic control  
[F4] (OK)

Set the control loop in manual mode, and press OK (F4).

2  
EJA:  
Choose analog output level  
2 20mA  
3 Other  
4 End  
[F4] (ENTER)

Select Other, and press ENTER (F4).

Supplementary explanation.

1. 4 mA:  
Outputs a 4 mA current signal
2. 20 mA:  
Outputs a 20 mA current signal
3. Other:  
Sets a desired output using the alphanumeric keys
4. End: Exits

3  
EJA:  
Output  
[F4] (ENTER)

Enter 12, and press ENTER (F4).  
A fixed current of 12 mA is output.

4  
EJA:  
Pld dev output is fixed at 12.000 mA  
[F4] (OK)

Press OK (F4).

5  
EJA:  
Choose analog output level  
2 20mA  
3 Other  
4 End  
[F4] (ENTER)

To finish the loop test, select End, and press ENTER (F4).


6  
EJA:  
NOTE-loop may be returned to automatic control  
[F4] (OK)

Press OK (F4).

F0227.EPS



### CAUTION

1. Test output is held for approximately 10 minutes, and then released automatically after the time has elapsed. Even if the HART Communicator power supply is turned off or the communication cable is disconnected during test output, it is held for approximately 10 minutes.
2. Press the  (OK) key to release test output immediately.

### (13) Sensor Trim

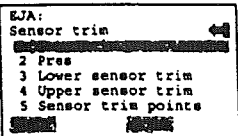
Each DPharp EJA Series Transmitter is factory characterized. Factory characterization is the process of comparing a known pressure input with the output of each transmitter sensor module over the entire pressure and temperature operating range. During the characterization process, this comparison information is stored in the transmitter EEPROM. In operation, the transmitter uses this factory-stored curve to produce a process variable output (PV), in engineering units, dependent on the pressure input. The sensor trim calibration procedure allows you to make corrections to the calculated process variable.

There are two ways to trim the sensor: full sensor trim and zero trim. A full sensor trim is a two point process, in which two accurate end-point pressures are applied (equal to or greater than the range values), and all output is linearized between them. A zero trim is a one-point adjustment typically used to compensate for mounting position effects or zero shifts caused by static pressure. (See section 1.1.1)

Example 1: For the range of 1000 to 3000 mmH<sub>2</sub>O

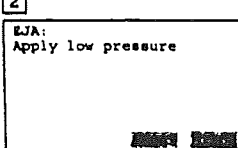
1. Device setup
2. Diag/Service
3. Calibration
3. Sensor Trim

**1**



Select the Lower Sensor trim.

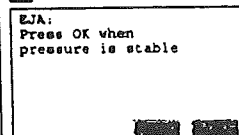
**2**



Apply a standard pressure of 1000 mmH<sub>2</sub>O to the transmitter. After obtaining a stable pressure, press OK (F4).

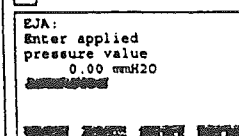
F02281.EPS

**3**



Press OK (F4).

**4**

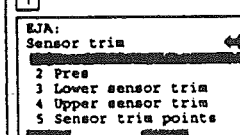


Enter 1000, and press ENTER (F4). Remove pressure appears for a while. Fine input adjustment (0%) is complete.

F02282.EPS

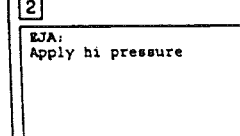
SPAN adjustment shall be carried out with **Upper Sensor trim**. After selecting **Upper Sensor trim**, apply a pressure of 3000 mmH<sub>2</sub>O (corresponding to 100% of the measurement range). Then, proceed the same as for the operations for **Lower Sensor trim**.

**1**



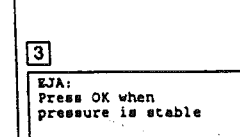
Select the Upper Sensor trim item.

**2**



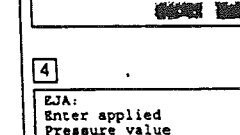
Apply a standard pressure of 300 mmH<sub>2</sub>O to the transmitter. After obtaining a stable pressure, press OK (F4).

**3**



Press OK (F4).

**4**



Enter 3000, and press ENTER (F4). Remove pressure appears for a while. Fine input adjustment (100%) is complete.

F0229.EPS

**(14) Trim Analog Output**

Fine output adjustment is carried out with **D/A trim** or **Scaled D/A trim**.

- **D/A Trim**

**D/A trim** is to be carried out if the calibration digital ammeter does not read 4.000 mA and 20.000 mA exactly with the output signal of 0% and 100%.

- **Scaled D/A Trim**

**Scaled D/A trim** is to be carried out if the output is adjusted using a voltmeter or other types of meters or using a meter whose the scale unit is 0 to 100%.

Example 1: For the adjustment using an ammeter ( $\pm 1\mu\text{A}$  is measurable)

**1. Device setup****2 Diag/Service****3. Calibration****2. Trim analog output**

**1**

EJA:  
Trim analog output  
2 Scaled D/A trim

Select the D/A trim item.

**2**

EJA:  
WARN-LOOP should be removed from automatic control

Press OK (F4).

**3**

EJA:  
Connect reference meter

Connect the ammeter ( $\pm 1\mu\text{A}$  is measurable), and press OK (F4).

**4**

EJA:  
Setting fld dev output to 4mA

Press OK (F4), and the transmitter outputs the output signal of 0%.

**5**

EJA:  
Enter meter value

4.115

Ammeter reading: 4.115

Enter the read value 4.115 of the ammeter, and press ENTER (F4). (The output of the transmitter changes.)

F0230.EPS

**6**

EJA:  
Fld dev output 4.000 mA equal to reference meter?

2 No

Ammeter reading: 4.000

Because the reading on the ammeter is 4.000 mA, select YES and press ENTER (F4). If the reading is not 4.000 mA, select item 2. NO. Repeat steps 4 and 5 until the ammeter reads 4.000 mA.

**7**

EJA:  
Setting fld dev output to 20mA

Press OK (F4), and the transmitter outputs the output signal of 100%.

**8**

EJA:  
Enter meter value

19.050

Ammeter reading: 19.050

Carry out the same procedures as those described under 4 and 5.

**9**

EJA:  
Fld dev output 20.000 mA equal to reference meter?

2 No

Ammeter reading: 20.000

Returning fld dev to original output appears.

**10**

EJA:  
NOTE-Loop may be returned to automatic control

Press OK (F4).

F0231.EPS

## Example 2: To adjust using a voltmeter

- 1  
EJA:  
Trim analog output  
2 Scaled D/A trim  
Select the Scaled D/A trim item.
- 2  
EJA:  
WARN-Loop should be removed from automatic control  
Press OK (F4).
- 3  
EJA:  
Trim will be scaled from 4.000 to 20.000  
2 Change  
Select Change, and press ENTER (F4).  
The same operations as for D/A trim are required when selecting item 3. Proceed.
- 4  
EJA:  
Set scale- Lo output value  
4  
Enter the value read on the meter when the signal is 4 mA. In this case, Enter the value of the voltage across a 250  $\Omega$  resistor (1 V), and press ENTER (F4).
- 5  
EJA:  
Set scale- Hi output value  
20  
Enter the value read on the meter when the signal is 20 mA. Then, enter 5, and press ENTER (F4).
- 6  
EJA:  
Trim will be scaled from 1.000 to 5.000  
2 Change  
Select Proceed and press ENTER (F4).
- 7  
EJA:  
Connect reference meter  
Connect the voltmeter, and press OK (F4).
- 8  
EJA:  
Setting fld dev output to 4mA  
Press OK (F4). The output signal of 0% is output.

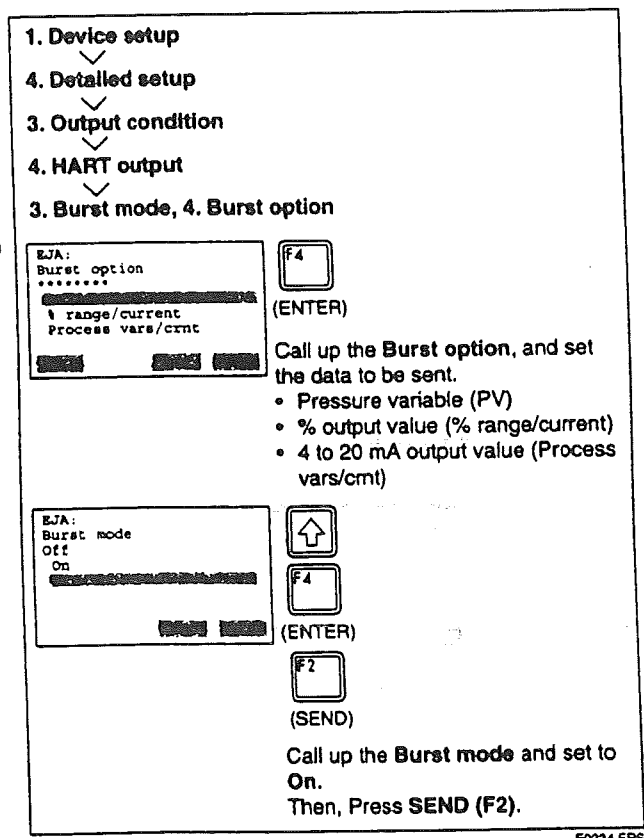
F0232.EPS

- 9  
EJA:  
Enter meter value  
1.01  
Voltmeter reading: 1.010  
Enter the reading of the voltmeter (1.010), and press ENTER (F4).  
(The output of the transmitter changes.)
- 10  
EJA:  
Scaled output: 1.000 equal readout device?  
2 No  
Voltmeter reading: 1.000  
Because the reading on the voltmeter is 1.000, select Yes and press ENTER (F4).  
If the reading is not 1.000, select No. Repeat steps 8 and 9 until the voltmeter reads 1.000 V.
- 11  
EJA:  
Setting fld dev output to 20mA  
Press OK (F4). The output signal of 100% is output.
- 12  
EJA:  
Enter meter value  
5.21  
Voltmeter reading: 5.210  
Enter the reading of the voltmeter (5.210), and press ENTER (F4).
- 13  
EJA:  
Scaled output: 5.000 equal readout device?  
2 No  
Voltmeter reading: 5.000  
Select Yes and press ENTER (F4).  
"Returning fld dev to original output"
- 14  
EJA:  
NOTE-Loop may be returned to automatic control  
Press OK (F4).

F0233.EPS

**(15) Burst Mode**

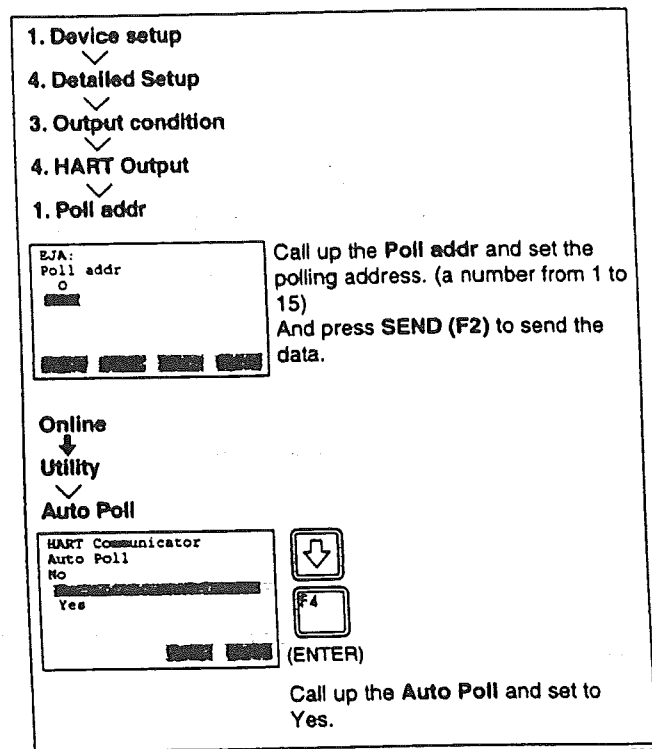
The transmitter continuously sends the data stored in it when the burst mode is set on. Either one of measured pressure variable, % output value, or 4 to 20 mA output value can be selected and sent. The data is sent intermittently as a digital signal at 75 ms intervals when the transmitter is set in the burst mode. Therefore, communication by the HART simultaneous communicator is also possible.

**Setting of Burst Mode****To Release from the Burst Mode:**

Call up the **Burst mode** display, and set to **OFF**.

**(16) Multidrop Mode**

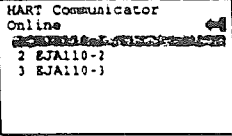
"Multidropping" transmitters refers to the connection of several transmitters to a single communications transmission line. Up to 15 transmitters can be connected when set in the multidrop mode. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15. This change deactivates the 4 to 20 mA analog output, sending it to 4 mA. The alarm current also is disabled.

**Setting of Multidrop Mode****NOTE**

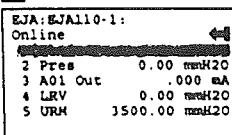
1. When the address is set and the multi-drop mode is set to "No" at the same time, Online menus cannot be called up and displayed. Be sure to turn the multidrop mode to "Yes" after setting the address with "Poll addr."
2. When the same polling address is set for two or more transmitters in multidrop mode, communication with these transmitters is disabled.

Example: Communication when set in the multi-drop mode

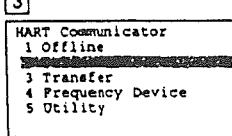
**1**



**2**



**3**



(1) The HART communicator searches for the transmitter that is set in the multi-drop mode when the HART communicator is turned on. When the HART communicator is connected to the transmitter, the manufacturer's x'ter type code and the tag will be displayed (display **1**).

(2) Select the desired transmitter. After that, normal communication to the selected transmitter is possible. However, the communication speed is slow in this case (display **2**).

(3) To communicate with another transmitter, turn off the power once and then turn it on again, or call up display **3**, and select **Online**.

(4) Display **1** will appear. Select the desired transmitter.

F0236.EPS

### To Release the Multi-drop Mode:

Follow the procedure below.

1. Call up the **Poll addr** display, and set the address to 0.
2. Call up the **Auto Poll** display, and set to **No**.

### (17) External Switch Mode

- Enabling/inhibiting zero point adjustment using the external zero-adjustment screw on the transmitter. Follow the procedure below to enable or inhibit zero point adjustment from the zero-adjustment screw on the transmitter.

This is set to **ENABLE** when the instrument is shipped.

Example: Inhibiting zero adjustment by the external zero-adjustment screw

**1. Device setup**

↓

**4. Detailed setup**

↓

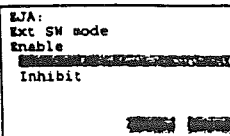
**5. Device information**

↓

**1. Field device info**

↓

**7. Ext SW mode**



**F4** (ENTER)

**F2** (SEND)

Select **Inhibit** and press **ENTER (F4)**. Press **SEND (F2)** to send the data.

F0237.EPS

### (18) Software Write Protect

EJA configured data is saved by the write protect function. Write protect status is set to **YES** when 8 alphanumeric characters are entered in the **New password** field and transferred to the transmitter. In write protect **YES** status, the transmitter does not accept parameter changes. When the 8 alphanumeric string entered in the **New password** field is also entered in the **Enable write** field and transferred to the transmitter, it will be possible to change transmitter parameters during a 10 minute period.

To change the transmitter from Write protect **YES** status back to Write protect **NO** status, enter 8 spaces in the **New password** field after Write protect has been released using enable write.

#### (a) Setting Password

Example: Set the password to 1 2 3 4

**EJA:**  
Hot key  
1 keypad input  
2 Enable Write  
3 New password

**EJA:**  
Enter New Password  
\*\*\*\*\*

**EJA:**  
Re-Enter New Password  
1234

**EJA:**  
Set New Password OK

**EJA:**  
Method Aborted

**F4** (ENTER)

Press Hot key. Select the **New password**.

**F4** (ENTER)

Set 1 2 3 4 and press **ENTER (F4)**.

**F4** (ENTER)

Press **ENTER (F4)**.

**F4** (OK)

Press **OK (F4)**. Write Protect status changes from **NO** to **YES**.

**F4** (OK)

Press **OK (F4)**.

F0238.EPS

## (b) Changing the Password

Example: To change the password from 1 2 3 4 to 6 7 8 9 A

EJA:  
Input password  
\*\*\*\*\*  
1 2 3 4

Press Hot key and call up Enable Write.  
Enter the password and press ENTER (F4).

EJA:  
Write enable in 10 minutes

Press OK (F4).  
Write protect status is released for 10 minutes.

EJA:  
Method Aborted

Press ENTER (F4).

EJA:  
Hot key  
1 keypad input  
2 Enable write  
3 New password

Select the New password.

EJA:  
Enter New Password  
\*\*\*\*\*  
6 7 8 9 A

Set 6 7 8 9 A

EJA:  
Re-Enter New Password  
\*\*\*\*\*  
6 7 8 9 A

Press ENTER (F4).

EJA:  
Set New Password OK

EJA:  
Method Aborted

Press OK (F4).

F0239.EPS



## NOTE

1. Enable Wrt 10 min releases Write Protect status for 10 minutes. While Write Protect status is released, enter a new password in the **New Password** field.  
It will not be possible to set a new password when 10 minutes have elapsed.
2. To release Write Protect status completely, enter 8 spaces in the New Password field according to the instructions given in (b), **Changing the Password**. This causes Write Protect status to change from YES to NO.

EJA:  
Enter New Password  
\*\*\*\*\*  
[Up Arrow] [Down Arrow] x8

Press ENTER (F4).

EJA:  
Re-Enter New Password  
\*\*\*\*\*

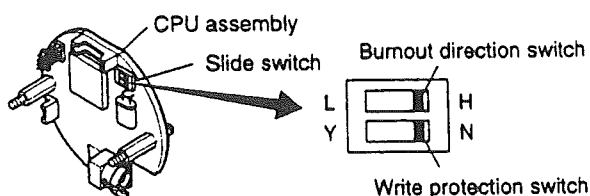
Press ENTER (F4).

- \* "Joker password" and "Software Seal"  
When you lose the password that has been registered, it is possible to release the mode for 10 minutes by using a joker password. Enter "YOKOGAWA" to release Write protect status for 10 minutes. If this joker password is used, the status shown in the parameter "Software seal" is changed from "Keep" to "Break." Press Hot key and select "2. Wrt Protect menu." Current status is shown in "4. Software seal." This status will be returned from "Break" to "Keep" by registering a new password.

F0240.EPS

### (19) Hardware Write Protect and Burnout Direction(with Optional code /F1)

This function prohibits parameter changes through a slide switch on a CPU assembly board. In the case the hardware write protection switch is set to YES, none of the communication method including the handheld terminal such as model 275 is allowed for the alteration of parameters. The write protection switch is factory set to NO(N position in the figure below).



Hardware write protection switch			
Write Protection Switch Position	L Y	H N	L Y
Write Protection	NO	YES	

Burnout direction switch			
Burnout Direction Switch Position	L Y	H N	L Y
Burnout Direction	HIGH	LOW	

F02F1.EPS

### (20) H<sub>2</sub>O Unit Select

When mmH<sub>2</sub>O, inH<sub>2</sub>O or ftH<sub>2</sub>O is set, the pressure varies with the standard temperature definition. The Yokogawa default setting for the standard temperature is 4°C (39.2°F). Use the procedure described below when a standard temperature of 20°C (68°F) is required.

Call up the H<sub>2</sub>O Unit select.

1. Device setup  
 4. Detailed setup  
 2. Signal condition  
 9. H<sub>2</sub>O Unit select

EJA:  
 H<sub>2</sub>O Unit select  
 04C  
 020C(68F)

↓  
 F4  
 (ENTER)

↓  
 F2  
 (SEND)

Select 020C (68F) and press ENTER (F4). Press SEND (F2) to send data.

F0241.EPS

## 2.4 Self-Diagnostics

### 2.4.1 Checking for Problems

#### (1) Identify Problems with HART Communicator

Self-diagnostics of the transmitter and check of incorrect data setting can be carried out with the HART communicator. There are two methods for self-diagnosis of the transmitter, self-diagnosis for every transmission and manually executing the SELF TEST command. When an error message appears, follow "ERROR MESSAGES".

#### Diagnostic by "self test"

1. Device setup  
 2. Diag/Service  
 1. Test/Status

1

EJA:  
 Test/status  
 2 Status

Call up the Test/Status, and select Self test.

2

EJA:  
 Self test OK

If there is no error detected, Self test OK will be displayed. When an error occurs, an error message appears, and the results of self-diagnosis appear in the Status item.

1

EJA:  
 Test/status  
 2 Status

Call up the Status item.

2

EJA:  
 Status  
 Field device not installed  
 OFF

(NEXT)

If there is no error, the result of diagnostics is indicated as OFF. If ON is indicated, a countermeasure for that error is necessary.

F0242.EPS

## • Error Messages — HART Communicator

Error Message	Probable Cause	Countermeasure
Pressure sensor error	Capsule problem	Replace capsule.
Temp (Cap) sensor error		
EEPROM (Cap) failure		
Sensor board not initialized		
Temp (Amp) sensor error	Amplifier problem	Replace amplifier.
EEPROM (Amp) failure		
Dev id not entered		
CPU board not initialized		
Invalid Selection		Change the setting.
Parameter Too High	Set value is too high.	
Parameter Too Low	Set value is too low.	
Incorrect Byte Count		—
In Write Protect Mode	Operation is set in the Write Protect mode.	—
Set to Nearest Possible Value	Value is set to a nearest possible value.	—
Lower Range Value too High	LRV set point is too high.	Change the range.
Lower Range Value too Low	LRV set point is too low.	
Upper Range Value too High	URV set point is too high.	
Upper Range Value too Low	URV set point is too low.	
Span too Small	Set span is too small.	
Applied Process Value too High	Applied pressure is too high.	Adjust the applied pressure.
Applied process Value too Low	Applied pressure is too low.	
New LRV pushed URV Over Sensor Limit	The shift of URV according to the new LRV setting exceeds USL.	Change the setting within the range of USL.
Excess Correction Attempted	Amount of correction is too much.	Adjust the amount of correction.
In Proper Current Mode	The fixed current mode is desired but not set in that mode.	Set in the fixed current mode.
In Multidrop Mode	Operation is set in the multi-drop mode.	—

T0205.EPS

## (2) Checking with Integral Indicator

If an error is detected in the self-diagnostic, an error number is displayed on the integral indicator. If there is more than one error, the error number changes at two-second intervals.

See Table 2.4.1 regarding the error numbers.



F0243.EPS

Figure 2.4.1 Identifying Problems Using the Integral Indicator



## • Error Messages — DPharp Integral Indicator

Integral Indicator Display	Description	Cause	Output Operation during Error	Countermeasure
None	GOOD			
—	ERROR			
Er. 01	CAP MODULE FAULT	Capsule problem	Outputs the signal according to status of burnout direction switch (High or Low).	Replace capsule.
Er. 02	AMP MODULE FAULT	Amplifier problem	Outputs the signal according to status of burnout direction switch (High or Low).	Replace amplifier.
Er. 03	OUT OF RANGE	Input is outside measurement range limit of capsule.	Outputs high range limit value or low range limit value.	Check input.
Er. 04	OUT OF SP RANGE	Static pressure exceeds specified range.	Displays present output.	Check line pressure (static pressure).
Er. 05	OVER TEMP (CAP)	Capsule temperature is outside range (–50 to 130°C).	Displays present output.	Use heat insulation or make lagging to keep temperature within range.
Er. 06	OVER TEMP (AMP)	Amplifier temperature is outside range (–50 to 95°C).	Displays present output.	Use heat insulation or make lagging to keep temperature within range.
Er. 07	OVER OUTPUT	Output is outside high or low range limit value.	Outputs high or low range limit value.	Check input and range setting, and change them as needed.
Er. 08	OVER DISPLAY	Displayed value is outside high or low range limit value.	Displays high or low range limit value.	Check input and display conditions and modify them as needed.
Er. 09	ILLEGAL LRV	LRV is outside setting range.	Holds output immediately before error occurrence.	Check LRV and modify as needed.
Er. 10	ILLEGAL URV	URV is outside setting range.	Holds output immediately before error occurrence.	Check URV and modify as needed.
Er. 11	ILLEGAL SPAN	SPAN is outside setting range.	Holds output immediately before error occurrence.	Check SPAN and change as needed.
Er. 12	ZERO ADJ OVER	Zero adjustment is too large.	Displays present output.	Readjust zero point.

T0206.EPS

# 3. PARAMETER LISTS

Item	UHI	Description	Remarks
	Tag	Tag number	Tag number, Up to 8 characters
	Descriptor	Descriptor	Up to 32 characters
	Message	Message	Up to 16 characters
	Date	Date	xx/yy/zz
Transmitter	Unit	Unit	inH <sub>2</sub> O, inHg, ftH <sub>2</sub> O, mmH <sub>2</sub> O, mmHg, psi, bar, mbar, g/cm <sup>2</sup> , kg/cm <sup>2</sup> , Pa, kPa, MPa, torr, atm
	LRV URV	Lower range value Lower range value	Set the calibration range by the keypad
	Apply values	Apply values	Range for 4 to 20 mA DC signal is set with actual input applied.
	Damp	Damping time constant	0.2, 0.5, 1, 1.5, 2, 4, 6, 8, 16, 32 sec
	Xfer fnctn	Transfer function	linear/Square root
	Low cut	Low cut	0 to 20 %
	Cut mode	Cut mode	Linear/Zero
	Bi-dire mode	Bi-directional mode	On/Off
	H <sub>2</sub> O Unit select	H <sub>2</sub> O Unit select	④ 4°C/④ 20°C (68°F)
	Snsr temp unit	Sensor temperature unit	°C/°F
Display	Static pres unit	Static pressure unit	inH <sub>2</sub> O, inHg, ftH <sub>2</sub> O, mmH <sub>2</sub> O, mmHg, psi, bar, mbar, g/cm <sup>2</sup> , kg/cm <sup>2</sup> , Pa, kPa, torr, atm
	Display mode	Display mode	Normal % , User set , User set & % , Inp pres , Pres & %
	Display fnctn	Display fnctn	linear/Square root
	Engr unit	Engineering unit	Up to 8 characters
	Engr disp LRV	Engineering display LRV	-19999 to 19999
	Engr disp URV	Engineering display URV	-19999 to 19999
	Engr disp point	Engineering display decimal point	0, 1, 2, 3
HART output	Poll addr	Polling address	1 to 15
	Auto poll	Auto poll	No/Yes
	Burst option	Burst mode option	Pres , % rng , A01 out
	Burst mode	Burst mode	ON/OFF
Monitoring	Pres % rng A01 out Snsr temp Static pres Engr display	Pressure variable % output variable 4 to 20 mA output variable Sensor temperature Static pressure Output (in Engr unit)	-5.0% to 110.0% -3.2 mA to 21.6 mA -19999 to 19999
Maintenance	Loop test	Test output % setting	-5.0% to 110.0%
	Self test	Self test	Check using the self-test command.
	Status	Status	Display of the result of self-test, calibration of transmitter.
	A01 Alarm typ	Status of analog output alarm	High/Low
	Write Protect	Write Protect	Yes/No
	Enable Write	Enable Write	8 characters
	New password	New password	8 characters
	Ext SW mode	Ext SW mode	Enable/Inhibit
	Software seal	Software seal	Keep/Break
Adjustment	Zero trim	Zero trim	Set the current input value to 0 kPa.
	Lower sensor trim Upper sensor trim	Lower sensor trim Upper sensor trim	Adjust only measured pressure variable.
	D/A trim Scaled D/A trim	Digital/Analog output trim Scaled D/A trim	Adjust the output value at the points of 4 mA and 20 mA.

T0301.EPS

Item	UHI	Description	Remarks
Sensor information	Isoltr matl	Isolator material	Hast-C, Tantalum, 316L, Unknown, Special
	Fill fluid	Fill fluid	Silicone oil, F oil, Unknown, Special
	Gasket matl	gasket material	PTFE, 316L, Unknown, Special
	Flange matl	Flange material	Carbon Steel, Hast-C, 316L, Unknown, Special
	Drain vent matl	Drain vent material	316SST, Hast-C, 316L, None, Unknown, Special
	Flange type	Flange type	Conventional, Remote seal, Level, Unknown, Special
	RS isoltr matl	Remote seal isolator material	316 SST, Hast-C, Monel, Tantalum, 316L, Unknown, Special
	Flange size	Flange size	ANSI 150, ANSI 300, ANSI 600, None, Unknown, Special
	Num remote seal	Number of remote seal	One seal, Two seal, None, Unknown
	RS fill fluid	Remote seal fill fluid	Silicone oil, SH704, SH705, Ethy Gly/H <sub>2</sub> O, Prop Gly/H <sub>2</sub> O, None, Unknown, Special
	RS type	Remote seal type	Wafer, Nozzle, HTV-W, HTV-N, None, Unknown, Special
Additional information	Distributor	Distributor	YOKOGAWA EJA
	Dev type	Device type	
	Dev ID	Device ID	
	Final asmbly num	Final assembly number	
	Universal rev	Universal revision	
	Fld dev rev	Fld dev revision	
	Software rev	Software revision	
	Model	Model	
	Style	Style	
	LSL	Lower range limit	
	USL	Upper range limit	
	MIN SPAN	Minimum span	
	Manufacturer	Manufacturer	
	Lo snsr trim pt	Lower snsr trim pt	
	Up snsr trim pt	Upper snsr trim pt	
	Serial No.	Serial Number	

T0302.EPS

## REVISION RECORD

Title: Model EJA Series HART Protocol

Manual No.: IM 01C22T01-01E

[illegible]

# YOKOGAWA

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## YOKOGAWA BLUE STAR LTD.

### Head Office

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Phone : 91-80-2271513 Fax : 91-80-2274270

**PRESSURE-REDUCING VALVE****SAF installed in control board****Item 783-09-14 for 1800MT LOX TANK****Item 783-102-14 for 1000MT LIN TANK**

**SUPPLIER :** SAF  
13 – 17 Rue d' EPLUCHE  
95310 SAINT OUEN L'AUMONE

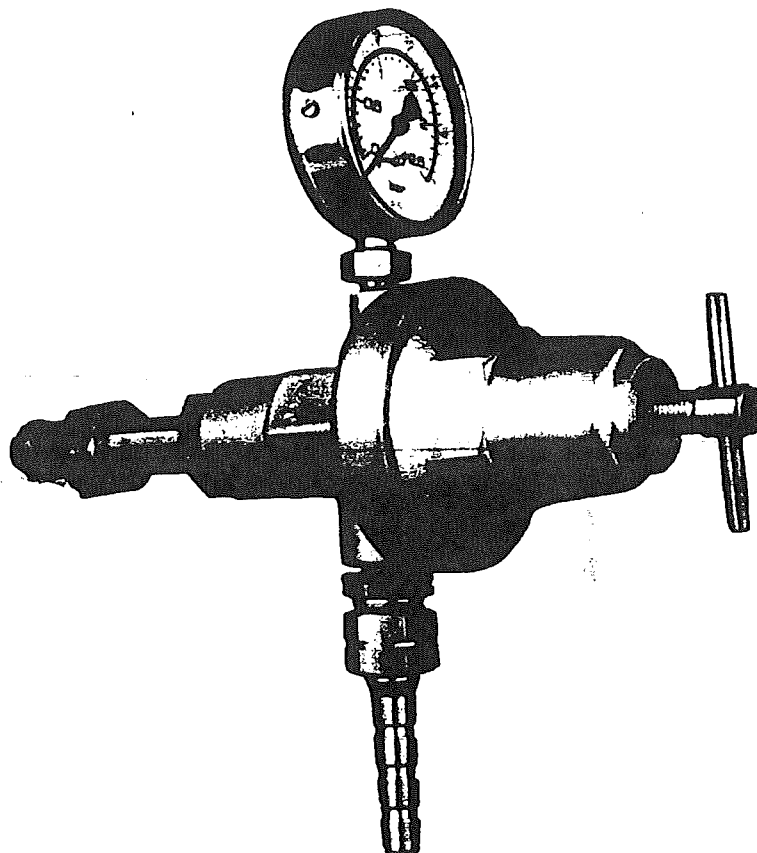
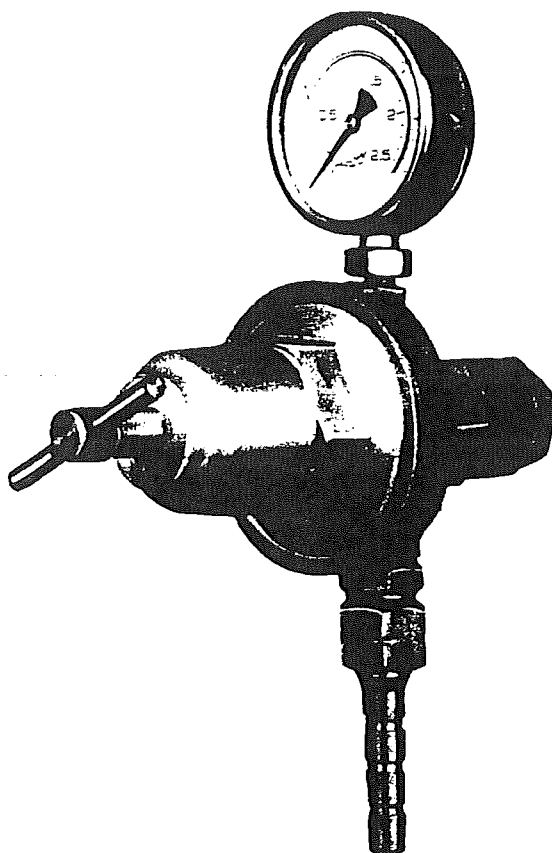
# détendeur pour canalisation et bouteilles GPL

**SAF**

instruction  
d'emploi  
et d'entretien

maintenance  
and instruction  
manual

Anweisung für die  
Verwendung und  
die Wartung



Caractéristiques d'emploi <i>Operating conditions</i> <i>Einsatzbedingungen</i>	Détendeur <i>Regulator</i> <i>Druckminderer</i>	0/2.5 0/6 0/16	Pression maximum de détente <i>Maximum outlet pressure</i> <i>Maximaler Emddruck</i>	bar 1,5 4 10	PSI 22 59 147	Débit maximum <i>Maximum flowrate</i> <i>Maximal durchsatz</i>	M <sup>3</sup> /h 10 25 95
---	---	----------------------	--	-----------------------	------------------------	--	-------------------------------------

## Mise en service

Monter en dérivation le détendeur canalisation sur une conduite de gaz dont la pression n'excédera pas 20 bar. S'assurer que la vis de détente est complètement desserrée et alimenter l'appareil.

Serrer progressivement la vis de détente jusqu'à ce que la pression lue au manomètre soit égale à la pression désirée.

En cas d'arrêt définitif couper l'alimentation puis desserrer complètement la vis de détente.

## Operation

Fit the pressure-reducing valve on a bypass line connected to a gas line in which the pressure will not exceed 294 psi. Ensure that the adjusting screw is fully out and open the gas supply to the line.

Progressively screw up the adjusting screw until the pressure read on the gauge corresponds to the desired pressure.

When the system is shut down, cut off the gas supply, then fully unscrew the adjusting screw.

## Inbetriebnahme

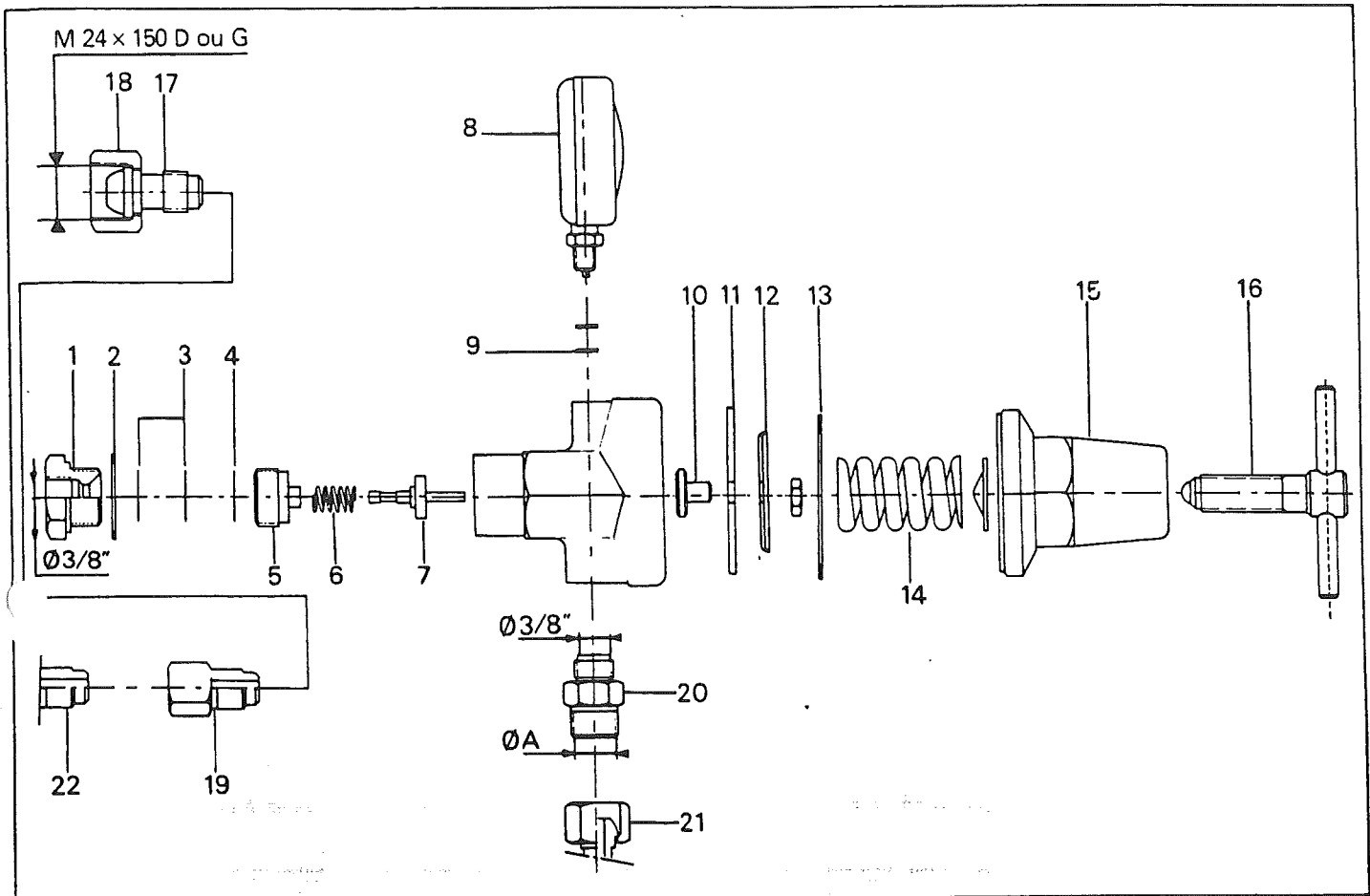
Den Leitungs-Druckminderer als Abzweigung in eine Gasleitung, deren Druck 20 atü nicht überschreitet, einbauen.

Sich versichern, dass die Druckminderschraube vollkommen gelockert ist, anschließend den Apparat beschicken.

Die Druckminderschraube bis zum Erhalt des, am Manometer angezeigten, gewünschten Drucks, progressiv anziehen.

Im Falle von endgültiger Stillegeung, die Beschickung absperrern, alsdann Stellschraube völlig lösen.

Numéros nomenclature  
Part numbers  
Bestellnummern



- 1 - Raccord intermédiaire d'entrée  
2 - Joint de raccord  
3 - 50 filtres  
4 - 50 tôles perforées  
5 - Guide de clapet  
6 - Ressort de clapet  
7 - Clapet

- 8.1 Manomètre avec raccord M 10 x 100  
- 2,5 bar  
- 6 bar  
- 16 bar

- 8.2 Manomètre avec raccord G 1/4\"  
- 2,5 bar  
- 6 bar  
- 16 bar

- 9 50 joints  
- pour raccord M 10 x 100  
- pour raccord G 1/4\"

- 10 - Centre de membrane  
11 - Membrane  
12 - Plateau de membrane  
13 - Joint de membrane

- 14 - Ressort de détente: 1,5 bar  
4 et 10 bar

- 15 - Couvercle  
16 - Vis de détente  
17 - Embout sphérique

- 2935 0038  
2935 0039  
2935 2007  
  
2935 0035  
2935 2009

- 6841 1602  
6841 1603  
6841 1604  
  
6841 1540  
6841 1541  
6841 1542

- 2901 2100  
  
2935 0043  
2953 2500  
2935 0042  
2919 0038

- 2935 2016  
2901 0013  
2935 0052

- 18 - Ecrou M 24 x 150 à droite  
Ecrou M 24 x 150 à gauche  
19 - Intermédiaire de raccord d'entrée  
20/21 - Mamelon de sortie - raccord pour tuyau

TYPE	GAZ	A	20	21
NF	Non Combustible	M 16 x 150 DROITE	2935 2538	7001 2021
	Non Combustible	M 20 x 150 DROITE	2935 0062	7001 2023
	Combustible	M 16 x 150 GAUCHE	2936 2510	7001 2022
	Combustible	M 20 x 150 GAUCHE	2936 0041	7001 2024

- 22 - Raccords d'entrée pour bouteille GPL

Ø 22,91 x 1,814 Whit. gauche	Ø 21,7 x 1,814 SI gauche
Tetrene NF Type H: 2903 2002	Propane } NF Type E: 2901 2012 Butane }

- 23 - Sachet de 10 joints

2901 2038

FRANCE  
**LA SOUDURE AUTOGENE  
FRANCAISE**  
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Saint-Ouen-L'Aumône  
95315 Cergy-Pontoise Cedex  
Tél. : 01 34 21 33 33  
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RCS Pontoise B 552 033 821

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SAF reserves itself the right to embody modifications without prior notice. The illustrations, descriptions and characteristics are given for information only and do not engage the responsibility of the constructor

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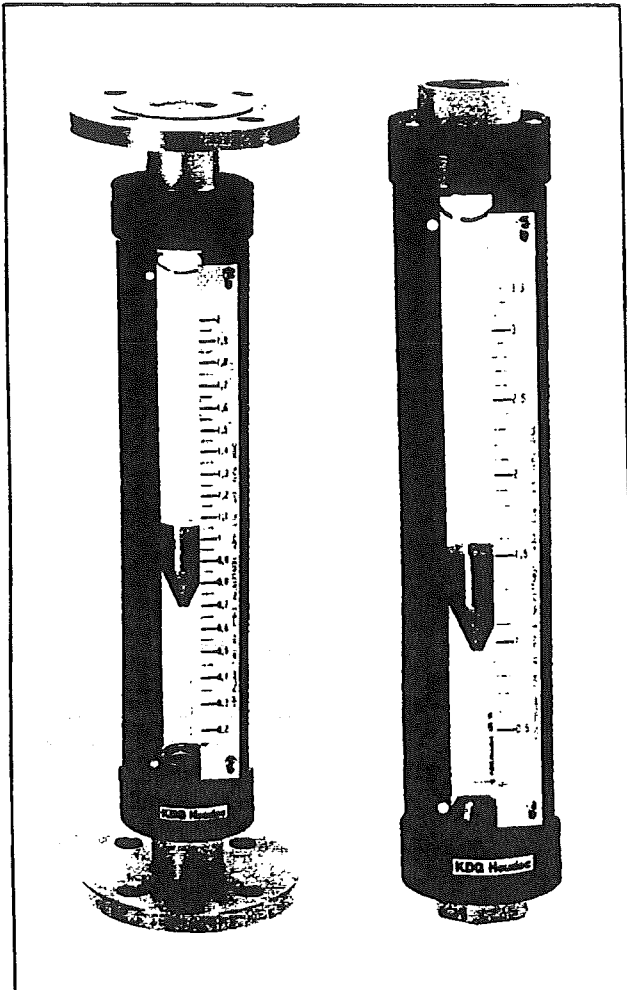


**FLOWMETER type 134  
KDG HOUDEC installed in control board**

**Item 783-09-20/21 for 1800MT LOX TANK  
Item 783-102-20/21 for 1000MT LIN TANK**

**SUPPLIER: MOBREY**  
**PARC Silic**  
**23, Rue du Petit Albi**  
**BP 8308**  
**95803 CERGY PONTOISE Cedex**  
**Mr Plilippe CHAUVIN / Christophe CARREIRA**  
**Tel : 0130174063**  
**Fax : 0130174087**

# THE MOBREY GROUP



## KDG HOUDEC VARIABLE AREA FLOWMETER TYPE 134

Installation, operation and  
maintenance instructions

### Models:

- Threaded connections
- Flange connections

## SUMMARY

### 1. Description

- 1.1- Use
- 1.2- Operating principle
- 1.3- Component parts

Page 2  
Page 2  
Page 2

### 2. Installation

Page 2

### 3. Commissioning

Page 3

### 4. Maintenance

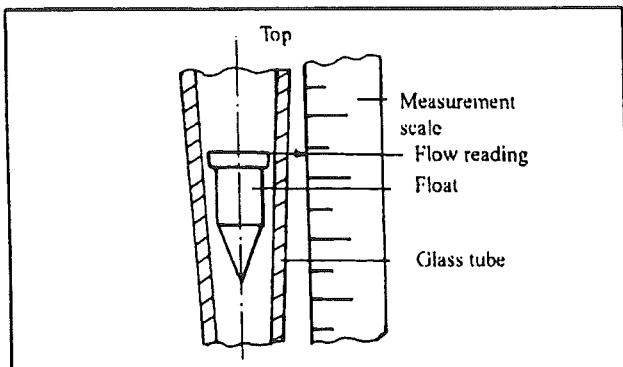
- 4.1- Removal and replacement of the glass tube Page 3
- 4.2- Removal and replacement of the reading scale Page 3
- 4.3- Adding / replacing alarm contacts Page 4
  - 4.3.1 ILS bistable type contact Page 4
  - 4.3.2 Photo-electric cell type contact Page 4
  - 4.3.3 Annular bistable inductive type contact Page 4
- 4.4- Spare parts list Page 4

## 1. DESCRIPTION

### 1.1 - Use

- The 134 type flowmeter is designed for the measurement of the flow rates of transparent mediums.
- The flow rate is indicated on a separate scale which enables calibration to be modified easily.
- Axial connections with threaded or flanged fittings.
- Technical specifications - see brochure.

### 1.2 - Operating principle

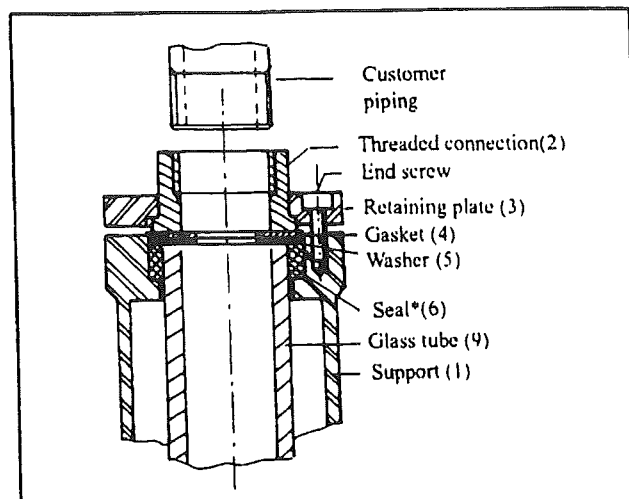


- A plumb-line type float is pushed by the fluid and moves up vertically inside a tapered borosilicate glass tube which gets wider towards the top.
- The cross section is therefore variable and increases progressively.
- For a given flow-rate, the float settles at a particular level whereby the weight of the float is in equilibrium with the thrust of the fluid.
- The upper collar on the float provides an instant indication of the flow rate on the separate measurement scale.

### 1.3 - Components parts

- The flowmeter is composed of : (see attached drawing 50556-01-02-15-16).
- A painted aluminium alloy support (1).
- A borosilicate glass tube widening towards the top (9).
- A float designed for use with the fluid or for special requirements (alarm contacts). The float can either be unguided with upper and lower stops, or guided (Frame 4, dural or stainless steel float).
- A separate graduated scale in painted aluminium alloy to indicate the flow rate.
- 2 painted aluminium alloy retainer plates (3) fixed by 3 screws used to provide a tight seal between the connection and the glass tube by means of :
  - 2 seals (6)
  - 2 gaskets depending on model (4).
  - 2 stainless steel washers (5).
- Threaded or flanged connection (2).
- Optional alarm contacts, see paragraph 4.3.
- Refer to specific 50556 drawings for further details.

## 2. INSTALLATION



#### Before mounting the equipment :

- Ensure that the lines have been drained and that they do not contain any solid particles (filings, small pieces of metal, etc...) which could damage the glass tube or the float when the equipment is put into service.
- Take care to remove the foreign structures used for packing and especially to block the float.
- The flowmeter should be installed on a vertical piping. To obtain an accurate reading, it is essential that the instrument be in a precisely vertical position. The medium must flow from bottom to top.
- Check the compatibility of the pipe and flowmeter connection fittings (same nominal diameter).
- When making connection (threaded or flange assembly), the piping must not impose any abnormal stresses to the meter, it must be clamped by convenient devices upstream and downstream the meter. It is advised to make provision for a straight length of about 5 times the pipe diameter in front of the meter upstream.
- While tightening the piping on the flowmeter, hold the threaded connection firmly, or unscrew sufficiently the three end screws to allow the connection fitting to be moved (WARNING : do not forget to retighten the screws after connecting up the meter, the screws provide the pressure required to obtain a tight seal).
- Ensure that service condition parameters do not exceed the limits for the equipment (details provided in the specifications).
- \* When the seal is made from several elements with different thicknesses, install the thicker the last (against the intermediate washer).

### 3. COMMISSIONING

- Avoid subjecting the equipment to shock when putting the flowmeter into service (increase pressure progressively). Retighten the retainer plates (3) if required.
- Ensure that the arrow on the indicator scale is exactly opposite the reference arrow engraved on the glass tube.

### 4. MAINTENANCE

- In order for the equipment to operate correctly, all parts must be kept clean.
- Use soap and water or methylated spirits for cleaning the glass tube.
- If cleaning is difficult, the various parts (tube, float, limit stop, connection, etc...) can be cleaned with a solvent which is compatible with material of the components.
- Clean the polycarbonate protective screens (optional) with soap and water and a non-abrasive sponge to avoid scratching or clouding.

#### 4.1 - Removal and replacement of the glass tube

- The line must be isolated before this operation is carried out.

##### Important note :

- Up to and including tube size 10, the measurement assembly comprised of the tube, the float and the limit stops should not be taken apart. The components are not to be changed with parts from other identical flowmeters. (When the assembly is replaced the entire tube + float + limit stop unit must be changed).
- From tube size 14 upwards, the components are interchangeable (for standard flow rates).

##### 4.1.1 - Removal

- The equipment is removed in reserve order to the installation procedure (paragraph 2).
- Unscrew the screws (8).
- Separate the retainer plates (3) holding the connection fitting (2). This may be threaded, glued, flanged, etc. depending on the model (refer to applicable 50556 drawing).
- Withdraw the support assembly (1) plus the tube (9), seals, float (11), limit stops (7) and washers or guides.
- Clean or replace defective components.

##### Note :

- If the seals harden or adhere to parts with which they are in contact, removal may prove difficult. Take care not to break the glass tube if it is not going to be replaced.
- Seals should preferably be replaced when the meter is removed after use.

#### 4.1.2 - Replacement

- Fit the float (11) (point facing downwards) and the upper and lower stops (7) in the measuring tube (9) (widest part upwards), refer to the 50556 drawing applicable to the model.
- Place this assembly in the frame.
- Install the adjustment washers (12) if required.
- Fit the seals (6) and then, depending on the model, the washers (5) (for models with guides, washers 5 with the guide rod goes on the upper part of the meter) and the gasket (4).
- \* When the seal is made from several elements with different thicknesses, install the thicker the last (against the intermediate washer).
- Next place the retainer plates (3) fitted with the appropriate connection in position together with the screws (8).
- Ensure the the glass tube is centred vertically on the support, and adjust if necessary (IMPORTANT).
- Tighten up the screws (8) moderately tightly.
- Check operation, ensure that there is a good seal and tighten further if necessary.
- Check that the arrow of the indicator is exactly opposite the reference arrow on the tube (if necessary, unscrew the arrow and move it in the slots provided).

#### 4.2 - Removal and replacement of the reading scale (10)

- Unscrew the two retaining screws (or the 4 screws holding the optional protective screen).
- Withdraw the scale.
- Refit the replacement scale and ensure that the reference arrow is directly in front of the reference arrow on the tube.

### 4.3 - Adding/replacing alarm contacts

#### 4.3.1 - ILS bistable type contact (see diagram 4.3.1)

- Use with all floats with magnets (see options in brochure).
- Technical specifications in accordance with data sheet 1040.
- Adjustable by movement along rail over the full range of the scale (see drawing 50556-30)
- The float must be replaced when a contact is added (if the equipment was not originally supplied with ILS contacts) (see 4.2 for removal of the equipment).
- It is possible to install several contacts on the same flowmeter (approx. distance between 2 contacts 40 mm).
- Test a contact : pass a bar magnet down over the end of the block and make sure that the change of state occurs between the blue and white wires.
- Replace a contact : install the new contact in the same position as the old and ensure that the distance between the tube and the end of the block is within  $\leq 1\text{mm}$ .

#### 4.3.2 - Photo-electric cell type contact (see diagram 4.3.2)

- Use for all flow rates for transparent particle-free fluids.
- Technical specifications in accordance with data sheet 1033 plus supply relay in accordance with data sheet 1028.
- Adjust by moving on rail over full range of the scale (see drawing 50556-31)
- The equipment requires no modification when a cell is added (apart from removal of the optional protective screen is applicable).
- Adjust sensitivity using integrated potentiometer.

##### Note :

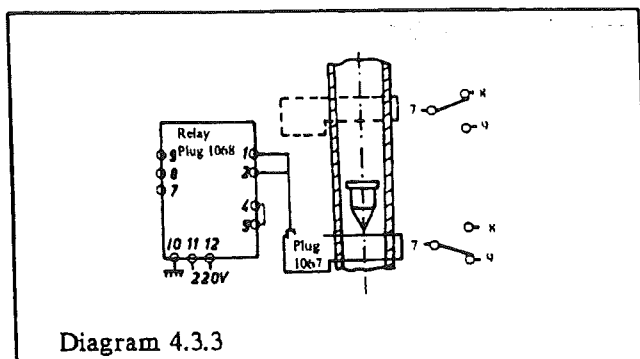
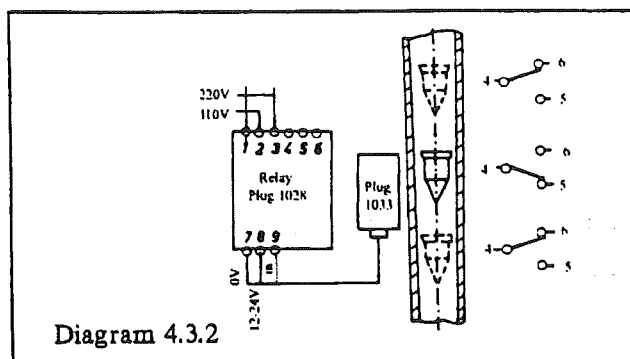
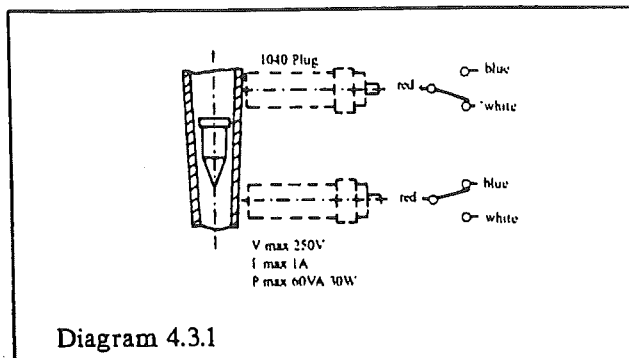
- The cell provides a transitory contact, i.e. there is a change of state when the float is in front of the eye of the cell. If the float moves out of the field of the eye (upwards or downwards) the state returns to its initial position.
- Test a cell : pass a metal object (e.g. screwdriver) in front of the detector and note the change of state on the relay (or red indicator light).

#### 4.3.3 - Annular bistable inductive type contact (see diagram 4.3.3)

- Use limited to series 5 and 7 tubes with stainless steel and PVC floats (frame 1).
- Technical specifications in accordance with data sheet 1067 plus supply relay in accordance with data sheet 1068.

- Important : the measuring tube must be removed before an annular contact is added or replaced.
- Test a contact : pass a metal object (e.g. 3mm screwdriver blade) and ensure that the relay changes state.

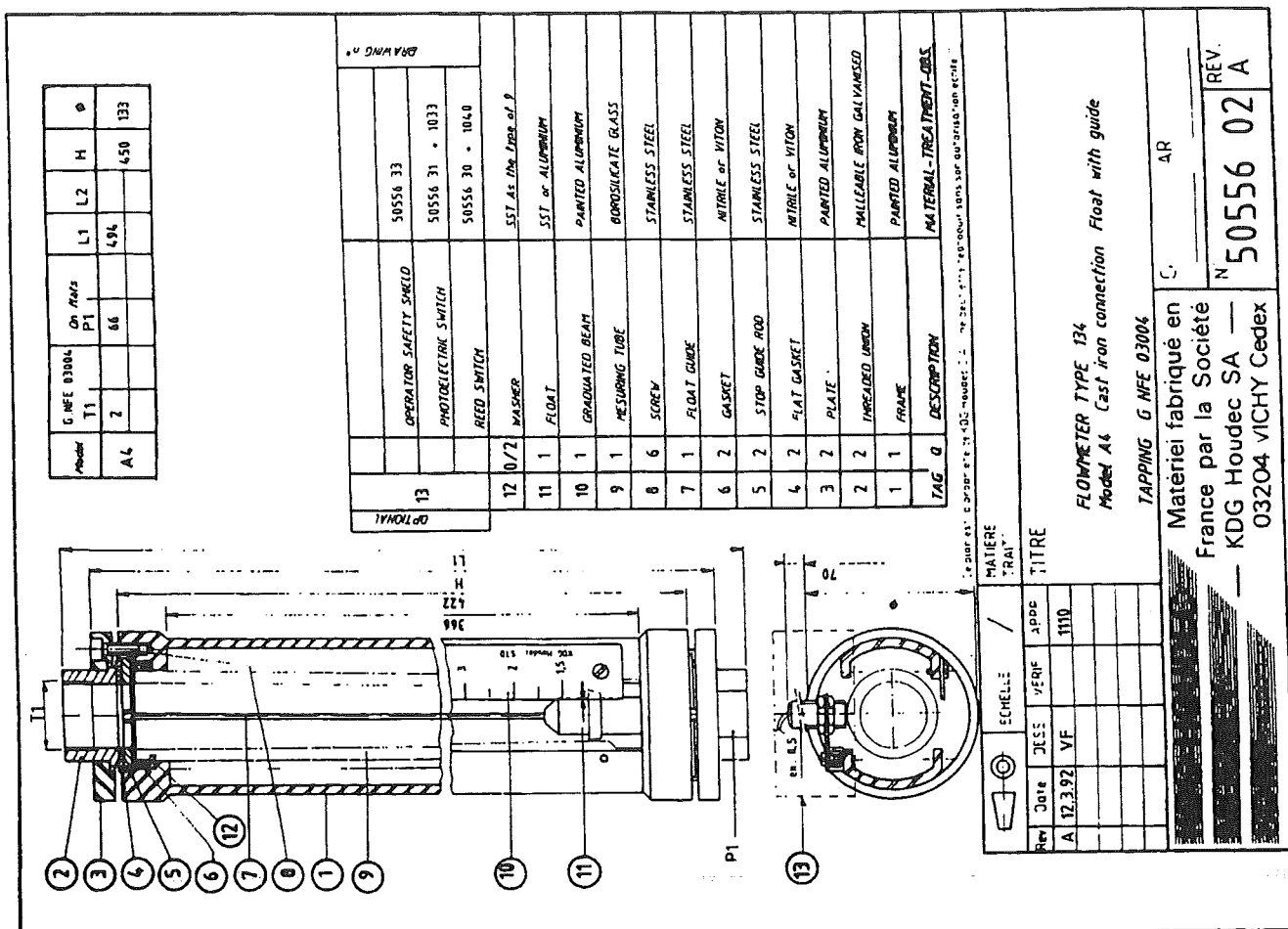
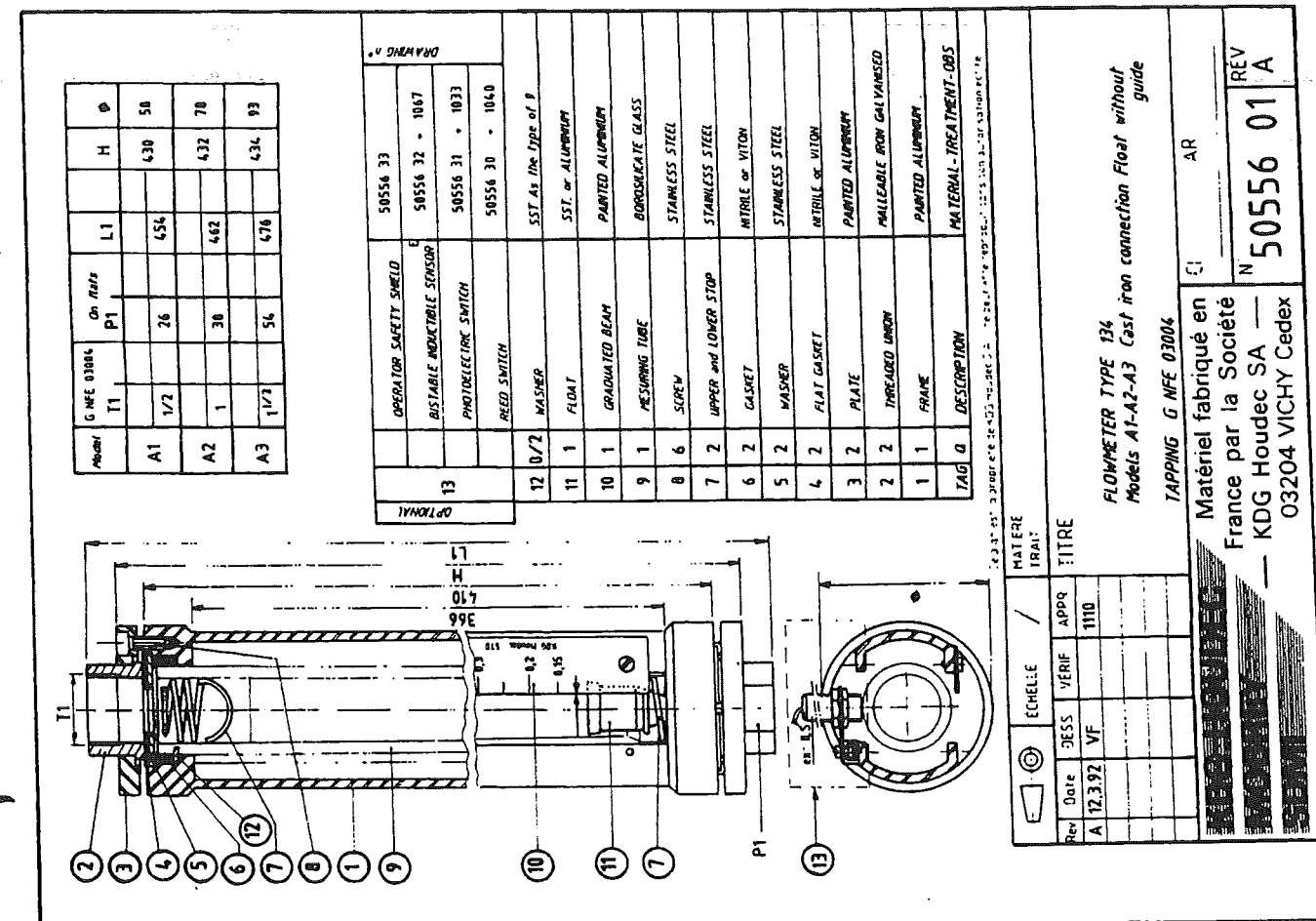
##### Block diagrams :



### 4.4 - Spare parts list

- |                     |               |
|---------------------|---------------|
| - Measuring tube    | - Float       |
| - Seals             | - Limit stops |
| - Measurement scale |               |

The only reference that needs to be mentioned is the equipment serial number, if this is not available use the code on the 134 type manual for standardised flow rates.





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☎ : 04.90.93.33.30 - Téléfax : 04.90.93.33.31

**783-MA1**

**CHAPTER XV**

**Capsule Pressure Gauge type 632  
WIKA installed in control board**

**Item 783-09-32/39 for 1800MT LOX TANK  
Item 783-102-32/39 for 1000MT LIN TANK**

**SUPPLIER :**

**WIKA**  
Parc d' Affaires des Bellevues  
ERAGNY PARC / Immeuble COLORADO  
8, Rue Rosa Luxembourg  
95 – ERAGNY SUR OISE – BP 261  
95615 CERGY PONTOISE Cedex  
Mr Francois DUVAUCHEL  
Tel : 0603845738  
Fax : 0321303068

# Capsule Pressure Gauges

## Stainless Steel Series • Model 632.50

### Pressure Gauges

#### Service intended

All stainless steel pressure gauge.  
Suitable for corrosive environments and gaseous media.

#### Design

EN 837-3

#### Nominal size

63, 100 and 160 mm

#### Accuracy class per EN 837-3 /6

1.6

#### Scale ranges per EN 837-3 /5

63 mm: 0 ... 40 to 0 ... 600 mbar

100 mm: 0 ... 16 to 0 ... 600 mbar

160 mm: 0 ... 2.5 to 0 ... 600 mbar

or other equivalent units of pressure or vacuum.

#### Working pressure

Steady: full scale value

Fluctuating: 0.9 x full scale value

#### Operating temperature

Ambient: -20 ... +60 °C

Medium: +100 °C maximum

#### Temperature effect

When temperature of the pressure element deviates from  
reference temperature (+20 °C):

max.  $\pm 0.6\%$  / 10 K of true scale value

#### Ingress protection

IP 54 per EN 60 529 / IEC 529

#### Standard features

##### Pressure connection

Material: stainless steel 1.4571

Threaded entry (radial or back) per EN 837-3 /7.3

63 mm: G 1/4 B (male), 14 mm flats

100, 160 mm: G 1/2 B (male), 22 mm flats

##### Pressure element

Material: stainless steel 1.4571

##### Sealing ring

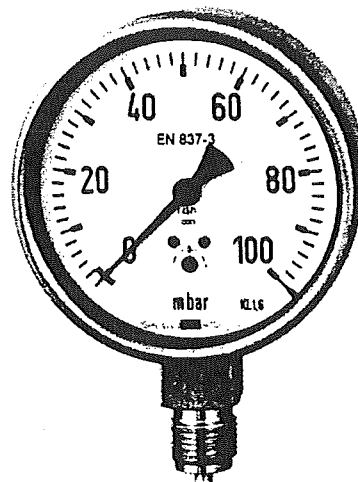
FPM (Viton)

##### Movement

Material: stainless steel

##### Zero adjustment

Through window



#### Dial

White aluminium with black lettering

#### Pointer

Black aluminium pointer

#### Case

Natural finish stainless steel

#### Window

Laminated safety glass

#### Bezel ring

Cam ring (bayonet type), natural finish stainless steel

#### Optional extras

- Other pressure connection
- Accuracy class higher, class 1.0
- Overpressure and vacuum safety
  - 3 x with scale ranges  $\leq 25$  mbar
  - 10 x with scale ranges  $> 25$  mbar
- 3-hole panel or surface mounting flange
- Narrow panel ring with clamp
- 100 and 160 mm: scale ranges  $\geq 100$  mbar with liquid filling (Model 633.50)

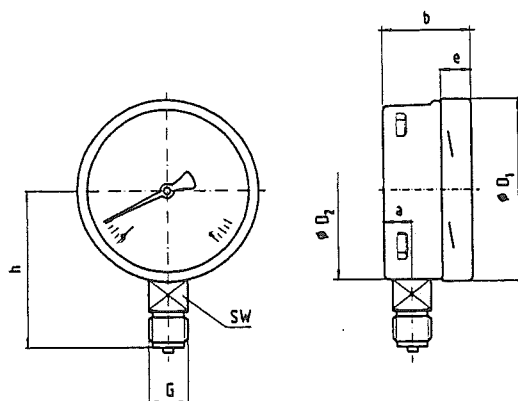


## Dimensions

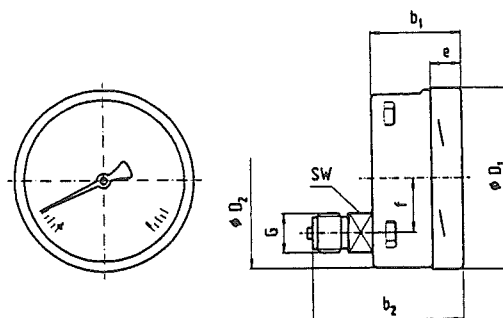
### Standard version

NS 100, radial bottom pressure entry

NS 100, lower back pressure entry



1520 857.01



1520 865.01

Nominal size	Dimensions [mm]											Weight [kg]
	a	b	b <sub>1</sub>	b <sub>2</sub>	D <sub>1</sub>	D <sub>2</sub>	e	f	G	h ± 1	SW	
63	9	42	42	63	64	62	22	1)	G ¼ B	52	14	0.19
100	15.5	49.5	49.5	83	101	99	17.5	30	G ½ B	87	22	0.60
160	15.5	49.5	49.5	83	161	159	17.5	50	G ½ B	118	22	1.10

Standard pressure entry with parallel thread and seating to EN 837-3 / 7.3.

1) Centre back pressure entry

## Ordering information

State:

Model / Nominal size / Scale range / Size and location of connection / Optional extras required

Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing. Modifications may take place and materials specified may be replaced by others without prior notice.



**WIK A Alexander Wiegand GmbH & Co.**  
 Alexander-Wiegand-Straße • 63911 Klingenberg  
 ☎ (0 9372) 132-0 • ☎ (0 9372) 132-406/414  
<http://www.wika.de> • E-mail: [info@wika.de](mailto:info@wika.de)

**Tube Pressure Gauge type 232  
WIKA installed in control board**

**Item 783-09-37 for 1800MT LOX TANK  
Item 783-102-37 for 1000MT LIN TANK**

**SUPPLIER :**

**WIKA**  
Parc d' Affaires des Bellevues  
ERAGNY PARC / Immeuble COLORADO  
8, Rue Rosa Luxembourg  
95 – ERAGNY SUR OISE – BP 261  
95615 CERGY PONTOISE Cedex  
Mr Francois DUVAUCHEL  
Tel : 0603845738  
Fax : 0321303068

# **Bourdon Tube Pressure Gauges Stainless Steel Series Model 232.50/233.50, without/with Liquid Filling**

WIKA Data Sheet PM 02.02

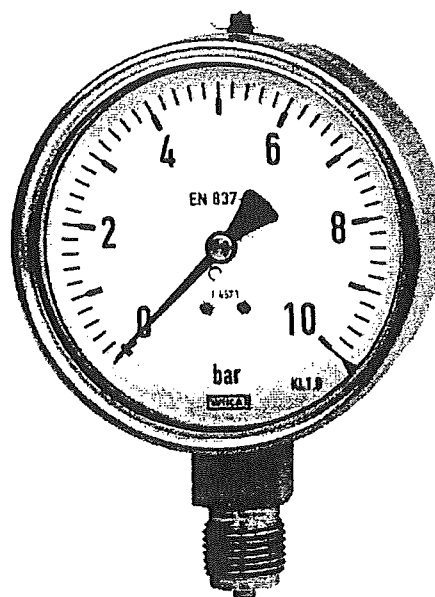


## **Applications**

- With liquid filled case for applications with high dynamic pressure pulsations or vibrations
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petro-chemical, power stations, mining, on- and offshore, environmental technology, mechanical engineering and plant construction

## **Special Features**

- Excellent load-cycle stability and shock resistance
- All stainless steel construction
- Approval German Lloyd and Gosstandart
- Scale ranges up to 0 ... 1600 bar



**Bourdon Tube Pressure Gauge Model 232.50**

## **Description**

**Design**  
EN 837-1

**Nominal size**  
63, 100 and 160 mm

**Accuracy class**  
63 mm: 1.6  
100, 160 mm: 1.0

**Scale ranges**  
63 mm: 0 ... 1 to 0 ... 1000 bar  
100 mm: 0 ... 0.6 to 0 ... 1000 bar  
160 mm: 0 ... 0.6 to 0 ... 1600 bar  
or other equivalent units of pressure or vacuum

### **Working pressure**

63 mm:	Steady:	$\frac{1}{4}$ of full scale value
	Fluctuating:	$\frac{2}{3}$ of full scale value
	Short time:	full scale value
100, 160 mm:	Steady:	full scale value
	Fluctuating:	0.9 x full scale value
	Short time:	1.3 x full scale value

### **Operating Temperature**

Ambient:	-40 ... +60 °C without liquid filling
	-20 ... +60 °C gauges with glycerine filling
Medium:	+200 °C maximum without liquid filling
	+100 °C maximum with liquid filling

### **Temperature effect**

When temperature of the pressure element deviates from reference temperature (+20 °C):  
max.  $\pm 0.4$  %/10 K of true scale value

### **Ingress protection**

IP 65 per EN 60 529 / IEC 529

## Standard features

### Pressure connection

Material: stainless steel 316L

Lower mount (LM) or lower back mount (LBM)

63 mm: G 1/4 B (male), 14 mm flats

100, 160 mm: G 1/2 B (male), 22 mm flats

### Pressure element

Material: stainless steel 316L

< 100 bar: C-type

≥ 100 bar: helical type

### Movement

Stainless steel

### Dial

White aluminium with black lettering,  
63 mm with pointer stop pin

### Pointer

Black aluminium

### Case

Natural finish stainless steel, with pressure relief in case top  
(63 mm) or in case back (100 and 160 mm),  
ranges ≤10 bar with compensating valve to vent case

**Window:** Laminated safety glass

**Bezel ring:** Cam ring (bayonet type), natural finish stainl. steel

**Liquid filling (for model 233.50):** Glycerine 99.7 %

## Special versions

**Ammonia gauges** (100 and 160 mm)

Scale in °C for refrigerant R 717 (NH<sub>3</sub>),

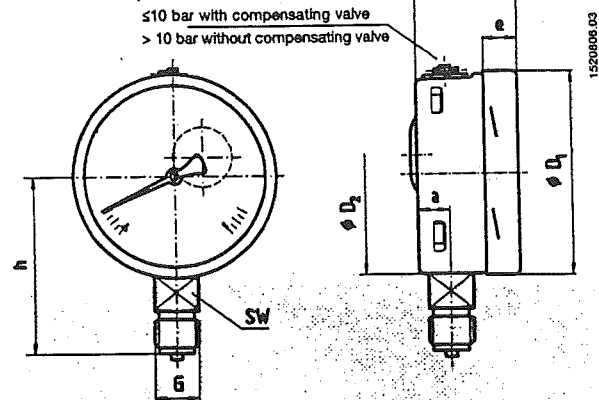
Pressure ranges: -1 ... 0 ... 15 bar or -1 ... 0 ... 26 bar

## Optional extras

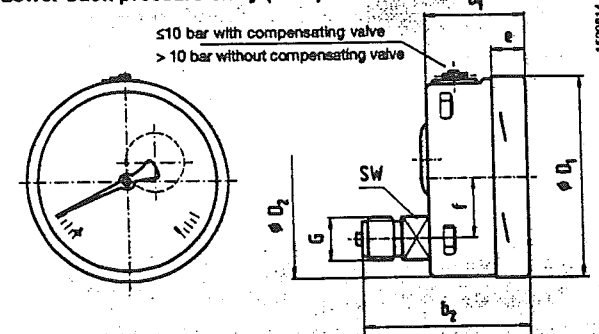
- Other pressure connection
- Monel pressure system (model 26X.50)
- Pressure system stainless steel 1.4571
- 3-hole surface or panel mounting flange, stainless steel
- 3-hole panel mounting flange, stainless steel, polished
- Triangular bezel, stainless steel, polished, with clamp
- Ambient temperature -40 °C: silicon oil filling
- Alarm contacts (see data sheet AC 08.01)
- Transmitter (model 232.30 with combined transmitter model 89X.34, see data sheets PM 02.04 and AE 08.02)

## Standard version

### Radial bottom pressure entry (LM)



### Lower back pressure entry (LBM)



## Dimensions in mm

NS	Dimensions in mm										Weight in kg		
	a	b	b <sub>1</sub>	b <sub>2</sub>	D <sub>1</sub>	D <sub>2</sub>	e	f	G	h ± 1	SW	Mod. 232.50	Mod. 233.50
63	9.5	33	33	57	63	62	11.5	- 1)	G 1/4 B	54	14	0.16	0.20
100	15.5	49.5	49.5	83	101	99	17.5	30	G 1/2 B	87	22	0.60	0.90
160	15.5	49.5 3)	49.5 2)	83 2)	161	159	17.5	50	G 1/2 B	118	22	1.10	2.00

Standard pressure entry with parallel thread and sealing to EN 837-1 / 7.3

1) Centre back pressure entry (CBM)

2) Plus 16 mm with pressure ranges ≥ 100 bar

3) Plus 16 mm with pressure range 1600 bar

## Ordering information

Pressure gauge model / Nominal size / Scale range / Size and location of connection / Optional extras required

Modifications may take place and materials specified may be replaced by others without prior notice.  
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.



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