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C 1 Safety precautions

WARNING

Danger by holes in concrete ceilings

May lead to severe injuries.

- Cordon off the erection area to make sure that persons cannot fall through these holes.

WARNING

- **Danger: detergents and solvents**

May lead to skin injuries, acid burns and other severe injuries

- Use only approved detergents and solvents.
- The use of easily inflammable solvents such as benzene, kerosene, naphtha or mineral spirit is prohibited. This applies also to fire-distinguishing liquids such as R12B1. We recommend that you refrain from employing any refrigerants, i.e. fluorinated hydrocarbons, as your contribution to protect the environment.
- Make sure to wear personal protective equipment such as safety goggles, rubber gloves, aprons and, if need be, breathing equipment.
- Make sure to vent closed rooms thoroughly when working with such detergents and solvents.

After use, all detergents and solvents are to be collected in closed containers for proper disposal. Ensure adherence to the warning signs stuck to the containers which give information on which agents may be collected in the individual containers.

WARNING

Danger by breathing residues when welding, soldering and grinding.

May lead to incompatibles and sickness.

WARNING

Danger of explosion

May lead to severe or lethal injuries.

- Only use spark-free special tools in hazardous areas.
- Smoking and open light are expressly prohibited.
- Welding must only be performed if this is approved by the fire warnings issued by the customer.

C 2 Erection

We propose erection of the plant by Atlas Copco personnel.

The turbomachinery plant is erected as per the conditions specified by you and the resulting drawings which have been made available to you for comment/ approval during order handling, the most important of which are the following:

- Foundation plan
- Layout plan
- P+I diagram
- documentation on instrumentation

C 2.1 Ambient conditions

The turbomachinery plant was designed for the following ambient conditions:

- **Climate**

Ambient temperature:	min. 3 °C	max. 45 °C	Average 20 °C
Relative humidity:	min. %	max. %	Average 67 %

- **Local condition**

	Indoors with heating
Motor and compressor on one frame	Flexible pipe connection

All foundation loads are indicated on the foundation plan.

C 2.2 Supply connections, electricity and auxiliary materials

- **Electric energy for**

Component	Voltage V	Power kW	Phases AC	DC	Frequency Hz
Lubricating oil pump motor/s	400	2.2	3		50
Oil heater/s	400	2 x 4.5	3		50
Motor oil mist separator	345 - 415	0.7	3		50

- **Water supply for compressor 14 – 2275 and 14 – 2276, operating points A1, A2, A3**

Gas cooler, After cooler and Oil cooler		Consumption m^3/h	130
Fouling factor 1.7 • 10^{-4} $\frac{m^2K}{W}$			
Inlet pressure:	2.5 bar (g)	Inlet temperature: Outlet temperature:	16 °C 26 °C

- **Water supply for compressor 14 – 2276 only, operating points B1, B2, B3**

Gas cooler, After cooler and Oil cooler		Consumption m^3/h	138
Fouling factor 1.7 • 10^{-4} $\frac{m^2K}{W}$			
Inlet pressure:	2.5 bar (g)	Inlet temperature: Outlet temperature:	37 °C 47 °C

For dimensions of pipe connections refer to P + I diagram and layout plan.

- **Further specified supply connections**

	Pressure bar(g)	Temperature °C	Dew point °C	Consumption Nm^3/h
Instrument air				
	3.5 design 4.0		-70	10 *
Seal gas				
Type				
N_2	design 1.1		-70	50

* Consumptions depends on control proceedings

For dimensions of pipe connections refer to P + I diagram and layout plan.

Seal and flushing gases must meet the following requirements: Filter mesh size: 5 µm

- **Oil fillings**
- Quality ISO VG 32
- Quantity first filling 950
- Quantity further fillings 900.

C 2.3 Preparations, checks of foundation

- **Unpacking of plant parts**

You are obliged to observe any and all identification attached to packing, refer also to the instructions for transport, storage and preservation. If the turbomachine or its single parts/accessory are packed in wooden or cardboard boxes, open the packing with care. Doing so, make sure that you do not damage the parts with the tools you use in the process to ascertain proper operation of the parts in question. Whenever heavy parts must be lifted from boxes, ropes must be attached to them as specified to lift them properly.

- **Foundation checks**

Check the following against the foundation and layout plan prior to commencing any erection work and record any non-compliance:

- In particular the anchor holes provided for installation of the base frame and the accessories must be checked for position, depth, distance to each other and from centre and axes. Any deviations must be corrected, if required.
- Check foundation height of motor- or generator foundation if any.
- Remove water residues and other contaminants from the anchor holes. Remove any left over boarding material, which have been employed to board up the anchor holes. Afterwards clean the foundation and its adjacent area thoroughly.
- Protect the anchor holes against repeat contamination after they have been cleaned until the machine is installed respectively until they are grouted (cover or seal tightly).
- The plant grade line ± 0 or a related variant must be marked as binding by the construction supervisor in the erection area in question.

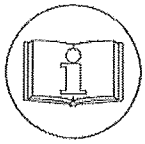
Whenever non-compliance with regard to the foundation might affect AC's scope of supply, it is up to the customer to decide whether he intends to modify either the foundation or AC's scope of supply.

C 2.4 Assembling sequence

CAUTION

During assembling of gas coolers one after the other check the correct position of water headers after each step. Additionally you have to re-check the gear alignment after each step.

1. Erection of base frame and alignment
2. Grouting of anchor feet
3. Assembling of further gas coolers
4. Assembling / connecting of water header loose
5. Assembling / connecting gas piping loose
6. Assembling of water lines to / from all coolers
7. Check of gasline alignment - connect.
8. Assembling of driver, coupling - align driver towards compressor



You are requested to adhere to manufacture's operating instructions for erection, assembly, operation and maintenance of the driver.

9. Assembling of all other pipe work as blow-off-line, oil piping etc.
10. Erection of panel/control board

The test run may start after all components have been installed and connected to customer's process pipes.

C 2.5 Positioning of centrifugal-compressor on foundation

WARNING

Danger: suspended load
Danger: falling parts

May lead to severe injuries.

- Use only approved hoisting equipment and cranes of sufficient capacity. For information on weights refer to the foundation and layout plan, or information on packing.
- Employ special auxiliary equipment, e.g. traverses, loading joists, if specified.
- Use only undamaged ropes and chains.
- Protect the edges whenever hoisting chains or ropes are conducted over edges of packing or machinery.
- Lifting eyelets are not always designed to receive the total weight. Pay attention to the information contained on their stickers.
- Secure parts against shifting during transport/handling.
- Observe the shift in center of gravity during transport.
- Refrain from staying below suspended loads.

The foundation must only be loaded, i.e. the machine must only be erected on the foundation, after the setting time specified by the customer foundation contractor in charge of building the foundation has elapsed. Strict adherence to this time is mandatory.

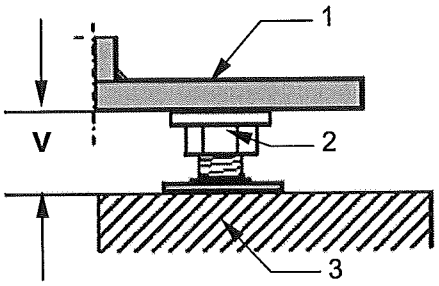
- **Installation of base frame**

1. Position jack screws as per foundation and layout plan prior to installing the compressor. The contact surfaces of the jack screws must be clean and level (retouch foundation, if necessary).
   Adjust jack screws to centre position. For more details refer to manufacturer's description.

CAUTION

Maximum adjustment of jack screw V = 57 mm, minimum V = 42 mm.

Bigger distances (foundation height too low) must be compensated by adding a shim of corresponding thickness on top of the jack screw.



1 Base frame
2 Jack screw
3 Foundation

Make sure that the provided grout may still be applied for the resulting new grouting height

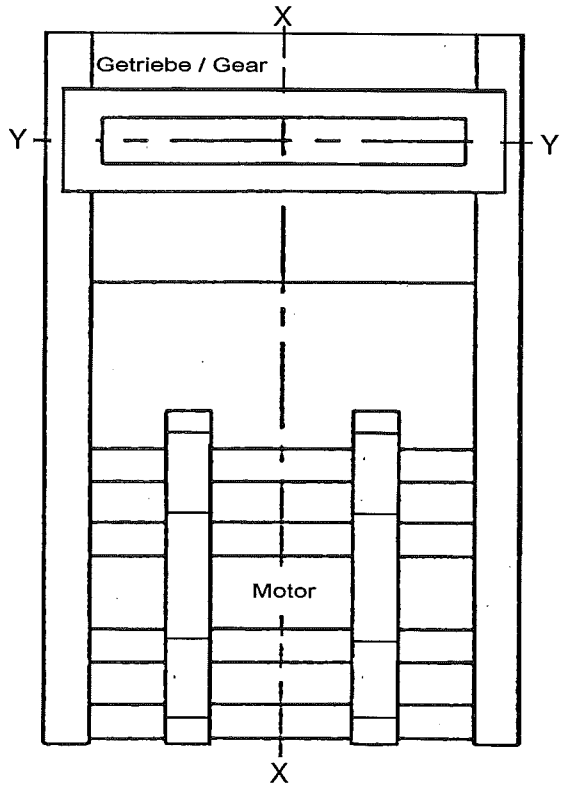
2. For machines exceeding a weight of 20 t, 3 - 4 steel supports of 50 mm thickness should be provided on each side to avoid damages to the jack screws in the event of unilateral positioning of the base frame. This will also greatly facilitate any shifts of the base frame for readjustment without using a crane.

CAUTION

Whenever grease has been employed to facilitate sliding, any surfaces of base frame and foundation that have come into contact with the grease must be thoroughly degreased after the steel supports have been removed.

Horizontal alignment must always be carried out using a calibrated shaft water level, precision per scale interval = 0.1 mm/m.

3. First of all assemble base frame parts if delivered separately.
   To install the integral base frame inc. cooler stage 1 and 2 bolt the anchor feet to it. Doing so, make sure to place cap screws (detail Y of foundation plan) and in particular stud bolts (detail Z of foundation plan) into the centre of the bores provided for them in the base frame so that they can be fastened with ease.
   The same principle applies to the adjacent aftercooler.
   Machine axis **X** is checked for alignment at the free bullwheel shaft end.
   Lateral axial **Y** is checked for alignment at the overhung of the gear contact surfaces on the base frame.
   Tolerances for final alignment:
   Machine axis **X** = 0.1 mm/m
   Lateral axis **Y** = 0.2 mm/m



CAUTION

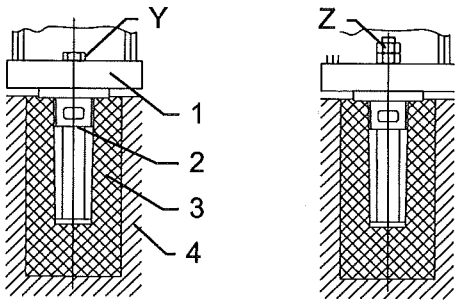
The anchor feet may be grouted after assembly of core unit and driver has been accomplished

Remove the alignment aids or jackscrews after the grout has hardened and settled. Then, check whether the cap screws, item **Y** have correctly tightened.

Then loosen nut, item **Z**, and tighten it by means of a tie nut until the gap toward the baseframe / cooler feet is 0.5 mm. Then counter lock the nut.

This will enable the coolers to slide on the heads of the anchor feet in presence of thermal expansion.

Document final alignment values.



1	Base frame
2	Anchor block
3	Grout (shrink-free)
4	Foundation
Y	Hexagon screw
Z	Locking screw with nuts and lock nuts

WARNING

Danger: suspended load
May lead to severe injuries.

Make sure to lift the compressor only at the points that are provided on the base frame for this purpose. Insert shackles into the holes, see chapter Transport

CAUTION

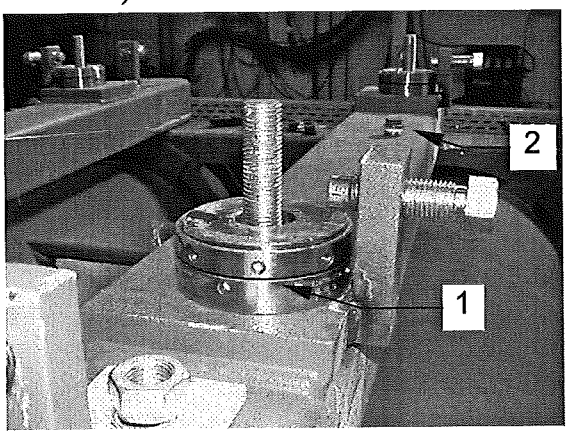
When machinery is erected outdoors, alignment might be impaired by unilateral exposure to the sun

- **Erection and completion of centrifugal compressor plant**

The sequence in which the centrifugal compressor plant has to be erected depends on the plant concept and on the conditions prevailing on site, see assembly sequence. When erecting and aligning the gearbox, however, make sure to install heavy components, such as driver, cooler/s etc. at the proper point in time, as these will substantially affect alignment.

All measured values are to be registered in the gearbox/base frame alignment record.

- **Erection of driver and fastening of supporting structure for driver (Screw joint with supporting structure for motor).**



CAUTION

ACE's standard routine is to deliver the motor separately. In this case, the coupling half is installed, but the spacer is removed. If the motor is not included in ACE's scope of supply, it might be necessary to first pull on the coupling half as per manufacturer's instruction.

Ensure that the supporting surfaces for the motor are clean and level.

When the driver is supplied separately for reasons associated with execution of the plant or delivery of driver by customer directly to plant, proceed as follows:

When aligning the motor observe marks and manufacturer's data as to mechanical and magnetic centre.

Position the motor on the sole plates [2] as prescribed and effect final alignment of the motor toward the gearbox. For horizontal alignment use the delivered steel shims or compensating elements (Vibracon [1]) between driver and sole plate. Once the desired position has been reached, tighten motor screws firmly.

C 2.6 Installation of accessories

- **Installation and alignment of further coolers**

CAUTION

To prevent damages at compressor during erection or dismantling of housings or gas piping, the Victaulic couplings always have to be dismantled completely.

1. After the base frame has been erected, the third cooler must be installed on jackscrews next to the base frame. Pre-positioning is effected by installing the supplied distance pieces and subsequent connection of the cooling water pipes to the coolers installed in the base frame. After the gas pipes have been connected to the cooler, the final position of this cooler has been reached (it might be necessary to re-adjust the cooler slightly).
2. On conclusion of these activities start grouting the anchor feet.

- **Installation of pipes**

CAUTION

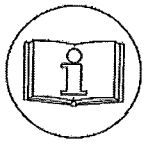
It is prohibited to weld components (such as supports, fastening devices) to plant parts supplied by ACE.

For pipes which are manufactured on site, it is imperative to adhere to the application of proper materials with regard to correct dimensions, identification of materials, welding procedures, welding fillers, welding procedure qualification and inspection, see chapter works standards and quality requirements.

CAUTION

Compliance with ACE's Works Standard on cleanliness is mandatory.

Prior to installing the suction nozzle or suction pipe, check proper operation of the inlet guide vanes, if any are installed in the compressor.



When connecting pipework, accessories, refer to sub-suppliers manuals!

Pipes must be installed in a way that no or at least only negligible forces and moments are transmitted to the centrifugal compressor (refer to layout plan). For this reason, the use of expansion joints, flexible expansion joints and supports is highly recommended.

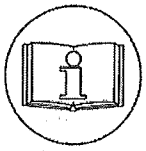
Whenever finished pipes are modified, these modifications have to be documented as specified (weld seams, x-ray films, pressure tests, etc.).

Whenever the plant user has taken other action to ensure that the permissible forces and couples are not exceeded at the compressor stage, regardless of the prevailing operating conditions, and given that all pipes are installed free of any stress, pipes may be installed without expansion joints.

All piping must be cleaned and treated prior to final assembly as required for the application and in the relevant specification (in this context, also refer to our Works Standard for associated information).

The following instructions must always be adhered to:

- Check that pipes are installed free of stress by breaking the discharge nozzle flange after first plant shutdown.
- All gas pipes and pressure measuring pipes must be absolutely tight.
- A non-return flap must be installed in the centrifugal compressor discharge pipe to rule out any backflow of gas.



When installing compressor components such as filters, expansion joints, silencers, valves etc., compliance with manufacturers' instructions contained in the annex is madatory.

- During operation, hot pipes must not come into contact with wood, paper, and other inflammable materials.
- After commissioning the start up strainers in the inlet pipes of centrifugal compressor have to be removed.

- **Victaulic couplings**

WARNING

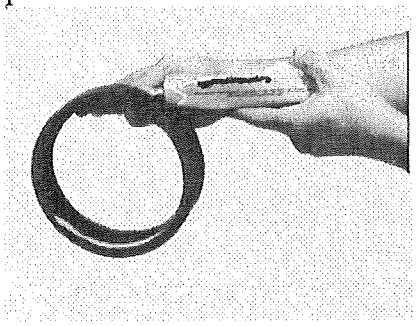
Danger by loose Victaulic couplings

May lead to lethal injuries

- Never uncouple Victaulic couplings until the pipe is de-pressurised and drained.

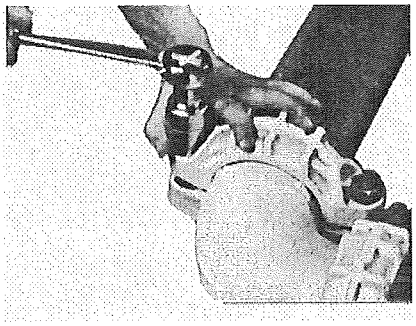
Proceed as follows to install Victaulic couplings:

1. Make sure that pipe ends have been prepared as specified (grooved and deburred) and that the gasket is undamaged.
2. Apply Victaulic grease to the seal, part number: 6970 083 410



3. Push the seal over one pipe end. The sealing lip must not protrude the pipe end, otherwise it will be damaged.

4. When pipes are flush, push the seal into its correct position, i.e. the sealing lips must be located in the two grooves.
5. Now place the metal clamps around the seal. To accomplish this, loosen one screw connection, place metal clamps around the seal, and re-tighten screw slightly.
6. Insert screws, tightening them alternately, evenly and firmly until the metal of the two pipe coupling halves is in contact.



- **Electrical connections**

Most of electrical components installed on Atlas Copco turbo machineries have been pre-wired.

The customer is advised to wire driving motors, all compressor accessories and the control panel as per the instructions for instrumentation contained in the annex.

WARNING

Danger: electric voltage

May lead to lethal injuries.

- Prior to working on electrical equipment, de-energize the plant.
- Work on power plants must only be carried out by expert personnel.
- When de-energising units, do not forget auxiliary circuits, e.g. standstill heatings.
- Make sure to protect switches against re-activation when de-energising units.
- Isolate or cover any adjacent life parts.

C 2.7 Anti-frost measures

Protect your plant against frost. Any additional trace heaters for water pipes, measuring lines, instruments, etc. must be provided by the customer.

C 2.8 Alignment of driver towards compressor

Refer to alignment protocol Drive-Gear.

General preparation and instructions for alignment

1. Prior to alignment, thoroughly clean all measuring surfaces and all surfaces that are designed to support the measuring instruments and check them for damage.
2. Check shafts and coupling halves for run-out and surface evenness. Deviations should not exceed 0.01 mm/100 mm measurement diameter.
3. Driver and compressor should have the same temperature when effecting cold alignment. If, for instance, the compressor is standing in the shade and the driver in the sun, there is the danger that the two components might heat and thus expand differently. We recommend to align the two components when both of them are in the shade (install tarpaulin) or at night or in the early morning.
4. Any check-up measurement has to be carried out at operating temperature. For this purpose, both the compressor and the driver must have been operating for at least one hour. Any displacement in height, angle and parallelism from compressor towards driver determined in the course of this check-up measurement has to be corrected subsequently.

When aligning the motor observe marks and manufacturer's data as to mechanical and magnetic centre.

- **Alignment by means of laser system**

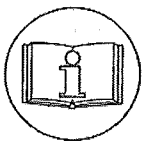
Whenever alignment is carried out by means of laser system, particular attention must be paid to the system description and system instructions. Early preparation and provision of the equipment required in each single application is indispensable.

CAUTION

Special equipment is required for explosion-proof areas.

Tolerance (ACE formula) for optimum cold alignment 0.01 mm/100 mm measurement diameter

1. For radial alignment, the different growth in height between centrifugal compressor and driver, depending on the concept of the plant and the driver type, must be determined and/or considered in the measurement (refer to alignment protocol to determine difference in height).
2. Measure "L" = distance between the shaft ends has to be complied with in consideration of the magnetic center (electrical drivers) and the axial clearances. This measure "L" is shown in the layout plan. For more details, refer to the corresponding coupling drawing.
3. The determined difference must be corrected by adding shims below the driver feet subsequent to each measurement. The measurements and corrections have to be carried out, until measured values are within the applicable tolerance.



Adherence to the instructions for use of the laser system shall be imperative. These instructions contain invaluable advice on which parameters are required and have to be entered for correct alignment between driver and driven machine.

During alignment, some laser systems could be assembled and switched on. Thereby the relevant alignment values will be shown immediately.

For information on cold alignment of the machine unit (increase in height, axial clearances) refer to the annex. An alignment record is handed over to the plant user after final alignment.

- **Installation dossier, records and measuring devices and instruments**

All measuring devices and instruments must be checked and calibrated.

- All measured values, in particular final alignment checks, have to be diligently registered in the relative records and must be added to the site documentation and/or the final installation record (for forms and examples refer to the annex).
- Complete documentation is indispensable on account of quality demands, in particular as far as alignment and its impact on the contact pattern of the tooth flanks and the vibration quality are concerned. For this reason, alignment checks must be repeated prior and during commissioning and during revisions, if possible.
- For better long-term observation of gear contact patterns (contact patterns of tooth flanks, in particular after prolonged operation and during major revisions), the indications (coats of varnish on at least 5-6 teeth of bullgear and pinion shafts) must be checked and the results be documented.

C 2.9 Grouting

- **General information**

- Foundation anchors of centrifugal compressor plants have to be grouted as per the instructions contained in the individual foundation plans.
- The type of grout to be used must be specified at an early point in time to ascertain timely provision of required quantities, including equipment/ assistants.

- **Grouting**

- The anchor bolts and blocks need to be installed on the compressor base frame before the compressors put on the foundation. The holes provided in the foundation must be filled with non-shrinking grout once the unit is placed in its final position.

  Fill in grout as shown and as to manufacturer's instruction.

  Check tightening torque of anchor bolts after the grout has set. The foundation of the compressor is now ready.

- **Grout**

"Shrink-free grout" with high interim and final strength must be used for normal grouting heights of 50 mm.

- **General reference values for a.m. grouts:**

Pot life after preparation (at + 20 °C)	≈ one hour
Minimum application temperature (also components)	≥ + 5 °C
Dry mortar, weight	≈ 1.900 kg/m^3
Compressive strength after one day	≈ 50 N/mm^2
Compressive strength after 28 days	≈ 90 N/mm^2
Flexural and tensile strength after one day	≈ 6 N/mm^2
Flexural and tensile strength after 28 days	≈ 9 N/mm^2

- **Compliance to regulations/ manufacturer's instructions regarding special features, e.g.:**

- Application (in particular grout height, grout surface)
- Processing (mixing ratio, build, pot life)
- Cleanliness and post-treatment

- **Examples of some brand grouts from the ACE vendor list (revision 1996):**

Barra, Betec, Chockfast, Five Star, Pagel, Sikkens-Epoxy, Tricosal VGM, etc.

- When comparable grouts are not available, e.g. abroad, the AC Parts and Service department should be contacted early to initiate special action. Examples for special action:
  - Increase the number of jack screws,
  - Select equivalent grout, if recommended brand is not available
  - Recommend composition of grout
  - Special action for preparation/filling in of grout
  - Modify setting time etc.

C 3 First commissioning

This procedure must be followed for the original first commissioning and after plant overhauls and/or repairs!

CAUTION

All first commissioning has to be done by Atlas Copco personnel only

C 3.1 Preparations

Prior to commissioning centrifugal compressor plants, check the plant and all its components as follows, even if they are not expressly mentioned:

- All parts must be clean. If required, clean as described in chapter „Maintenance".
- Check alignment. Ensure that the plant was erected as per relevant drawings.
- Check proper operation of all shut-off valves.
- Fill and vent all components in a safe way

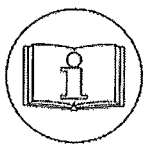
CAUTION

Lubricants, oils and greases must comply with the requirements specified in the ACE Works Standard. For details about fillings and consumption see lubrication schedule in chapter "Maintenance".

CAUTION

The check for correct direction of rotation must only be effected in uncoupled state.

Refer to direction of rotation arrows at gear.



Read manufacturer's instructions before commissioning the motor.

Check auxiliary drives for correct direction of rotation by means of the arrows. Rotating parts must not contact the driver guard.

- **Check the oil systems**

Check oil filling level (oil level at „full" mark)

- **Check lubrication of driver.**

C 3.2 Aim

CAUTION

First commissioning of the centrifugal compressor must only be effected by trained and qualified staff, refer to chapter „Basic safety precautions".

The centrifugal compressor may be commissioned in compliance with all instructions for start-up included in the instruction manual, after the manual shut-off valves on the compressor discharge side and the cooling water inlet pipe (if required) have been opened.

After start-up, noise and vibration level, pressures and temperatures must be closely watched to enable early recognition of any irregularities.

- **Check for :**

- Leakage during first start-up.
- Apply sealing compound to any leaky plug. Re-tighten flanges. For this purpose, the compressor has to be shut down and depressurised.
- Professional and safe execution of the compressor control systems, the complete auxiliary devices and the compressors commissioning.
- Verification of the correct function of all devices without process medium.

C 3.3 Procedure

- In order to perform the commissioning of a complete system under process conditions the control system structure must be tested first for power supply including earthing, communication between operator panels and process logic control and function of the bus system.
- Then follows the cold commissioning of the control system without medium. This includes functional checks of the analogue and binary measurements, drives, heaters, demister and valves.
- All measurement ranges and settings are checked against the set point list.
- The sequence of the function blocks and the complete compressor control sequence will be tested under consideration of interlocking, alarms and trips according the logic function diagrams.
- All the checks are applied to the panels with the related field installation and equipment.

CAUTION

The description of first commissioning of the following chapters is an example only. The real commissioning of this plant depends on the control system of your supply. Please supply a similar chapter!

C 3.4 Commissioning of compressor control system structure

CAUTION

Doing this job the coupling of the main driver must be disassembled.

Some of the systems have already been checked at workshop. They needn't be checked again at site.

C 3.4.1 Earthing

Check the following points in the control room and the compressor house:

1. Central earthing point of the compressor base frame
2. Central earthing point of the compressor main driver
3. Central earthing of all the junction box (with start-, stop and emergency stop buttons).
4. Protective earthing of all the panels
5. Protective earthing of all auxiliary motors
6. Protective earthing of all solenoid valves if applicable
7. Shielding ground for all the panels
8. Shielding ground for all the junction boxes.

C 3.4.2 Power supply

- **Work shop tests and inspections**

The following tests have been performed after manufacturing of the junction box:

- Electrical safety inspection
- Dielectric voltage inspection
- Inspection of power supply
- Inspection of function

- **Test of the cubicle power supply**

1. Verify that all required power supply cables are connected to the terminals
2. Verify the insulation of all supply cables
3. Ensure that all main switches are turned to their OFF-position
4. Check that all circuit breakers are disabled
5. Request the client to energize the power supply cables
6. Check all supply lines for the correct voltage level on the related terminals

C 3.4.3 Energising the cubicles

1. Turn the main switch to the ON-position and check power supply to the connected circuit breakers
2. Switch on selectively the circuit breakers related to the cubicle internal transformers and power supply units to put them in service.
3. Record the secondary voltage level on the transformers and power supply units to ensure they are working correctly
4. Record the polarity of the output of the power supply units

C 3.4.4 Process logic control and operator panels

- Visual Check of the PLC and the OP
- Function test of OP
- Function test of PLC
- Functionality of bus system

C 3.5 Cold Commissioning

Some of the systems have already been checked at workshop.

C 3.5.1 General remarks

General test prerequisites:

1. All required power lines are in service
2. Commissioning of the control system structure are finished
3. All loops to the field measurement devices are powered up
4. All open loop indications (broken wire alarm) of the field measurement devices on the operator panel are cleared

Test activities of the commissioning engineer:

- All below mentioned activities in the field or at the power units with the related MCC are performed by the commissioning engineer with mechanical, electrical or instrumentation assistance from client site.
- The cold commissioning will be carried out step wise, starts with function check of all loops, commissioning of all drives and auxiliaries, followed by function block tests and finished with sequential control.

C 3.5.2 Function test of analogue and binary signals

- Check PLC - Input and signal indication on the operator panel
- Check measurement ranges, alarm and trip settings of the analogue signals
- Check correct indication of the binary signals on the operator panel

C 3.5.3 Calibration of transmitters and switches

Test prerequisites:

Complete function test of all analogue and binary signals are finished.

- **Analogue field measurement device**

A calibration check of the following transmitters should be carried out (if not done yet) and the indication of the simulated process value on the monitor should match with the set value of the test equipment:

- Pressure transmitters
- Differential pressure transmitters
- Flow transmitters
- Temperature transmitters
- Position transmitters
- Vibration transmitters

- **Binary field measurement device**

A calibration check of the following switches should be carried out (if not done yet) and the indication of the status change on the monitor has to be checked if the switch turns from normal to alarm at the adjusted setpoint:

- Pressure switches
- Temperature switches
- Position switches
- Level switches

C 3.5.4 Auxiliary devices

Test prerequisites:

The necessary medium for the auxiliary devices is provided.

All necessary binary and analogue signals are tested.

- **Lubricating oil pump**

1. Check setting of motor protection relays
2. Check direction of rotation
3. Start the pump and check the oilsystem pressure and thightness
4. Adjust pressure control valve and pressure safety valve

- **Lubricating oil heater**

1. Check setting of heater protection relays
2. Start heater and check if the temperature is increasing
3. Adjust temperature controller

- **Demister of oil system**

1. Check setting of motor protection relays
2. Check direction of rotation

- **Pneumatic Actuators**

The test will be applied to the following pneumatic actuator:

- **Inlet guide vane of compressor**

1. Adjustment of the PICV to the designed working pressure
2. Mechanical adjustment of required actuator stroke
3. Adaptation of the positioner to the system via internal positioner display
4. Test of control signal to the actuator
5. Test of the positioner feedback signal if applicable
6. Adjustment and test of the actuator limit switch
7. Check actuator for air leakages

- **Bypass valve of the compressor**

1. Test of control signal to the actuator
2. Test of the positioner feedback signal
3. Adjustment and test of the actuator limit switch
4. Check system for air leakages

C 3.5.5 Auxiliary drive control

Test prerequisites:

All necessary binary and analogue signals are tested.

- **Solenoid Valve**

The tests will be applied to the following solenoid valves:

Test procedure:

1. Adjustment of the PICV to the designed working pressure, if instrument air is connected
2. Adjustment and test of the open / closed limit switches if existing
3. Check circuit breaker supervision of solenoid valve coil
4. Check in line solenoid valves for gas leakage's while pressure test with nitrogen

C 3.5.6 Sequential control

Test prerequisites:

All function blocks are tested according to above mentioned procedures.

All function blocks are in service or enabled to be operated.

HV MCC for compressor main motor in test position.

Test procedure:

1. Simulation of the required plant conditions
2. Test of the compressor start up interlocks
3. Test of the compressor start and stop - sequences
4. Verification the of compressor control logic
5. Simulation of the compressor trip conditions with verification of the function of the HV-Breaker for the compressor main motor
6. Test of all signals between MCC - DCS and Compressor – PLC.

C 3.6 Hot commissioning for driver

C 3.6.1 General remarks

General test prerequisites:

- Cold commissioning of the compressor is finished
- All function blocks are in service or enabled to be operated
- The designed process medium is available to be handled by the compressor

Test activities of the commissioning engineer

- All below mentioned activities concern the compressor and the periphery equipment of the process gas station are performed by the commissioning engineer in co-operation with the client process responsible
- Before operation of the compressor in connection to the plant all safety controllers of the compressor are to be adjusted

C 3.6.2 Preparations

1. Pressure and leak test of the compressor and the complete pipe system at design pressure
2. Check direction of rotation of the compressor main motor
3. Test run of the compressor main motor until all motor temperatures become stable
4. Installation of coupling

C 3.6.3 Mechanical test run

- **1st Start of Compressor**

1. Start the compressor
2. Stop and record the run up time
3. Observe the indication of main motor current, wait till the start peak is abated and the main motor current remains constant
4. Stop the compressor
5. Stop and record the coast down time

- **2nd Start of Compressor**

1. Start the compressor for a period of time to carry out a mechanical test run, recommended approximately 4 hours.
2. Operate the compressor unloaded till all temperatures are steady and keep record of all measurements
3. Load the compressor stepwise till design values are reached and keep record of all measurements
4. Stop the compressor after all temperatures became stable at the design values of the compressor.

C 3.7 Hand-over to user

The machine is handed over to its user after the acceptance test run has been successfully concluded. The hand-over record certifies perfect operation of the plant. Machine and plant data are registered in these data sheets a copy of which is submitted to the ACE Parts & Service Center.

From this moment on, the plant user assumes full responsibility for the machine plant.

C 4 Tools

Here is some information on special tools of our delivery with material numbers that are required to assemble/disassemble the compressor. You are requested to exclusively use the tools shown here, if this is expressly called for in the instructions.

Standard tools, e.g. wrenches, dynamometric keys and others are not included in ACE's scope of supply. It is assumed that these are available on site.

The same applies to any and all dial gauges and their relevant fastening devices.

	Material number
Jack screws	6915 3192 56