Control System Specification

MAN

Compressor Type

RIKT 80-1+1+1+1

US STEEL

KOSICE SLOVAKIA

MAIN AIR COMPRESSOR UNIT

AIR LIQUIDE ™

N° D'AFFAIRE JOB NUMBER	FMT FMT	GROUPE GROUP	N° NBR	Rev Rev
KOSICE 50-3023-01	A4	611		

A	Rindlisbacher H	14.07.2005	Rindlisbacher H	14.07.2005	21012	Algorythmus changed
Rev.	Changed	Date	Checked	Date	Change No.	Change description
Rindlisbacher H		13.07.2005	Rindlisbacher H	14.07.2005	Rindlisbacher H	14.07.2005
Issued		Date	Checked	Date	Released	Date

Type/Size: RIK 80-1+1+1+1	Doc Type: SPE

Project No: N.7100175	Doc Title: **Min. Requirements of Anti Surge Control**

Project: **KOSAIR 2004**	Doc No: **837017409**	Rev.: A	Page 1 of 5

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References

Compressor Plant P&ID

0-837 016 878

Performance Curves for ASC

4-837 017 311

Operating Principle

The discharge pressure is measured by the pressure transmitter PT 1. This signal is fed into the function generator PY 2. The latter calculates the minimum required rate of flow in relation to the actual discharge pressure.

The antisurge controller BIC 4 compares the setpoint from function generator PY 2 with the differential pressure (ΔP_1) across the inlet nozzle (measured by the differential pressure transmitter PDT 3) and transmits the necessary positioning signal to the minimum selection relay BY 6. This signal is compared to the preset value of manual control station HIC 5. The lower value is allowed to pass.

The antisurge valve can be opened with the manual control station. However manual closing is only possible to the position set free from the antisurge controller, because of the minimum selection relay. The output of BY 6 is led to the asymmetric delay relay BY 7 providing a quick opening (adjustable within 2-3 seconds) and a slow closing of the valve (adjustable within 5-30 seconds).

The position controller GC of the valve BV 8 compares the setpoint from BY 7 with the actual valve position and corrects its output accordingly. The positioning signal from the valve position controller can be interrupted by the solenoid valve S which causes a complete opening of the valve. The solenoid valve is controlled from the start-up / shutdown sequence and eventually from a reverse flow protection.

Response Line

$$\Delta P_1 = f(P_2)$$

ΔP_1 Differential pressure across flow measuring device (or inlet side of regarded compressor stage)

P_2 Outlet pressure of regarded compressor stage

$f(P_2)$ Selected function (based on performance curves and adjusted during commissioning)
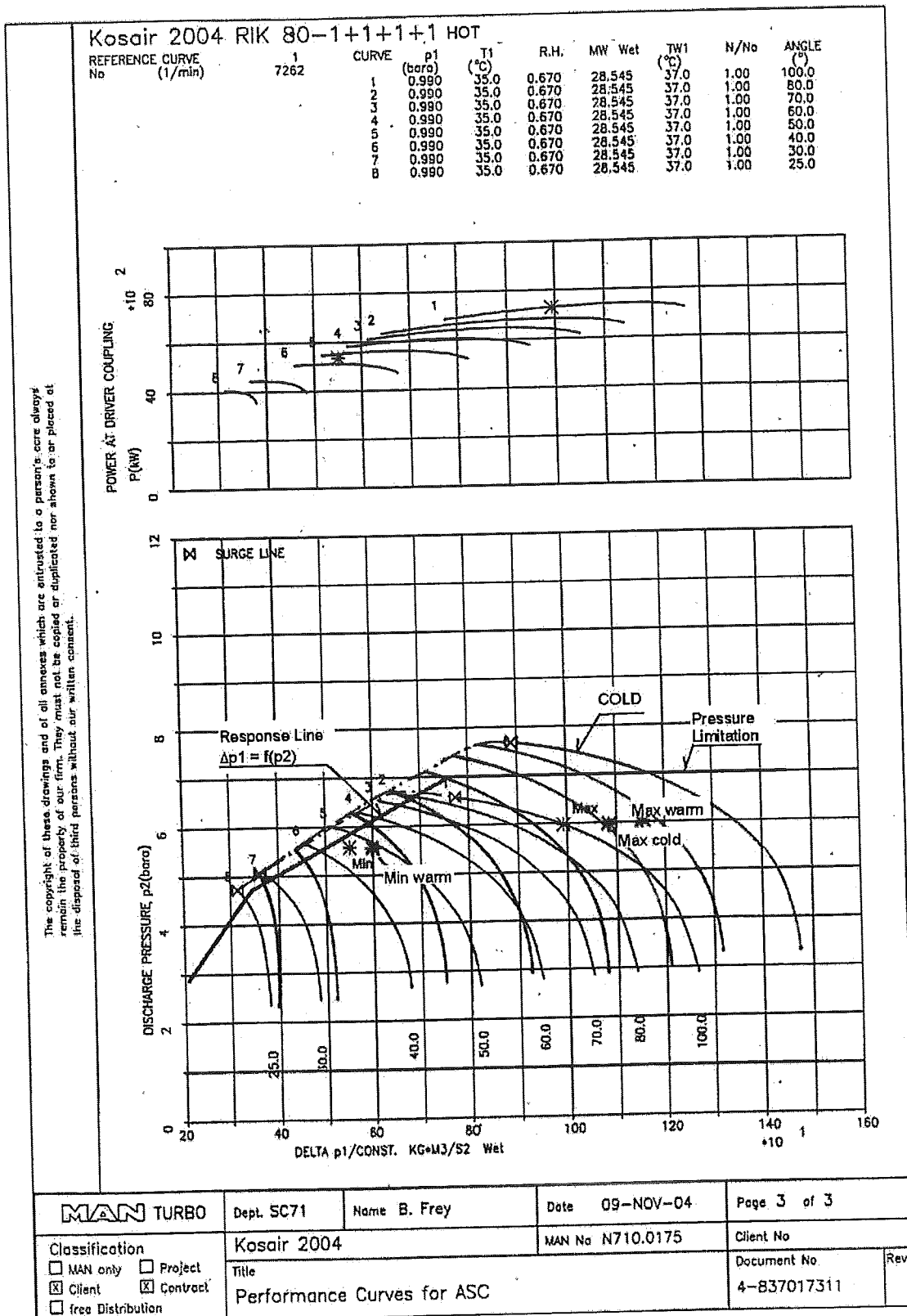
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f(ΔP1) Function Selection

According to enclosed Performance curves (in coordinates ΔP_1 versus P_2).

Kosair 2004 RIK 80-1+1+1+1 HOT

REFERENCE CURVE No (1/min)	CURVE	p1 (bara)	T1 (°C)	R.H.	MW Wet	TW1 (°C)	N/No	ANGLE (°)
1 7262	1	0.990	35.0	0.670	28.545	37.0	1.00	100.0
	2	0.990	35.0	0.670	28.545	37.0	1.00	80.0
	3	0.990	35.0	0.670	28.545	37.0	1.00	70.0
	4	0.990	35.0	0.670	28.545	37.0	1.00	60.0
	5	0.990	35.0	0.670	28.545	37.0	1.00	50.0
	6	0.990	35.0	0.670	28.545	37.0	1.00	40.0
	7	0.990	35.0	0.670	28.545	37.0	1.00	30.0
	8	0.990	35.0	0.670	28.545	37.0	1.00	25.0

MAN TURBO	Dept. SC71	Name B. Frey	Date 09-NOV-04	Page 3 of 3
Classification	Kosair 2004		MAN No N710.0175	Client No
☐ MAN only ☐ Project ☒ Client ☒ Contract ☐ free Distribution	Title Performance Curves for ASC			Document No 4-837017311 Rev

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Program Characteristics

Minimal cycle rate of hardware where the antisurge program is loaded (without control valve) :

<div align="center">50 to 100 msec.</div>

The program should at least have the following function blocks :

- Actual Value Treatment
- Setpoint Treatment (Control Algorithm)
- Discharge Pressure Limitation
- Shifting of Response Line (or similar feature)
- Dynamic Intervention (or similar feature in order to accelerate reaction of PI-algorithm near and over the response line)
- PI-algorithm
- Manual Loading Station
- Asymmetric Controller Output (enables a slow closing and a fast opening of the control valve)
- Output Treatment
- Gradient Supervision (or similar feature in order to speed up the control response and avoid surge in case of too fast (for PI-algorithm) rate of change of control deviation)
- Automatic Start/Stop Sequence
- Logic, Monitoring, Alarms
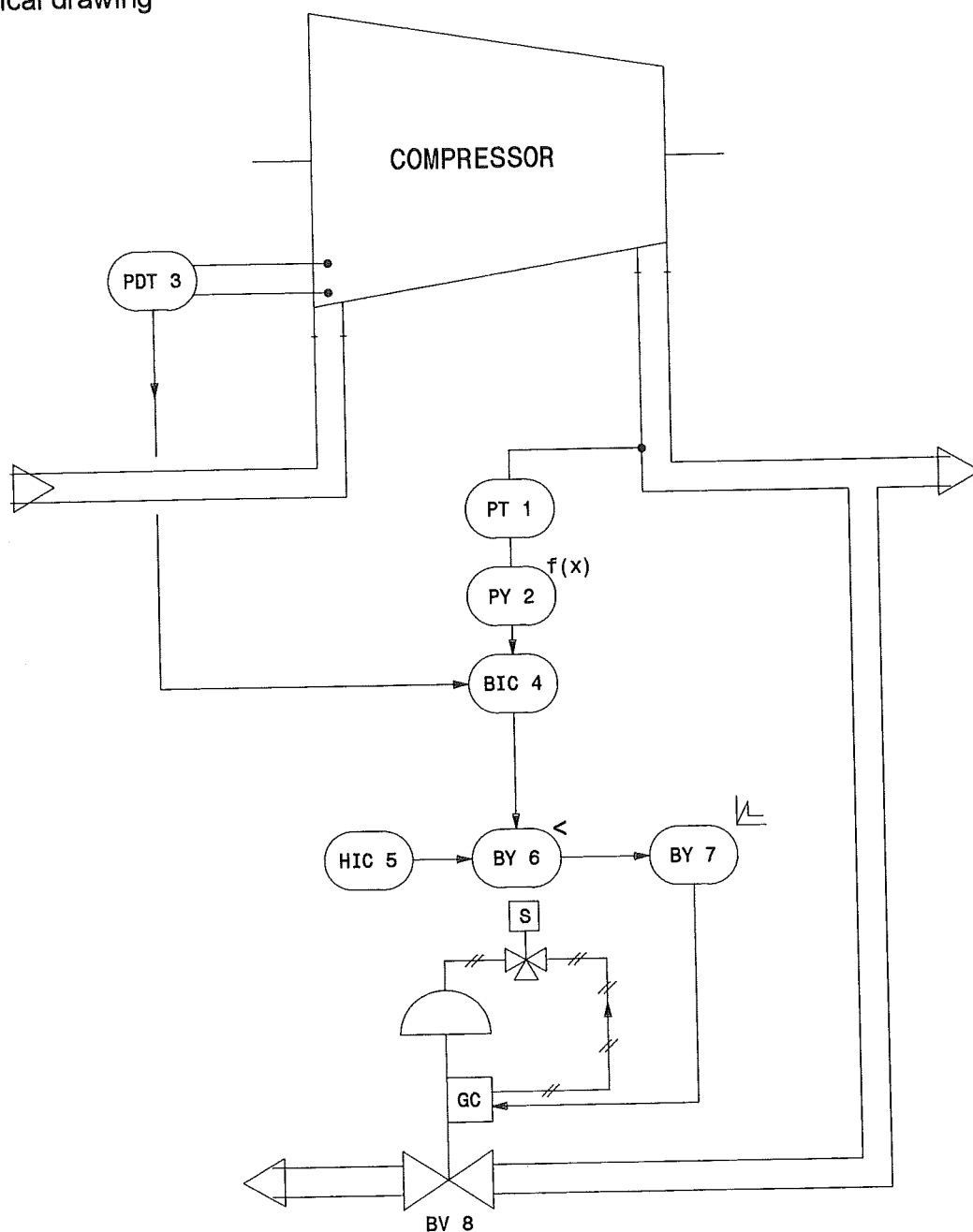
Transmitter Characteristics

Response time of selected transmitters (4 to 20 mA output) shall not be longer than the cycle rate of the antisurge system.

Schematical drawing

COMPRESSOR

PDT 3

PT 1

f(x)

PY 2

BIC 4

HIC 5 → BY 6 → BY 7

S

GC

BV 8

Legend :

PT 1   Pressure Transmitter (gauge)
PY 2   Function Generator
PDT 3   Pressure Differential Transmitter
BIC 4   Antisurge Controller
HIC 5   Manual Control Station
BY 6   Minimum Selection Relay
BY 7   Asymmetric Delay Relay
BV 8   Antisurge Valve with Position Controller GC and Solenoid Valve S