

ST 41

OPERATION AND MAINTENANCE INSTRUCTIONS

FOR

**HV-TURBO MODEL KA2SV-GK2
AERATION BLOWERS**

AT

**EASTERN WASTEWATER CENTRE
STAGE 3 AUGMENTATION**

FOR

IPSWICH CITY COUNCIL

**CONTRACT No. 367/94
SEPARABLE PORTION 6**

BY

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OIL SPECIFICATION



Prepared by: MC Date: 86.06.22
 Latest revision: FP Date: 96.07.31

Specifications on lubricating oils applicable for HV-TURBO compressors with antifriction bearings (ball/roller bearings).

Note: Turbochargers } Please note different specification
 Journal bearing gearboxes }

Company	Oil type	Supplier	Scandinavia Europe North America
BP	BP ENERGOL RC-S 46	BP BP BP	
ELF	BARELF SM32	ELF ELF ELF	
ESSO	ESSO COMPRESSOR OIL RS32	Esso Esso Exxon	
MOBIL	MOBIL SHC 624	Mobil Mobil Mobil	
Q8	Q8 SCHUMANN 32	Kuwait Petroleum Kuwait Petroleum -----	
STATOIL	COMPWAY SX 32	Statoil ----- -----	
SHELL	MADRELA AS 46	Shell Shell Shell	
TRIBOL	TRIBOL 1550/32	Square Oil A/S Tribol Tribol	
KLÜBER	KLÜBER SYNTH GEM 4-32	Klüber Klüber Klüber Lubrification	
FUCHS	FUCHS COFRABAR P32	Fuchs Fuchs Fuchs	

1.00 DESCRIPTION OF EQUIPMENT

1.1 GENERAL DESCRIPTION

Equipment	Aeration Blowers
Make	HV-Turbo
Model No.	KA2SV-GK2
Number	Three
Serial Numbers	3809, 3810, 3811

RATING

Unit Capacity	3212 Nm ³ /h (0°C, 1 atm)
Discharge Pressure	53.0 kPag
Inlet Temperature	45°C maximum
Motor MCR	75kW

ANCILLARY EQUIPMENT

Inlet Filter/Silencers	(3 off)
Local Control Panels LC-1D	(3 off)
Master Control Panel MCP-3	(1 off)
Blow Off Valves	(3 off)
Check Valves	(3 off) } Described in Manual for } Separable Portion 7
Pressure Transmitter	(1 off) }
Acoustic enclosures	(3 off)



1.2 TECHNICAL SPECIFICATIONS

To locate item numbers listed, see drawing KA2A096.0 at the end of this section.

COMPRESSOR - Pos. No. K100

Make	:	HV-TURBO
Type	:	KA2SV
Medium flow	:	Air
Inlet flow, min.	:	1445 Nm ³ /h
Inlet flow, max.	:	3212 Nm ³ /h
Inlet pressure	:	1 bar abs.
Discharge pressure, max.	:	1.53 bar abs.
Inlet temperature, normal	:	20 °C
Inlet temperature, max.	:	45 °C
Revolutions	:	23124 rpm
Power consumption, min.	:	32.7 kW
Power consumption, max.	:	71.6 kW
The power is indicated at	:	Inlet flow min/max., inlet pressure and inlet temperature, normal
Weight	:	690 kg

GEARBOX - Pos. No G100

Make	:	HV-TURBO
Type	:	GK2
Gear ratio	:	7.852
Oil requirement	:	5.5 litres ± 10%

DRIVE MOTOR - Pos. No. A401

Make	:	LEROY SOMER
Type	:	KN5-225M
Insulation class	:	F
Degree of protection	:	IP23
Power, nominal	:	75 kW
Mains frequency	:	50 Hz
Voltage	:	415 V
Revolutions, nominal	:	3000 rpm



LINEAR MOTOR - Diffuser - Pos. D224

Make	:	Magnetic AG. Liestal
Type	:	Sey 10
Pull-/push power	:	300 N
Max. length of stroke	:	70 mm
Velocity	:	0.63 mm/sec..
Degree of protection	:	IP54
Mains frequency	:	50 Hz
Voltage	:	1 x 220 V
Position indication	:	1000 Ω potentiometer built in. The resistance range <880 Ω can be specified after test run of the compressor.

LINEAR MOTOR - Prerotation - Pos. No.D407

Make	:	Magnetic AG.Liestal
Type	:	Sey 10
Pull-/push power	:	300 N
Max. length of stroke	:	70 mm
Velocity	:	0.63 mm/sec.
Degree of protection	:	IP54
Mains frequency	:	50 Hz
Voltage	:	1 x 220 V
Position indication	:	1000 Ω potentiometer built in. The resistance range <880 Ω can be specified after test run of the compressor.

AIR INLET**Air Inlet Filter (insert) - Pos. No. L102**

Make	:	Macrofalt
Type	:	Compact
EU-class DIN 24185	:	EU3
Filter clean/replace at max.	:	+ 20mm WC over start-up loss or 60mm W.C. maximum

Manometer

Medium	:	Coloured water
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LUBRICATING-OIL TEMPERATURE

Max.	:	110°C
Normal operating temperature	:	45 - 58°C

Thermometer - Pos. No.E1.22

LUBRICATING OIL TYPE

Lubricating oil types, see section 1.3 - Recommended lubricants.

OIL RESERVOIR IN GEARBOX - Pos. No. G100

Normal filling	:	5.5 litres ± 10%
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THERMOSTAT - OIL

Make	:	Danfoss A/S
Type	:	RT107
Sensor	:	In reservoir
Function	:	Stops compressor when oil temperature gets too high
Set point	:	110°C
Difference	:	Minimum

THERMOSTAT - AIR

Make	:	Danfoss A/S
Type	:	RT101
Sensor	:	In compressor's volute casing
Function	:	Stops compressor at recirculation (rising inlet temperature)
Set point	:	65°C
Difference	:	Minimum

PRESSOSTAT - SURGING

Sensor	:	SUC-3
Function	:	In compressor's inlet
	:	Stops compressor at surging



DIFFERENTIAL-PRESSURE TRANSMITTER - Pos. No. E302

Make	:	Endress & Hauser
Type	:	Deltabar PMD 130
Function	:	Regulation of prerotation
Range	:	0.35-0.55 bar
Sensor high pressure	:	In cone diffuser (discharge)
Sensor low pressure	:	in compressor inlet
Output	:	4 - 20 mA

TEMPERATURE TRANSMITTER - Pos. No.E303

Make	:	Leomotor
Type	:	PT 100
Function	:	Regulation of prerotation
Range	:	-50+50 °C
Sensor	:	In compressor inlet
Output	:	4-20mA

BLOW-OFF VALVE (In airmain from blower)

Make	:	Keystone
Size	:	65mm
Type	:	Butterfly
Material	:	C.I.
- Body	:	
- Spinde	:	S.S
- Lining	:	EPDM
Actuator	:	Electric
Make	:	Bernard
Type	:	OA6
Power	:	3ph, 415V, 50hz
Degree of Protection	:	IP54
Travel limit switches	:	Included
Position indicator	:	Included
Handwheel	:	Included
Opening time	:	6 seconds
Closing time	:	60 seconds (variable)



1.3 RECOMMENDED LUBRICANTS*IDEAL OIL*

The blowers as installed are fitted with MOBIL SHC 624. It is recommended that, at oil changes, the above oil be used. Should this not be available, equivalent oils may be substituted as follows:

COMPANY	OIL TYPE
BP	BP ENERGOL RC-S 46
ESSO	ESSO COMPRESSOR OIL RS32
SHELL	MADRELA AS 46

*CASTROL**AIRCOL SR 46***IMPORTANT!**

On no account should oils from different manufacturers be mixed. When changing from one oil to another, the blower gearbox is to be thoroughly flushed using the new oil and then filled to the mark on the oil level gauge at the front plate of the gearbox casing.

KA2SV Oil Capacity is 5.5 litres



1.4 BLOWER PERFORMANCE CURVES

For blower serial no.'s:

3809

3810

3811



HV-TURBO

Performance Certificate for KA-Compressor

Curves valid for nominal conditions (ISO5384/VDI2045):

Compressor KA2 SV - 3809

Inlet conditions: Temp= 20.0 C

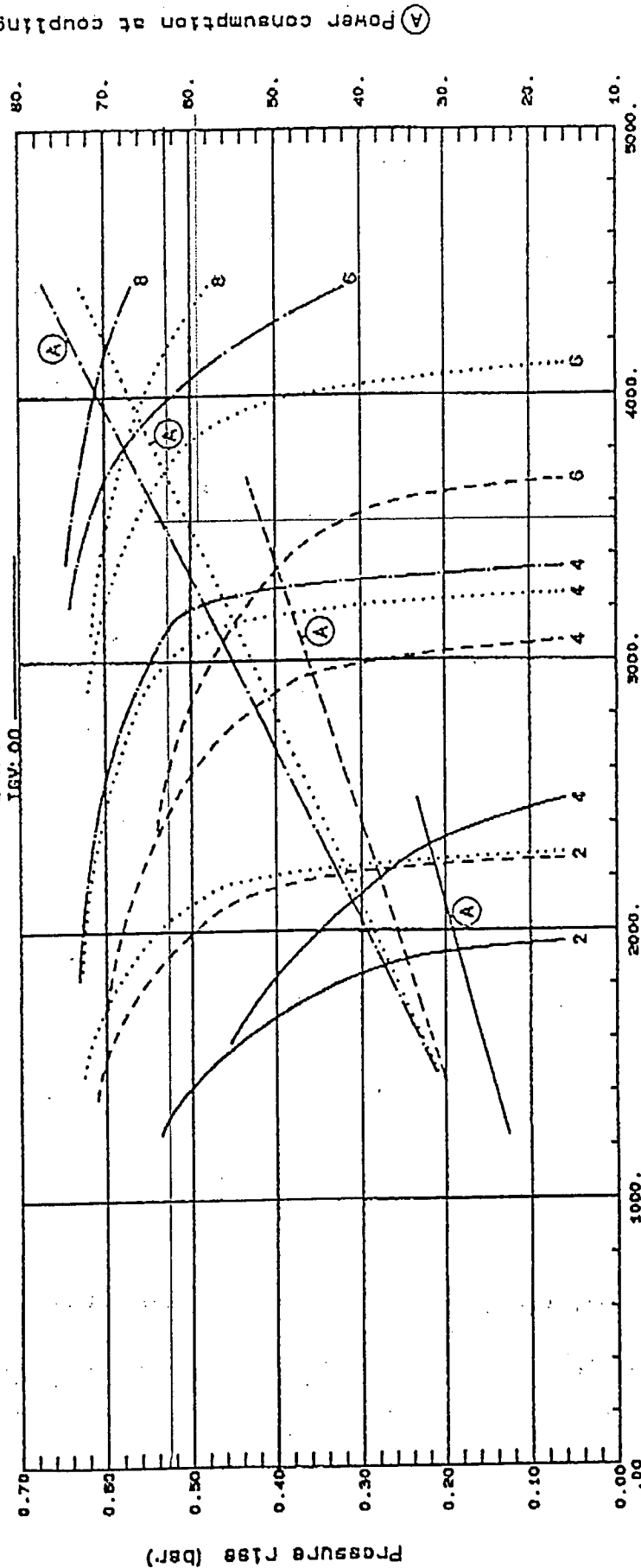
Compressor speed= 23124. RPM

Barom. Press.= 0.99 bar Rel. Hum.= 40. %

Motor Speed= 2345. RPM

ISV: 10
IGV: 08
ISV: 04
IGV: 00

Testmotor: LEROY-SOMER/ P225MR-T



Measuring Pipe: ISO5167/DIN1952

D = 309.0 mm d = 160.1 mm

Barometric Pressure at test: 1.03 bar

Inlet Temperature at test: 25.2 C

Rel. Humidity at Test: 44. %

Volumetric flow at inlet conditions (m³/h)

Test day: 951011

Sign: C. Hultgaard

HV-TURBO

Performance Certificate for KA-Compressor

Curves valid for nominal conditions (ISO5364/VDI2045):

Compressor KA2 SV - 3810

Inlet conditions: Temp= 20.0 C

Compressor speed= 23124. RPM

Barom. Press.= 0.99 bar Rel. Hum.= 40. %

Motor Speed= 2945. RPM

Testmotor: LEROY-SOMER/P 225MR-T

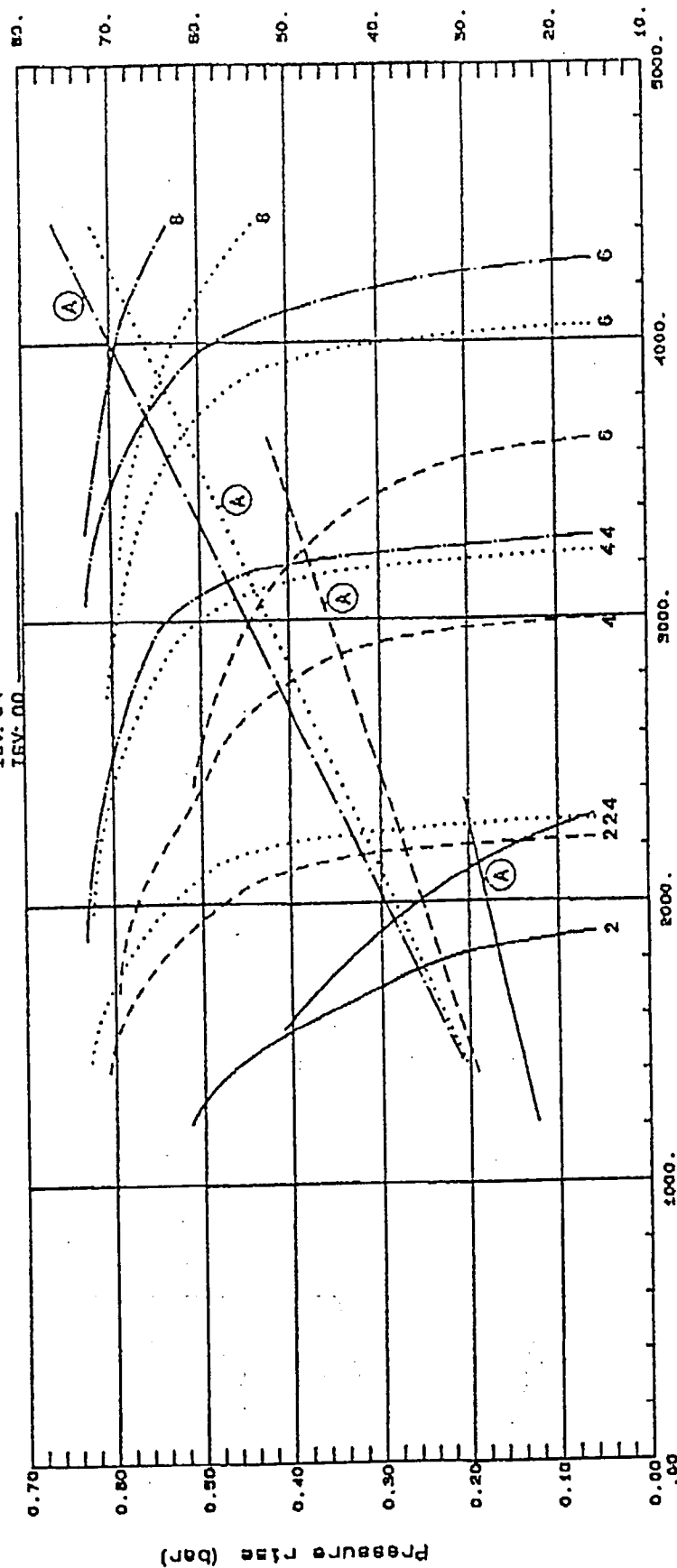
ISV: 10

ISV: 08

ISV: 04

ISV: 00

① Power consumption at coupling (kW)



Volumetric flow at inlet conditions (m³/h)

Measuring Pipe: ISO5167/DIN1952

D = 309.0 mm d = 160.1 mm

Barometric Pressure at test: 1.02 bar

Inlet Temperature at test: 25.2 C

Rel. Humidity at Test: 42. %

Test day: 551010

Sign: *C. Hoffmann*

HV-TURBO

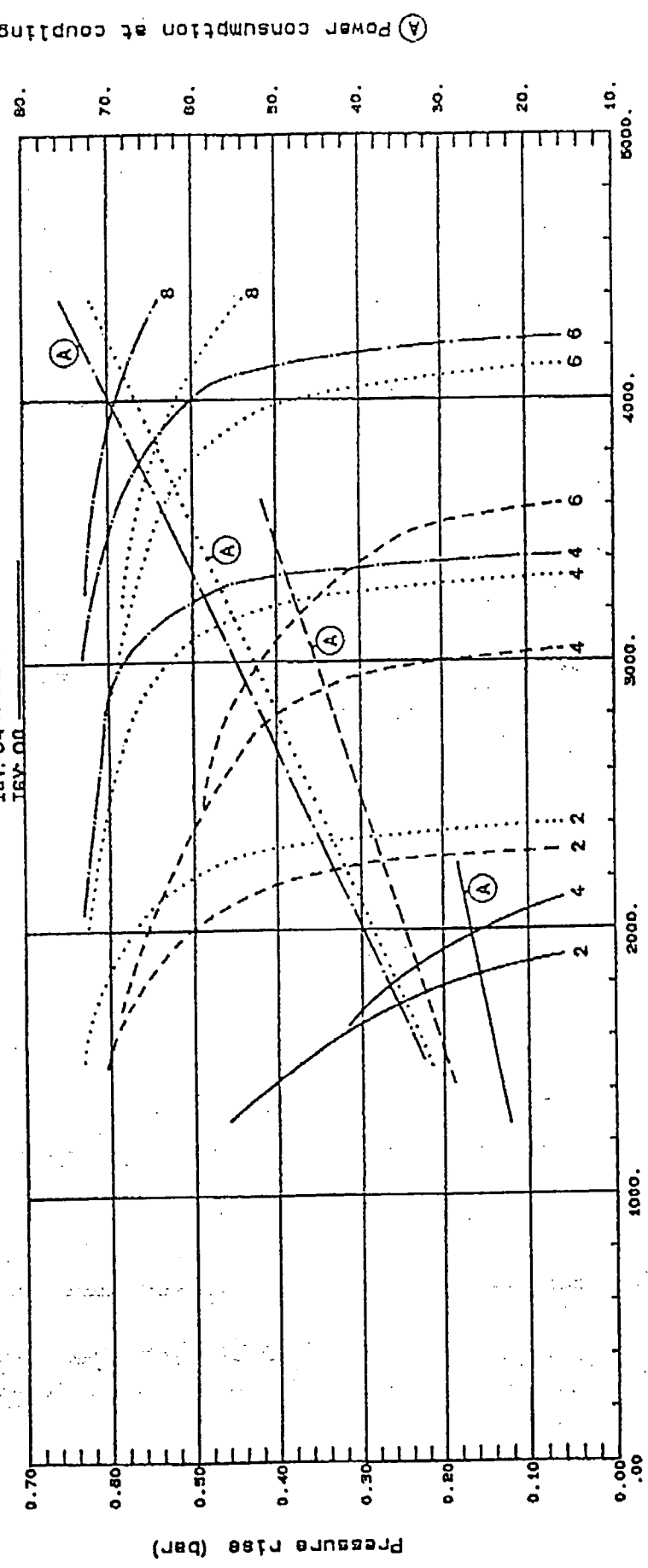
Performance Certificate for KA-Compressor

Curves valid for nominal conditions (ISO5384/VDI2045):

Compressor KA2 SV - 3B11
 Inlet conditions: Temp= 20.0 C Barom. Press.= 0.99 bar Rel. Hum.= 40. %
 Compressor speed= 23124. RPM Motor Speed= 2945. RPM

IGV: 10 ———
 IGV: 08
 IGV: 04 - - - -
 IGV: 00 ———

Testmotor: LEROY-SOMER/P 225MR-T



Volumetric flow at inlet conditions (m³/h)

Measuring Pipe: ISO5167/DIN1952

D = 309.0 mm d = 160.1 mm

Barometric Pressure at test: 1.02 bar

Inlet Temperature at test: 24.8 C

Rel. Humidity at Test: 47. %

Test day: 951012

Sign: *P. Hodge*

2.0 PRINCIPLES OF OPERATION

2.1 DESIGN AND FUNCTION OF THE COMPRESSOR

The compressor and integral gear box are flange mounted to the drive motor.

The motor carries the unit, as the feet of the motor are used to fasten the compressor unit to its base frame.

The compressor is surface-cooled and the gear housing is cast with cooling fins.

The monitoring system, such as thermostats and pressure switches, is mounted on the base frame with a common terminal box for connection.

The air intake silencer and the integral air inlet filter are mounted on to the base frame. The connection to the compressor inlet is a flexible band.

The item numbers shown in the following descriptions can be located on the following drawings which are attached to this Section 2 of the manual.

<u>Drawing No.</u>	<u>Description</u>
KA2M012.1	Compressor - Gearbox Crossection
KA2D031	Variable Prerotation External Drive
KA2D022	Variable Prerotation Internal Drive
KA2D053.0	Outer Diffuser Drive
KA2D008.1	Inner Diffuser Drive

2.1.1. Compressor Design

The compressor is a single-stage, radial flow, centrifugal compressor consisting of the following main components:

1.	Inner Prerotation Drive	Pos. No. D3.00
2.	Outer Volute Casing	Pos. No. H4.01
3.	Inner Volute Casing	Pos. No. H5.01
4.	Impeller	Pos. No. R4.14
5.	Inner Diffuser Drive	Pos. No. D1.00
6.	Rear Plate	Pos. No. H3.01

Diffuser and prerotation have adjustable blades, which makes it possible to regulate the compressor's air flow/volume.

2.1.2. Gear Design

Compressor and gear constitute a unit, which is flanged to the drive motor on the gear side.

The impeller is mounted directly onto the pinion shaft R2.01.

The gear teeth of the pinion shaft engage with gearwheel R1.03, which is mounted directly onto the drive motor shaft by means of the hub R1.06.



2.1.3. Lubricating System

The high speed shaft bearings and gear teeth are oil-mist or oil-splash lubricated.

2.1.4. Operation

The compressor is a constant speed, single-stage, radial flow, centrifugal compressor with adjustable diffuser blades for capacity control.

The air flow enters the impeller R4.14 axially via an annular inlet and from there is released into the volute casing via the diffuser blades. The air is expelled tangentially from the volute casing.

2.1.5. Sealing

The labyrinth bushing H3.03 is fixed to the rear plate and together with the labyrinth ring R4.02 on the pinion shaft it forms a labyrinth seal. The air leakage is thus limited to a minimum and is vented to atmosphere through channels between the rear plate H3.01 and the gearbox flange. These channels must never be allowed to become blocked as oil mist could be forced into the electric motor.

2.1.6. Variable Diffuser (HV-TURBO)

It is possible to obtain stepless air flow regulation within the capacity range specified for each compressor. The adjustment limits for the diffuser, which regulates the flow, are set on the diffuser position scale on each compressor. During factory testing, performance curves are developed for various scale positions within the adjustable range and these are noted on the performance certificate.

2.1.7. Outer Positioning Device of the Diffuser

The outer positioning drive of the diffuser is an electric linear motor D2.24 the movements of which are controlled by a local control panel. By means of the positioning lever D2.05 the circular movement is transmitted through the eccentric shaft D2.07 to the inner diffuser positioning device. The movement is limited by limit switches D2.10 which have been set by the manufacturer during factory testing of the compressors and their position must not be changed. Limit switches signal to the local control panel the MAX. and MIN. position of the diffuser. The diffuser position can be read on scale D2.13.

2.1.8. Inner Positioning Device of Diffuser

The outer diffuser drive - the linear motor - drives the eccentric shaft D2.07 thereby causing the guide ring D1.08 to be moved upwards and downwards. By this the shafts of the diffuser blades D1.17 are turned adjusting the diffuser blades D1.16.

2.1.9. Prerotation System

The system consists of a range of variable blades which are located around the inlet housing.

The system is controlled by a positioning motor (linear type) which is connected to a pull rod. Movement of the pull rod turns a ring and the movement is transmitted through a link and a lever to the blades.

The movements of the positioning motor are registered just as the positioning motor of the diffuser, on the local control panel (see the electric instructions).

The position of the inlet guide vanes is constantly and automatically monitored and adjusted to provide efficient compressor operation, safe from surging conditions. A controller in the LCP monitors inlet air temperature, differential pressure across the compressor and the air flow rate (diffuser position) and adjusts the inlet guide vanes to suit the prevailing conditions.

2.1.10. Positioning Motor

For diffuser and prerotation drive.

Data: See Section 1.00, Page 1.3 - Linear Motor

Function: Positioning of diffuser and prerotation blades: by manual push button operation of the local control panel (LCP) or by a signal from the automatic control system.

The gear and bearings of the positioning motor are lubricated for life. Spare oil for its spindle and nut is contained in the push rod. Under normal conditions maintenance is not necessary.

The positioning motor should not be dismantled or opened. Defective positioning motors should be returned to the manufacturer for repair.

Having a 1000 Ohm linear potentiometer built in, the positioning motor is equipped for instrument indication of position. Equipment for instrument indication is included in the LCP.



2.2. GEARBOX, TYPE GK

Description

The GK-gearbox has a single stage gear with precision ground gear teeth for very high speeds. The gearbox housing H1.01 is cast with cooling fins and is flanged to the compressor.

The electric motor shaft with gear wheel R1.03 comprises the drive shaft.

Labyrinth sealing prevents loss of lubricating oil from the drive shaft.

The pinion shaft R2.01 is also the impeller shaft and is supported in the special high speed ball bearings T2.08 and T2.10. At the compressor end this shaft is sealed by means of a labyrinth seal T2.20.

The journal bearing T2.08 is mounted in a special bearing housing T2.04.

The shims and the plate springs T2.19 maintain correct bearing pre-load.

The pump discs R2.06 are mounted on the pinion shaft R2.01 close to the bearing. They transport a mixture of air and oil mist through the bearings. The gearing is lubricated by an oil film, which is renewed continuously by the submersion of the gear wheel R1.03 into the oil bath within the oil shield.



2.3. LUBRICATING OIL SYSTEM

2.3.1. Oil Filling

The oil sump of the gear box is filled with approximately 5.5 litres of synthetic oil (the type of oil must be approved by HV-TURBO).

The filler stud S1.12 is located on the end wall of the gearbox (compressor end). Oil level and oil temperature are indicated on the sight glass EI.30 and thermometer EI.22 respectively. The oil level must never exceed the MAX-level on the sight glass, otherwise the oil temperature becomes too high. The marked oil levels on the sight glass apply for oil during operation. The oil level is somewhat lower when the oil is cold.

During normal operation the lubricating oil temperature will be between 60°C and 80°C above the ambient temperature.

2.3.2. Oil Outlet

Remove the screw plug S4.15 and let the oil drain off. Clean the magnetic plug. If significant steel particles are observed, the gear should be opened for inspection.

If the oil is strongly discoloured an oil sample should be sent to the oil supplier for analysis.

An oil level switch E1.20 is installed in the oil sump. If the oil level is lower than the indicator on the sight glass the oil level switch shall immediately stop the drive motor by a signal to the electrical safety chain (see paragraph concerning the electric system).

If the oil temperature exceeds 110°C a thermostat with sensor in the sensor pocket E1.34 will stop the compressor.

Excessive oil temperatures can be caused by insufficient ventilation of the compressor room (high ambient temperature).

2.3.3. Change of Oil

The initial fill of oil must be changed and the magnetic rod cleaned after maximum 500 hours of operation. The waste oil must not be re-utilised. Synthetic oil (approximately 5.5 litres) must be used for new oil filling. The oil level must be checked after every 2,000 hours of operation. New oil can be added up to the sight mark. After maximum 6,000 hours of operation or after 8 months the oil must be changed again.

The compressor must operate with synthetic oil types only, which are approved by HV-TURBO. Different types of oil must not be mixed, i.e. if the oil type is changed all oil must be changed. Oil from tanks which have been opened for some time must not be added as dust from the atmosphere will be absorbed in the oil.

2.3.4. Oil Types

The compressor must operate with synthetic oil only (see 1.3 Recommended Lubricants)

2.4 MONITORING FUNCTIONS

During operation the compressor is constantly monitored by a number of thermostats and pressure controllers mounted on the unit.

- | | |
|-------------------------|---|
| 1. Thermostat 107: | High oil temperature (sensor E1.OS in the oil sump) |
| 2. Oil Level Switch: | Low oil level (float E1.20 in the oil sump) |
| 3. Thermostat 101: | High air temperature in inlet "Recirculation" (sensor pocket E1.34 in the spiral casing). |
| 4. Surge Control SUC-3: | High air pressure in the spiral casing "stalling" (sensor pipe E1.16). |
| 5. Sight Glass: | Oil level (E1.30) - visual control. |
| 6. Thermometer: | Oil temperature (E1.22) - visual control. |

The monitoring system must be connected in such a way that it prevents the compressor from starting or stops the compressor if the pre-set conditions for safe operation are not present.

If the above thermostats and pressure controllers stop the compressor they can be reset by pressing the respective button on the electric control panel. However, before resetting it is important to make sure that the error has been corrected.

All thermostats and pressure controllers are adjusted and sealed by HV-TURBO. During the guarantee period the adjustment may be changed with the authority of HV-Turbo. All thermostats and pressure controllers must be checked at regular intervals (see Section 4.00, MAINTENANCE).

If the oil level drops below MIN. an oil level switch in the oil sump will stop the drive motor of the compressor. Furthermore, start-up of the drive motor will not be possible if the oil level remains too low.

2.4.1. Thermostat RT107: High Oil Temperature

Data: See also Thermostat - Oil, page 1.4.

Setting range: 70°C-150° C

Function: Stops the drive motor of the compressor when the oil temperature exceeds 110°C.

Setting: Dismount front cover of the thermostat and set the differential roll 19 on MIN. Scale 9 is set on 110°C by means of manual button 5.

Testing: The scale of the thermostat is set on 110°C. The sensor is taken out of the inlet and heated in oil to more than 110°C. If the compressor is in operation it must stop. If the compressor is not operating, starting must not be possible.

The thermostat is part of the electric safety system and is sealed after adjustment.

IMPORTANT (SEE OVER PAGE)



IMPORTANT!

DURING THE PERIOD OF WARRANTY OF THE COMPRESSOR, SEALED THERMOSTATS AND PRESSURE CONTROLLERS MUST BE ADJUSTED BY HV-TURBO AUTHORISED PERSONNEL ONLY.

THE WARRANTY WILL BE VOIDED IF THE SEAL IS BROKEN!

2.4.2. Thermostat RT101: "Air Temperature Too High"

Data: See also Thermostat - Air, page 1.4.

MAX : Ambient temperature:
 -50°C - +70°C.

MAX : Sensor temperature: 300°C

Function: To stop the driving motor of the compressor if the air temperature of inlet air exceeds 65°C, thus protecting against over-heating caused by recirculation.

Setting: Dismount front cover of the thermostat and set the differential roll 19 on MIN. Scale 9 is set on 65°C by means of manual button 5.

Testing: The scale of the thermostat is set on 65°C. The sensor is taken out of the inlet and heated in water to above 65°C. If the compressor is operating, it must stop. If the compressor is not operating, it must not be possible to start it.

The thermostat is part of the electric safety system and is sealed with lead after adjustment.

IMPORTANT:

DURING THE PERIOD OF WARRANTY OF THE COMPRESSOR, SEALED THERMOSTATS AND PRESSURE CONTROLLERS MUST BE ADJUSTED BY HV-TURBO AUTHORISED PERSONNEL ONLY.

THE WARRANTY WILL BE VOIDED IF THE SEAL IS BROKEN.

2.4.3. Surge Indicator**Function:**

To give alarm (stop the drive motor) in case of surging.

Sensor:

Inductive sensor NAMUR DIN 1923.

Mounting:

On the compressor inlet housing.

A: Suction in normal operation

B: Pressure in surging

The surge indicator is mounted vertically on the compressor inlet.

At normal operation a small steeldisc is forced down (away from the inductive sensor) by the vacuum in the inlet housing.

At surging the direction of the pressure is reversed, causing the steel disc to move towards the inductive sensor, which then gives the alarm.

2.4.4. Stalling or Recirculation

Stalling or recirculation are both situations which arise in connection with operational errors or errors in the automatic control system or the controlled functions. In either condition the compressor will run in an unstable operating range and must be stopped at once.

Stalling

Pressure air from the compressor outlet expands jerkily through the operating compressor. Stalling is usually caused by operating at too high a differential pressure. Stalling may also arise if the inlet temperature is much higher than the maximum design temperature. At increased inlet temperatures the max. achievable discharge pressure of the compressor will drop.

Stalling results in audible pressure blows, the frequency and strength of which are determined among other things, by the resonant conditions of the piping system on the discharge side. Strong pressure blows result in heavy loads on the mechanical parts of the compressor, and, therefore, the compressor must be stopped. The surge controller which is connected to the compressor housing through a pressure pipe, stops the drive motor when surging occurs.

Recirculation (air blowback)

If the compressor is working in an unstable operational range, the discharge air runs backwards through some of the impeller blades and heats the inlet air. Recirculation is caused by prolonged operation at near-surging conditions.

To avoid overheating and damage to the compressor it must be stopped immediately. A thermostat with a sensor in the compressor inlet takes care of this.

2.5 THE LOCAL CONTROL SYSTEM OF THE COMPRESSORS

The unit is equipped with our electric control system "LC-1D" (local control panel) through which the daily operation and monitoring occur.

The following conditions for start and operation will be maintained by the logic system in the local control panel:

1. When the "START" button is activated the automatic control system will open the blow-off valve and set the diffuser in MIN-position. At the same time the instruments of the safety system are checked, and if they are in order, the drive motor of the compressor will start.
2. When the compressor has been started the blow-off valve will close.
3. During operation, the diffuser will be adjusted continuously according to the operation conditions.
4. In case of errors, as e.g. high oil temperature, low oil level, high back pressure in the outlet pipe etc., the compressor will be stopped.
5. When the error has been found and corrected the monitoring system, which stopped the compressor, has to be reset.

IMPORTANT!

The design of the local control panel and all its electric functions are described in "THE ELECTRICAL DRAWINGS LC-1D No. 937.123.111.0.0 Sheets Nos.001-204, which are contained in Section 7 of the manual.

2.5.1. BLOWER CONTROLS

Each LCP controls and/or monitors the blower ancillary drives and safety devices including:

- Diffuser drive
- Diffuser position
- Inlet guide vane drive
- Inlet guide vane position
- High lube oil temperature
- Low lube oil level
- Blow-off valve drive
- Blow-off valve end travel limits
- Acoustic hood vent fan drive
- Inlet air temperature (recirculation)
- Surge detector
- Drive motor temperature
- Drive motor amps

The signals which pass between the LCP and the Master Control Panel (MCP) are as follows:

LCP to MCP

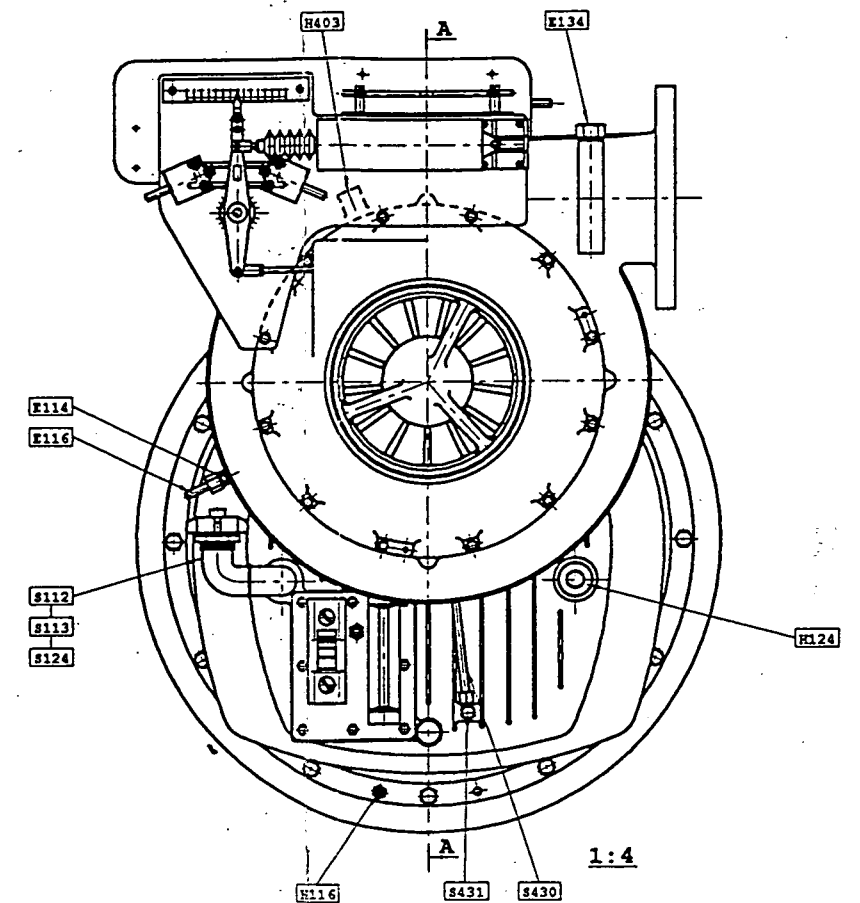
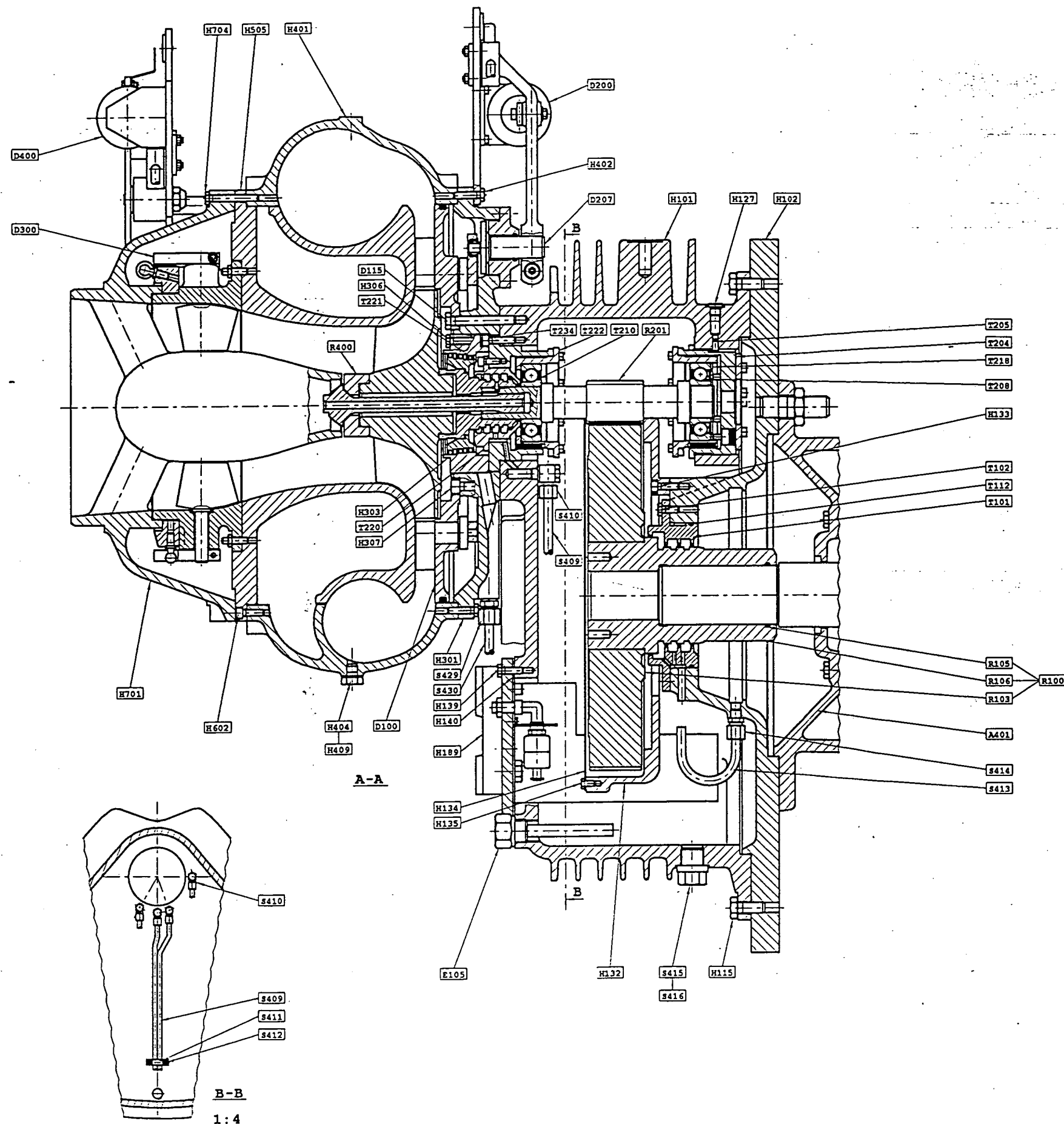
1. Blower ready to start
2. Blower general fault condition
3. Blower under local control
4. Blower running
5. Diffuser fully open
6. Diffuser fully closed

MCP to LCP

7. Open diffuser
8. Close diffuser
9. Start blower
10. Stop blower

For a full description of LCP functions, interaction between LCP and MCP and blower sequencing by the MCP, see manual for Separable Portion 7, Section 3.6



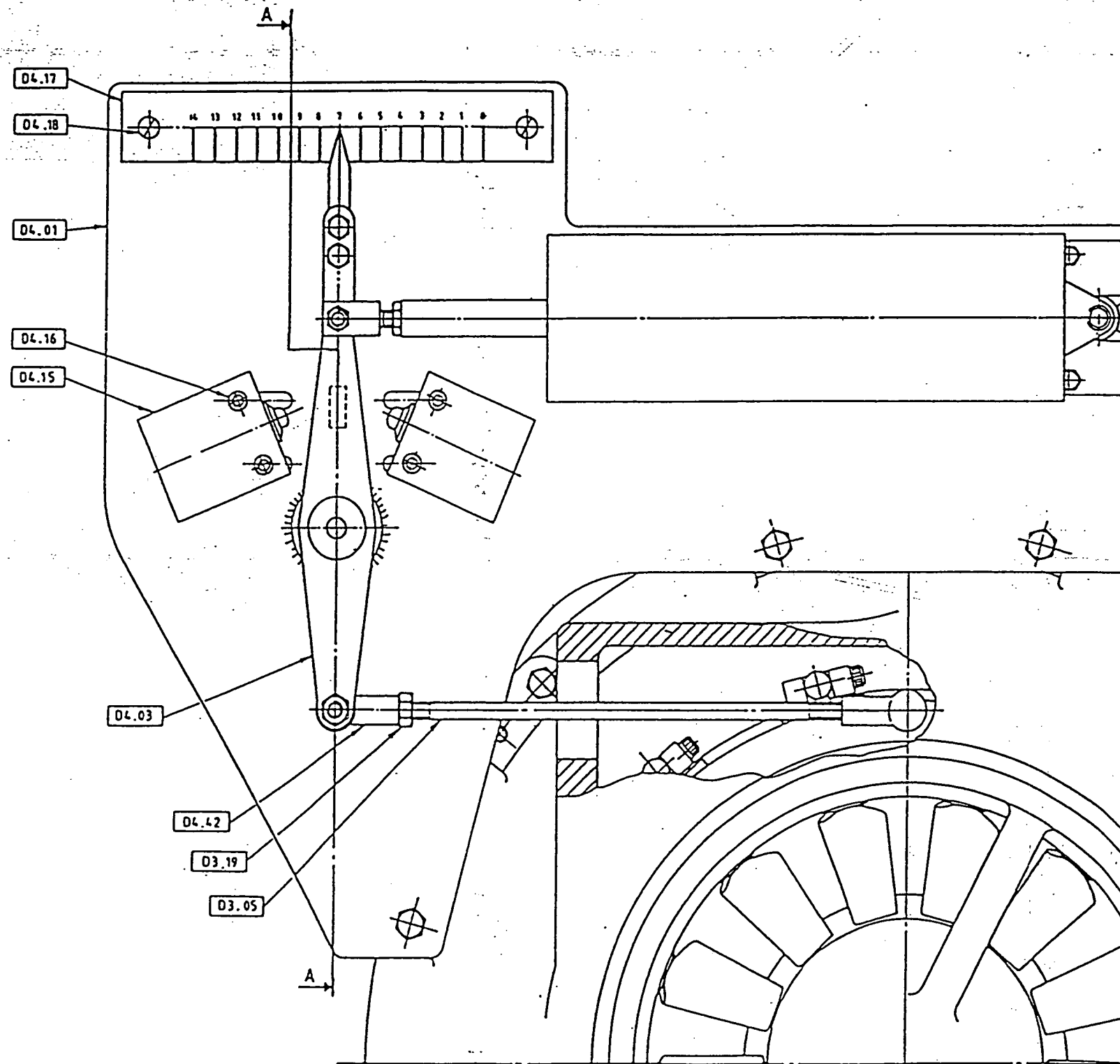


REV.	DATE	BY	CHKD.	APP.	DATE	BY	CHKD.	APP.
1	941208	JL/HJ			941208	JL		
2	941214	JL			941214	JL		
3	941214	JL			941214	JL		
TURBO				KA2M012				
KA 2 SV - GK 2				Compressor - Gearbox				
Drawing.				KA2M012.1				

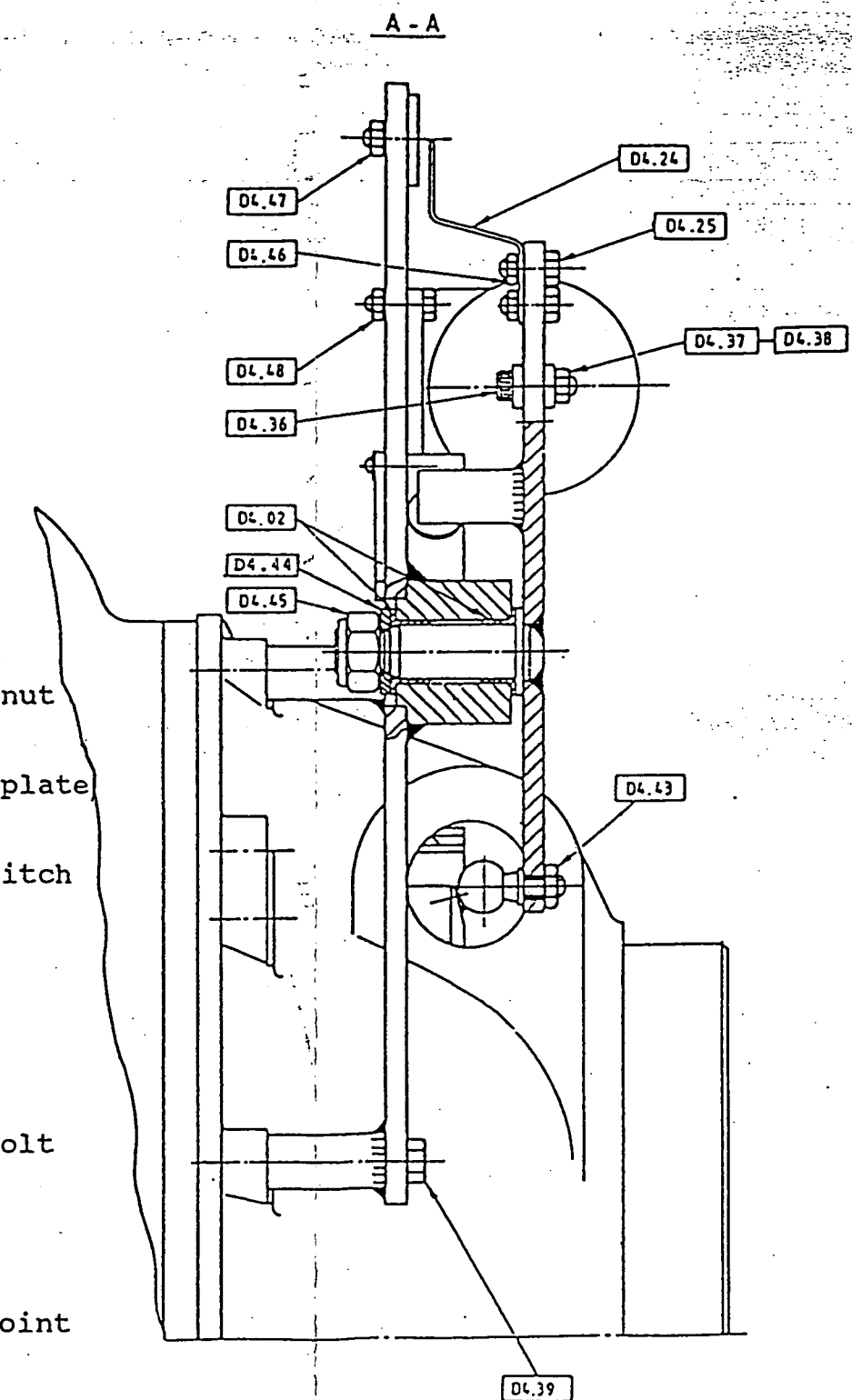


KA2SV-GK2

 VARIABLE PREROTATION
EXTERNAL DRIVE

 DK 3000 HELSINGØR
DANMARK
TELEFON: 45 49 211400
TELEFAX: 45 49 215225
KA2Do31


- D3.05 Pull rod
- D3.19 Counter nut
- D4.01 Plate
- D4.02 Bearing plate
- D4.03 Lever
- D4.15 Limit switch
- D4.16 Screw
- D4.17 Scale
- D4.18 Screw
- D4.24 Pointer
- D4.25 Screw
- D4.36 Fitted bolt
- D4.37 Washer
- D4.38 Nut
- D4.39 Screw
- D4.42 Swivel joint
- D4.43 Lock nut
- D4.44 Washer
- D4.45 Lock nut
- D4.46 Nut
- D4.47 Nut
- D4.48 Nut



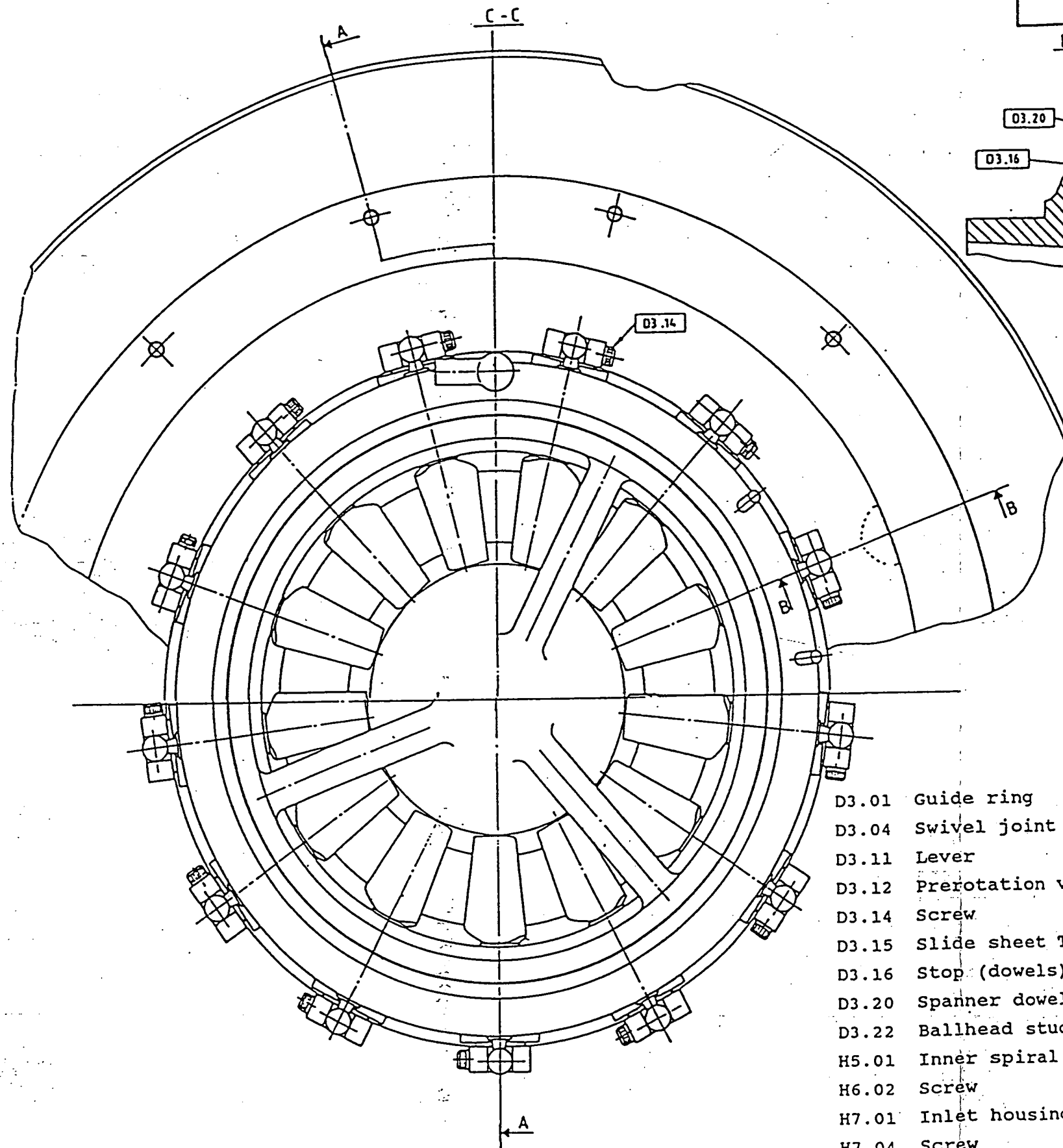


KA2SV-GK2

VARIABLE PREROTATION
INTERNAL DRIVE

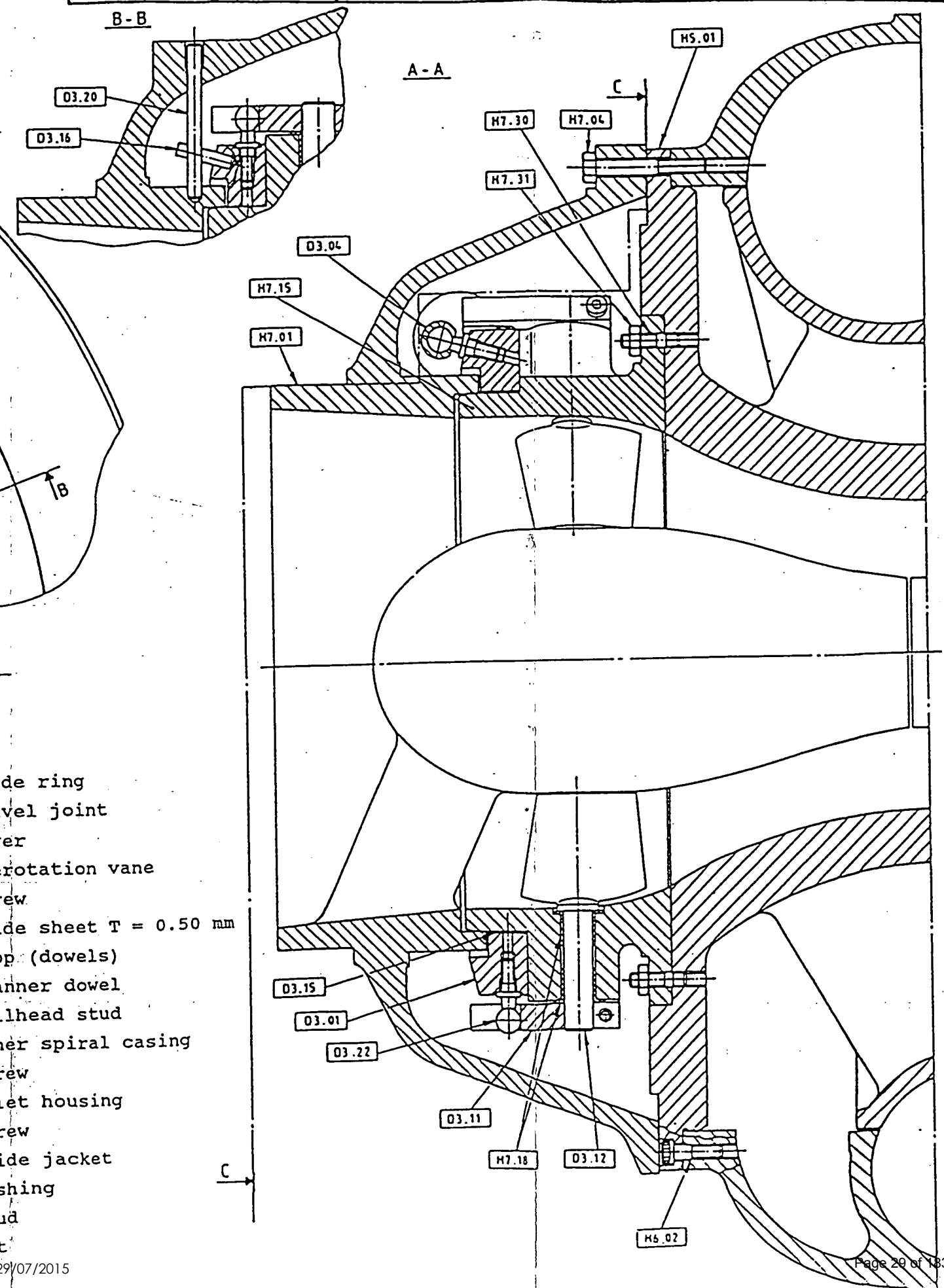
DK 3000 HELSINGØR
DANMARKTELEFON: 45 49 211400
TELEFAX: 45 49 215225

KA2D022



- D3.01 Guide ring
- D3.04 Swivel joint
- D3.11 Lever
- D3.12 Prerotation vane
- D3.14 Screw
- D3.15 Slide sheet $T = 0.50 \text{ mm}$
- D3.16 Stop (dowels)
- D3.20 Spanner dowel
- D3.22 Ballhead stud
- H5.01 Inner spiral casing
- H6.02 Screw
- H7.01 Inlet housing
- H7.04 Screw
- H7.15 Guide jacket
- H7.18 Bushing
- H7.30 Stud
- H7.31 Nut

Active 29/07/2015





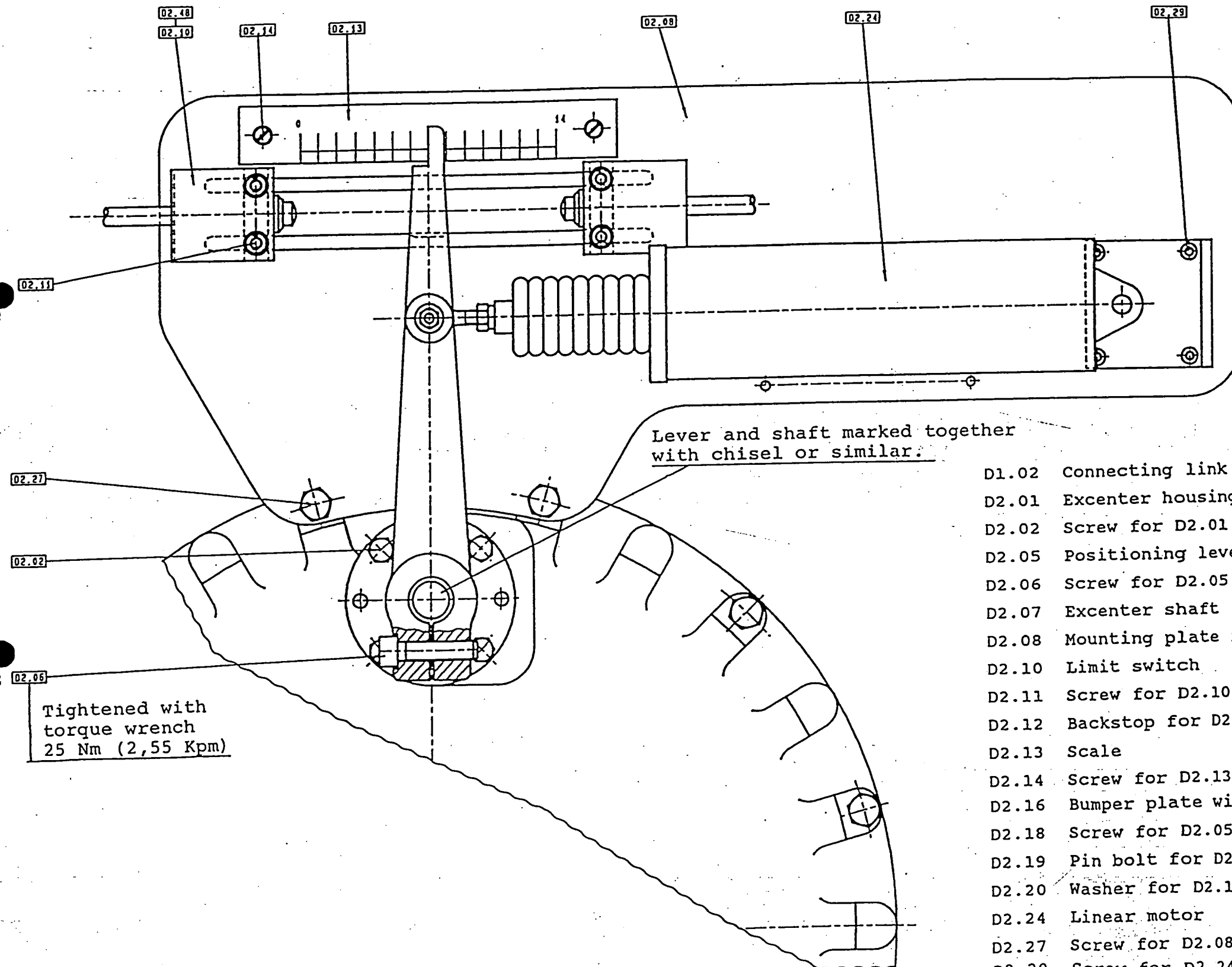
KA2S/SV-GK2

OUTER DIFFUSERDRIVE

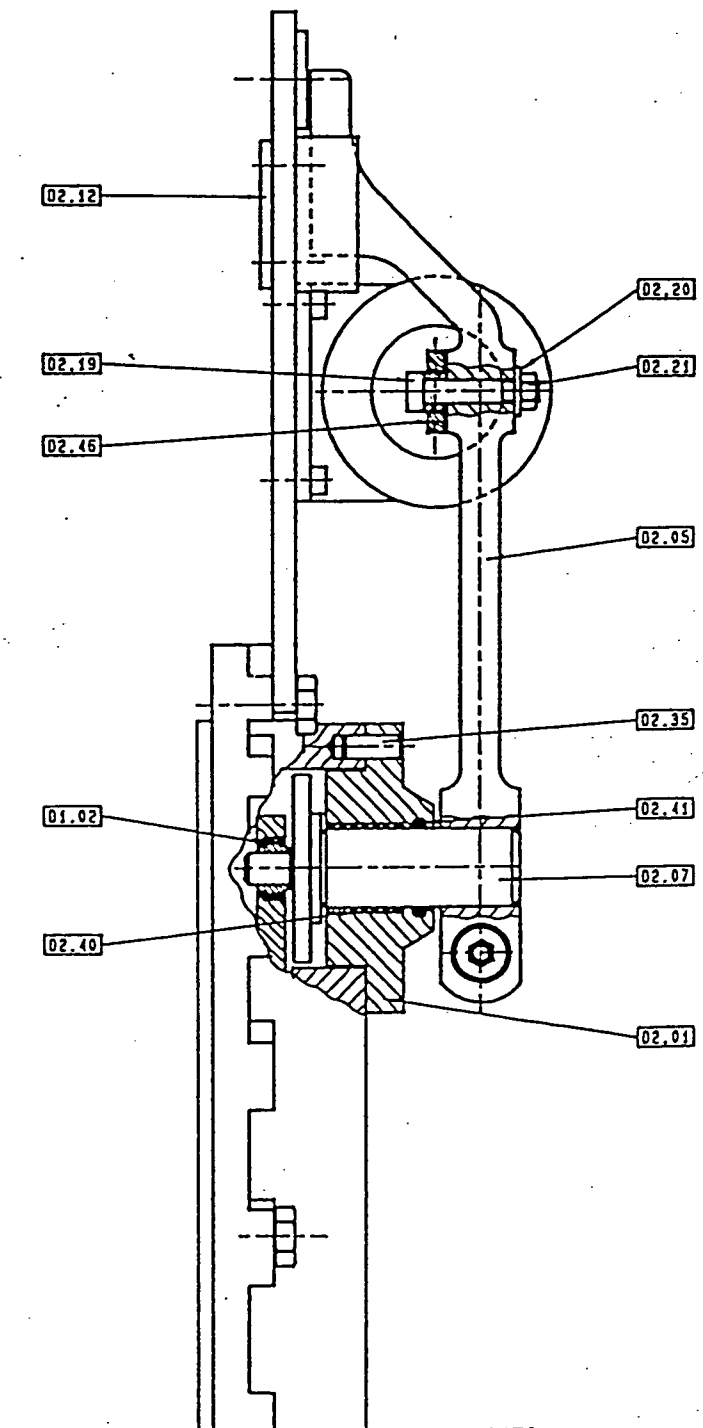
TURBO A/S

DK 3000 HELSINGØR
DANMARKTELEFON: 45 49 211400
TELEFAX: 45 49 215225

KA2D053.0



- D1.02 Connecting link
- D2.01 Excenter housing
- D2.02 Screw for D2.01
- D2.05 Positioning lever
- D2.06 Screw for D2.05 and D2.07
- D2.07 Excenter shaft
- D2.08 Mounting plate for D2.24
- D2.10 Limit switch
- D2.11 Screw for D2.10
- D2.12 Backstop for D2.11
- D2.13 Scale
- D2.14 Screw for D2.13
- D2.16 Bumper plate with pointer
- D2.18 Screw for D2.05
- D2.19 Pin bolt for D2.24
- D2.20 Washer for D2.19
- D2.24 Linear motor
- D2.27 Screw for D2.08
- D2.29 Screw for D2.24
- D2.35 Dowel for D2.01
- D2.40 Bearing for D2.01
- D2.41 Gasket for D2.01
- D2.46 Connecting link for D2.24
- D2.48 Support





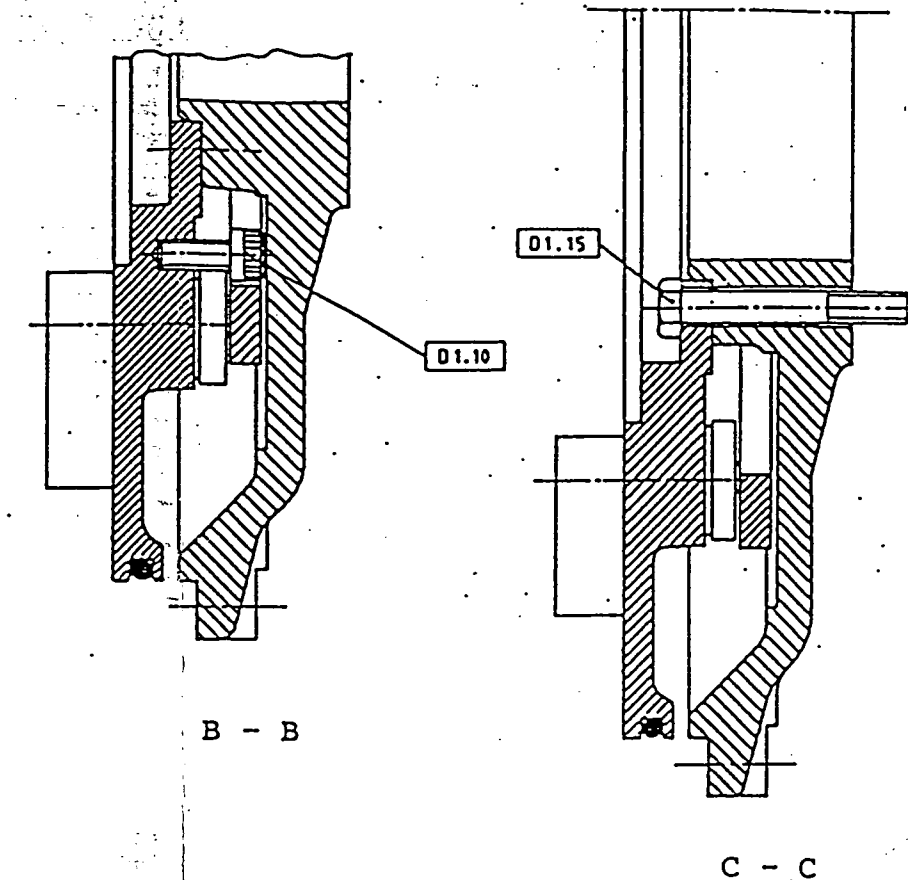
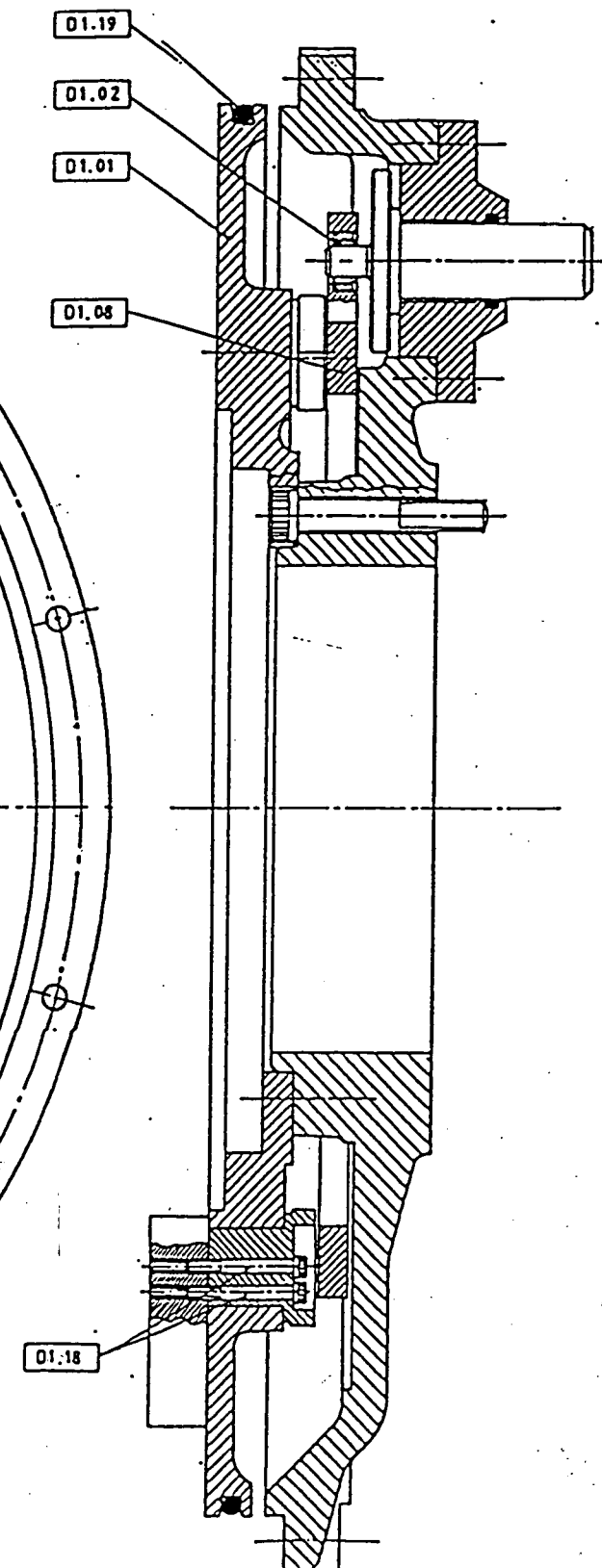
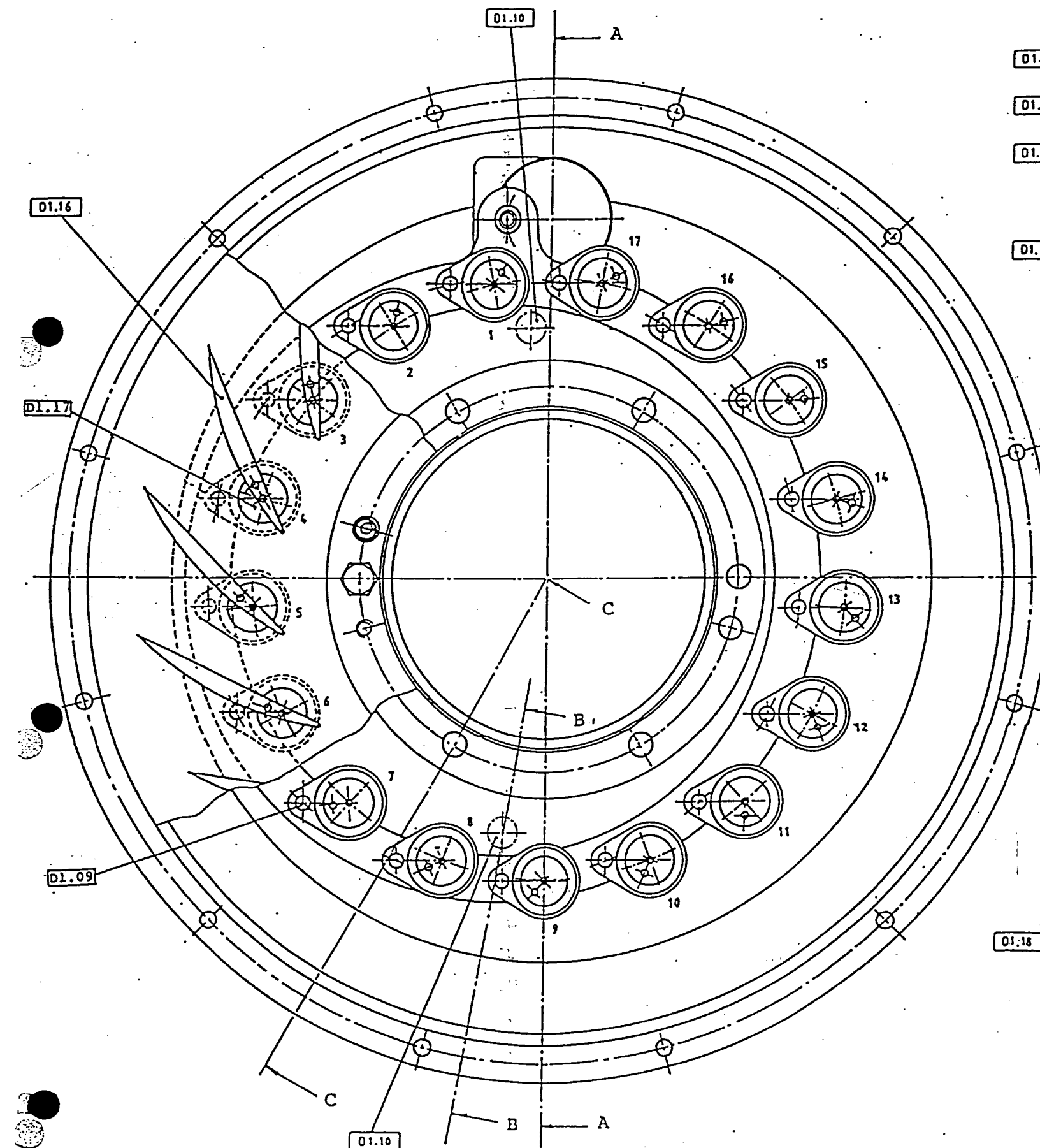
KA2S/SV-GK2
INNER DIFFUSER DRIVE

TURBO A/S

DK 3000 HELSINGØR
DANMARK

TELEFON: 45 49 211400
TELEFAX: 45 49 215225

KA2D008.1



Pos. No.	Description
D1.01	Diffuser plate
D1.02	Swivel joint
D1.08	Guide ring
D1.09	Dowel for D1.08
D1.10	Endstop
D1.15	Screw for D1.01/H3.01
D1.16	Diffuser blade
D1.17	Shaft for diffuser blade
D1.18	Screw for D1.16/D1.17
D1.19	O-Ring for D1.01

3.00 OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The HV-TURBO compressor package is carefully engineered to be a fully automatic compressor installation.

HV-TURBO has an advanced quality assurance system which ensures that all parts comply with the specification at each stage of production. The complete compressor unit, including instrumentation and controls, undergoes a rigorous, full-load, certificated works test.

The HV-TURBO commitment to you does not stop when the compressor package has been shipped. A large stock of spare parts for the turbo compressors is always available and ready for dispatch.

Aquatec-Maxcon has a service organisation with highly skilled engineers operating throughout Australasia, providing engineering backup, start-up and commissioning assistance, and service. A preventative maintenance contract can keep your HV-TURBO compressor in operation for many years. Aquatec-Maxcon also offers training programs to enable your own engineers to carry out maintenance.

3.2 SAFETY MEASURES

Safety has a very high priority during the construction phase as well as when selecting materials for HV-TURBO compressor units.

The following safety measures must be observed before the compressor units are installed.

3.2.1. During Installation

The compressor units are designed, tested and approved for the operating conditions stated in this Manual, Section 1.2 *"Technical Specifications"*.

Never operate the unit under conditions that deviate from design conditions.

Whenever the unit or parts of the unit are lifted, the procedure described in this Manual must be carefully followed.

IMPORTANT!

When installing please note:

The connections to the compressor inlet silencer and filter as well as the connections between the compressor and discharge piping system of the plant must be flexible as the compressor must not be loaded by external forces (e.g. heat deformations).



Preparations

Add lubricating oil. Oil level according to marks on sight glass. Normally, on delivery the gear is filled with preservative oil, RUSTBAN 355. The compressor must on no account be started in this condition. The preservative oil must be drained out carefully and lubricating oil added before starting the compressor.

Type of oil: See 1.3 - Recommended Lubricants

Only new and absolutely clean oil must be added.

3.2.2. During Operation

The compressor must not be started until all safety devices have been connected.

Never stay near or block the inlet filter or silencer system when the compressor is ready for start or operation.

Operating conditions beyond the stated design limits must not occur under any circumstances!

Beware of hot surfaces on compressor, pipework and drive motor when the unit is operating, and for a while after it has stopped.

Never stay near operating compressor units which have their acoustic enclosure removed unless protected by a hearing-protective device.

Check at regular intervals that the compressor unit is correctly grounded.

Beware of compressors in "AUTOMATIC" (see Manual). Starting up can occur without prior warning.

3.2.3. During Maintenance

All maintenance work must be carried out by trained personnel only and only when:

- the drive motor has been disconnected, thereby preventing unintentional start of the compressor; i.e. in the case of electric motors the main circuit must be disconnected.
- the compressor's LC-panel must be disconnected
- the emergency stop has been activated and locked
- the outlet pipe system from the compressor's discharge flange has been isolated by a blind flange or the like, in order to prevent pressurised air from flowing back through the compressor. If a manually operated discharge isolating valve has been mounted, it must be closed.

Touching electric wiring inside the LC-panels and terminal boxes may endanger your life!

Any opening of, and/or electrical work on these units must **only** be carried out by trained personnel and in accordance with HV-TURBO's Manual.



3.3 START UP PRE-CONDITIONS

The compressor will not start unless all of the following conditions are met:

Diffuser is at minimum setting

Inlet Guide Vanes (I.G.V.) are at minimum setting

Blow-off valve is fully open

No active alarm conditions exist

Blower is not set in "service" control mode at the Local Control Panel.

For automatic start and control, the control mode at the Local Control Panel must be in "Automatic" and not "Manual" mode.

3.3.1. START

To check whether the direction of rotation is correct, the compressor is started and stopped immediately afterwards (wrong direction of rotation for a few seconds only may cause permanent damage to the compressor and gear). If the direction of rotation is wrong it must be corrected. After approximately 15 min. the compressor can be restarted (in order to protect the windings of the motor).

Correct direction of rotation: Seen from the motor non drive end: clockwise

The electric control system (Local Control Panel LC-1D) logic system will take care of all necessary functions before and after start up when the start order is given by pressing the run button. In case of errors or if the starting conditions are not fulfilled, the local control panel will indicate "ERROR".

When the compressors have been put into service, the operator should occasionally alter the start priority so that all compressors on the plant operate at regular intervals over a long period time, thus obtaining the same number of operating hours.

On plants where the diffuser and/or prerotation system is not frequently run from fully open to fully closed, due to special operating conditions, the local panel shall be set on "Manual" at least once a week, and the diffuser and/or prerotation run from fully closed to fully open at least twice. This also applies to compressors which are not in operation.

If the compressors have not been in operation for a month, the following procedure shall be implemented:

Set the local panel on "Manual" and start up the compressor briefly with the blow-off valve completely open. This brief start interval only has to last 5-10 seconds.



4.00 MAINTENANCE

4.1 ROUTINE MAINTENANCE

4.1.1. Observations

Lubricating oil level (sight glass E1.30), especially in new plants must be inspected often, e.g. twice a day the first 10 days of operation, and then once a day.

The oil temperature (thermometer E1.22) must be recorded for the first 10 days of operation and compared with the figures stated in the Technical Specification.

After that: the oil level in the oil sump must be checked once a month.

With severe environmental changes (summer/winter) the ventilation of the compressor room and its effect on the air cooling of the compressor unit must be observed.

Regular inspections should include:

1. Listen for foreign noises
2. Check filter losses < 60mm W.C.
3. Check oil level
4. Check oil temperature
5. Check motor amps

4.1.2. Fault Conditions

The following conditions will stop the blowers or prevent them from starting and will raise alarms on the LCPs.

Motor temperature too high

Oil level too low

Oil temperature too high

Inlet air temperature too high (recirculation)

Blower surge (differential pressure too high)

General (common) alarm - Blow-off valve not closed in time

Emergency stop engaged

Motor doesn't start



4.1.3. Maintenance Schedule

Reference should be made to Section 5.00 of this manual - *Repair and Overhaul* - for further details.

DAILY

- a. Check for fault lights on LC-1As. Are the amp. readings quite normal?
- b. Listen to, and feel the operating blower(s). Are there any unusual noises? Is the temperature normal? Read the output air pressure gauge: is it in the right range for the water depth at the time?

WEEKLY

Inspect oil level in blower gearboxes and check for any evidence of oil leaks.

EVERY MONTH

Check pressure drop over blower inlet filter/silencer.

First Oil Change

After 500 hours.

Every 6,000 Hours

Change oil in blower and replace inlet filter fabric.

Every 18,000 Hours/3 Years whichever is Earlier

Replace blower bearings. Clean diffuser blades and position devices. Carry out complete service as per HV-Turbo instructions. See Section 4.2 of this manual.

IMPORTANT

It is recommended that all the above be carried out by approved HV-Turbo service personnel.

4.2 SCOPE OF SERVICE

The service entails cleaning and checking of all parts exposed to the medium as well as check/replacement of flexible gaskets, test and if necessary, adjustment of control panel and test run.

If the diffuser and/or prerotation cease to operate smoothly (due to impurities in the compressor) before the 18.000 hrs./3 years have lapsed, the first service check shall be brought forward and the subsequent services timed accordingly, as a dirty compressor is less effective than a clean one.

The following jobs are performed during servicing:

- O1A Test run of compressor to check oil leaks.
- O1B Vibration level at the test point (RMS-value), measured before disassembling of compressor (notes).
- 02A Dismounting of air inlet duct.
- 02B Dismounting of silencer and air-inlet filter.
- 02C Dismounting of silencer.
- 03A Check and replacement of air-inlet filter or 03B.
- 03B Check and cleaning of air-inlet filter.
- 04A Check of silencer.
- 04B Repair of silencer.
- 05 Dismounting of outer diffuser drive systems.
- 06 Dismounting of outer prerotation drive system
- 07 Dismounting of inlet housing, spiral casing, contour ring, impeller/rotor and diffuser plate.
- 08 Check and cleaning of all air-exposed surfaces, especially of impeller/rotor.
- 09A Disassembling of inner diffuser drive system.
- 09B Check, lubrication, and cleaning of all parts in the diffuser drive system.
- 09C Assembling and measuring of diffuser drive system. Check of minimum throat area of diffusers.
- 10A Disassembling of inner prerotation drive system.
- 10B Check, lubrication, and cleaning of all parts of prerotation drive system.



- 10C Assembling and measuring of prerotation drive system
- 11 Disassembling of gear.
- 12 Visual check of gearwheel and sealing.
- 12B Replacement of sealing (optional).
- 13 Replacement of ball bearings.
- 16 Cleaning of all parts.
- 17 Assembling of gear.
- 18 Check and measuring of axial play in gear (notes).
- 19A Assembling of compressor. Visual check of all parts including check of axial clearance of bearing in rotor (see notes).
- 19B Checking of clearance between impeller and spiral casing (see notes)
- 20 Replacement of all O-rings.
- 21 Mounting, checking, and adjustment of outer diffuser drive system. Check of mechanical limit switch to stop at scale value "0". Check of limit switch (see notes).
- 22 Mounting, checking, and adjustment of outer prerotation drive system. Check of limit switch (see notes).
- 23A Mounting of silencer.
- 23B Mounting of silencer and air-inlet filter.
- 23C Mounting of air-inlet duct.
- 25 Change of lubricating oil.
- 27 Check of drive motor (cleaning of fan and lubrication).
- 28 Check of blow-off valve and non-return valve (functional test).

4.2.1. Simulated Test Run

In order to check the start/stop sequence as well as the electrical connections, a simulated test run is carried out.

- 08 When simulating operation, thermostats and pressure sensors, as well as all safety monitoring equipment, shall be tested for satisfactory operation. For pressure and temperatures, see technical specifications section 1.2



- 09 Turn compressor manually to check whether the rotation is smooth. This is most easily done at the non drive end of the motor.

During the test run the following shall be checked/adjusted:

- 11A Opening and closing time of blow-off valve. The blow-off valve should signal "closed" within 180 seconds of the start (depending on type of valve and plant conditions).
- 11B Function of the non-return valve.
- 11C Build-up and stability of air pressure in the discharge pipe
- 11D Lubricating-oil level and temperature shall stabilised.

For lubricating-oil level and temperature during operation, see technical specifications section 1.
- 11F Test diffuser manual adjustment.
- 11G Test inlet guide vane manual adjustment.
- 11H Test safety monitoring system, thermostats and pressostats as well as emergency stop during operation.
- 11I Test normal start and stop sequence.
- 11J Adjust motor overload protection (diffuser/prerotation limit).
- 11K Check for oil leaks at operating temperature.

4.2.2. Record of Observations/Measurement

- NO1B Vibration level before service RMS (mm/S):
- N09C Diffuser throat area after maintenance (mm):
- N21 Limit switch positions, diffuser MIN/MAX:
- N22 Limit switch positions, prerotation MIN/MAX:
- N32C Vibration level after maintenance RMS (mm/S):
- N33 Hour counter (hours):

4.2.3. Inlet Silencer

The inlet silencer is designed for atmospheric air and lined with sound-absorbing material.



Cleaning of the sound-absorbing foam can be done by a vacuum cleaner during service. Avoid bending the silencer shell.

The sound absorbing material should never be exposed to steam or washed with water.

IMPORTANT! Organic solvents will damage the silencer material and reduce its adhesion to the silencer shell.



5.00 REPAIR, OVERHAULING AND DISMANTLING

5.1 INTRODUCTION

The HV-Turbo compressor is designed to operate for many thousand hours with a minimum of maintenance.

Periodic inspections and cleaning are most important and for these the compressor and gearbox require disassembly. Instructions of disassembly and reassembly are given below. Follow these instructions carefully, and if any doubt please contact Aquatec-Maxcon who will do their utmost to be of assistance to you. The HV-TURBO compressor is built with very fine tolerances and operates at very high speeds so it is necessary to be very careful during maintenance works. Only use the correct tools only and avoid any kind of bumping of the compressor parts.

Observe proper cleanliness.

Do not use cotton waste for cleaning or drying as it may contain particles of dirt or metal.

NOTE: The HV-Turbo item numbers shown in the following, are indicated in the cross-sectional drawing of the compressor gearbox number KA2M012.1, which can be found in Section 6 - Parts Lists. The detail drawings of the items to be dismantled/repared/reassembled follow the cross sectional drawing and also show the same item numbers. These drawings are located directly after Section 5 (this section).

The special tools which are itemised as 'A' to 'E' and which were handed over at the blower delivery time are also shown in Section 6 of the manual.

5.2 DISMOUNTING AND MOUNTING OF OUTER PREROTATION DRIVE D4.00

AIDS : ORDINARY HAND TOOLS

JOINT PASTE : NONE

: **DISMOUNTING:** Wires leading from the linear motor (D4.07) to the terminal box are separated from the compressor without disconnecting the end connections. Remove the nut (D4.43) and release the pull rod (D3.05) from the lever (D4.03). Hold the lever and lead it to its bottom position. Take out the screws (D4.39) and remove the plate (D4.01) with the linear motor (D4.07).

: **MOUNTING:** Mounting in reverse order of the above.

IMPORTANT! The positions of the lock nut (D3.25) and the swivel joint (D3.24) must not be altered. The limit switches (D4.15) must not be loosened or moved.

The performance of the compressor depends on the above.

5.3 DISMOUNTING AND MOUNTING OF INLET H7.01

AIDS : LIFTING HOOK 'D', CRANE LIFT AND ORDINARY HAND TOOLS

JOINT PASTE : JOINT PASTE CURIL-T

: **DISMOUNTING:** Mount the tool (lifting hook) "D" and arrange for crane lift. Remove the screws (H7.04) and the lever (D3.05) after which the inlet can be taken out. Take care that the inlet does not knock against the prerotation vanes (D3.12).

: **MOUNTING:** Clean the flanges of the inlet and spiral casing thoroughly and remove old joint paste. Apply a thin even coating of new joint paste and place the inlet in its recess.

Fit the screws (H7.04) and tighten diametrically (see the paragraph concerning torque moments).

IMPORTANT! The prerotation vanes (D3.12) must be protected against damage of any kind.

5.4 DISMOUNTING AND MOUNTING OF GUIDE PLATE H7.15

AIDS : ORDINARY HAND TOOLS

JOINT PASTE : JOINT PASTE CURIL-T

DISMOUNTING: Remove the nuts (H7.31) and lift off the guide plate.

: **MOUNTING:** Clean the guide plate and flanges of the inlet thoroughly and remove old joint paste. Apply a thin even coating of new joint paste and place the guide plate in its recess. Tighten the nuts (H7.31) diametrically.

5.5 DISMOUNTING AND MOUNTING OF OUTER DIFFUSER DRIVE D2.00

AIDS : ORDINARY HAND TOOLS

JOINT PASTE : JOINT PASTE CURIL-T

: **DISMOUNTING:** Wires leading from the positioning motor (D2.24) to the terminal box are separated from the compressor without disconnecting end connections. Remove the pin bolt (D2.19) with washer and pin (D2.20) and (D2.21). Hold the lever and lead it to its bottom position. Take out the screws (D2.27) and remove the plate with the positioning motor (D2.24). Loosen the screw (D2.06) and remove the positioning lever (D2.05).

: **MOUNTING:** Mounting in reverse order of the above.

IMPORTANT! Tighten the screw (D2.06). The limit switches (D2.10) must not be loosened or moved.

The performance of the compressor depends on the above.

5.6 DISMOUNTING AND MOUNTING OF INNER VOLUTE CASING (INLET) H5.05

AIDS : LIFTING HOOK 'D', CRANE LIFT AND ORDINARY HAND TOOLS

JOINT PASTE : JOINT PASTE CURIL-T

: **DISMOUNTING:** Mount the tool (lifting hook) "D" as shown on drawing and arrange for crane lift. Remove the screws (H7.04) after which the inner volute casing can be taken off. Take care that the casing does not bump the impeller.

: **MOUNTING:** Clean the flanges of the inner volute casing and spiral casing carefully and remove old joint paste. Apply a thin even coating of new joint paste and place the casing in its recess.

Fit the screws (H7.04) and tighten diametrically (see the paragraph concerning torque moments).

IMPORTANT! The impeller must be protected against any kind of damage.

5.7 DISMOUNTING AND MOUNTING OF SPIRAL CASING H4.01

AIDS : CRANE LIFT, EYE BOLT, SHACKLE

JOINT PASTE : MOLYCOTE PASTE

DISMOUNTING: Place eye bolt in the spiral casing (H4.01) as shown and arrange for crane lift (diffuser and necessary positioning drives have already been removed). Take out the screws H4.02 so that the spiral casing can be lifted out as soon as it is loosened from the O-ring (D1.19).

MOUNTING: Clean the spiral casing and the surface of the diffuser plate carefully. Take out and clean the O-ring (D1.19) and apply a thin coating of MOLYCOTE paste carefully.

Lift the spiral casing into position in its recess, taking care that the O-ring D1.19 is not pinched or cut. Fit and tighten screws (H4.02) (see paragraph concerning torque moments). Wipe off carefully surplus MOLYCOTE paste (inside as well as outside).

5.8 DISMOUNTING OF IMPELLER COMPLETE (Fig. 3)

1. Heat central screw as described in 5.10, point 5, and then dismount.
2. Dismount impeller complete by means of pull-off tool, as described in Fig. 3.

5.9 MOUNTING OF PUMP DISC ON PINION SHAFT R201

: To be carried out after weighing of pinion shaft.

Heat pump disc R206 to min. 150°C, before shrinking it onto the pinion shaft.

Having shrunk it on, the pump disc is then pressed firmly against the pinion shaft.

Please note!

With the balancing process in mind, the pump disc and the pinion shaft are to be marked together using an indelible ink marker.

5.10 MOUNTING OF IMPELLER COMPLETE ON PINION SHAFT (FIG.1-2)

1. Make sure that screw, (Pos. R411), has been positioned in the rotor drive shaft, (Pos. R401).
2. An antifriction agent must be used between the shaft, (Pos. R201) and the rotor drive shaft, (Pos. R401), as well as between the central screw (R405) and the impeller complete.

When using an antifriction agent, it must be smeared on in a thin layer and then rubbed into the components, after which they are wiped off lightly, leaving only a very thin layer.

3. Squeeze/press impeller assembly complete with seals onto the pinion shaft by means of tool KA2VO24.
4. When the impeller is in place, the tool is removed and the central screw, (Pos. R405), is then lightly screwed in by hand.
5. The central screw is heated by means of a heating cartridge, tool KA2V011, for approx. 3,5 min.(MAX 6 min.), expanding its length. The heat transition between cartridge and central screw must be assisted by use of copper paste (or similar).
6. Turn heated central screw 90 degree in the tightening direction (counterclockwise), corresponding to the distance between 2 consecutive markings on the screw head.
7. Now cool the complete rotor down to ambient temperature, shrinking the central screw and tightening the parts which then settle in.
8. When the rotor has been cooled to ambient temperature, heating is then repeated, see point 5., and the central screw is loosened by turning it clockwise a couple of times.

Please note!

Repeated heating without cooling down in between, serves no purpose and may destroy the heating cartridge.

9. Cool rotor once more to ambient temperature, then screw central screw lightly in by hand.
10. Repeat process of point 5 and 6.
11. With the balancing process in mind, all parts, incl. the central screw, shall be marked with a Build-No.

5.11 DISMOUNTING AND MOUNTING OF DIFFUSER UNIT D1.01

AIDS : ORDINARY HAND TOOLS

JOINT PASTE : MOLYCOTE PASTE

: **DISMOUNTING:** Remove screws (D1.15), so that the diffuser unit (D1.01) can be lifted out of its recess. Take care that the guide ring (D1.08) is kept in its position and is only released from the drive pin of the eccentric shaft (D2.07). If the diffuser unit is put down on edge, take care not to damage the O-ring (D1.19).

: **MOUNTING:** Clean the O-ring groove of the diffuser carefully and grease the O-ring with MOLYCOTE paste (see also mounting of spiral casing). Place the diffuser unit in its recess and mount and tighten the screws (D1.15) (see the paragraph concerning torque moments).

5.12 DISMOUNTING AND MOUNTING OF REAR PLATE H3.01

AIDS : ORDINARY HAND TOOLS

JOINT PASTE : NONE

: **DISMOUNTING:** Loosen the drain pipe (S4.30) at the upper as well as the lower end and remove it. The gear housing must be emptied of oil. Remove the screws (H3.06), so that the labyrinth sealing H3.03 can be detached.

: **MOUNTING:** Clean the rear plate carefully and place it in its recess. Screw in and tighten screws (H3.07) (see torque moments). Mount labyrinth sealing (H3.03) with screws (H3.06).

Mount drain pipe (S4.30).

5.13 DISMOUNTING AND MOUNTING OF IMPELLER SHAFT R2.01 (PINION SHAFT)

AIDS : ORDINARY HAND TOOLS

JOINT PASTE : NONE

: **DISMOUNTING:** Detach bearing housing (T2.22). Remove the pinion shaft (R201) with the bearing housing (T2.22) and sealing ring (T2.20) along with the journal bearings (T2.08) and T2.10) from the gear housing. Take care that shims and wave springs (T2.18) in the bearing housing (T2.04) do not fall out and into the oil sump.

: **MOUNTING:** Clean the unit carefully and mount it in its recess. Dirt will reduce the life of the bearings considerably. Shims, wave springs, and bearings must be smeared with lubricating oil during mounting. The shims and wave springs were selected during manufacture so that the preload of the bearings is correct; for this reason no shims and wave springs should be removed. Take care that the holes in the bearing housing (T2.22) are replaced in line with the holes in the gear housing.

5.14 DISMOUNTING AND MOUNTING OF GEAR HOUSING H1.01

AIDS : CRANE LIFT, EYE BOLT, SHACKLES, BUCKET FOR APPROXIMATELY 6 L OIL
ORDINARY HAND TOOLS

JOINT PASTE : JOINT PASTE CURIL-T

DISMOUNTING: Drain off the oil in the gear box by unscrewing the magnet plug (S4.15).

Dismount cable leading to the oil level switch (E1.20) from the terminal box and attach it to the compressor if convenient. Take out the thermostat from the sensor pocket (E1.05). Take care not to squeeze or crack the capillary tube (see also front drawing). Mount 1 eye bolt in the gear housing (H1.01) and arrange for crane lift. Remove screws (H1.15) after which the gear housing can be pulled out of its recess and lifted away, lifting it carefully over the gear wheel.

MOUNTING: Clean the inner gear housing thoroughly of oil and dirt. Clean off old joint paste carefully and apply a thin even coat of new joint paste. Place the gear housing in its position, screw in screws (H1.15) and tighten them evenly and diametrically (see torque moments). Mount magnet plug (S4.15). Screw thermostat in sensor pocket (E1.05).

Connect cable from to oil level switch E1.20 to the terminal box. Wipe off excess joint paste.

REMEMBER TO FILL UP WITH OIL BEFORE START UP!
(See Technical Specifications for oil type and quantity).

5.15 DISMOUNTING AND MOUNTING OF GEAR WHEEL R1.03

AIDS : TOOL "E" (SEE TOOL INDEX), SKF-PUMP OR SIMILAR UNIT WITH A CAPACITY OF 1200 BAR. SOURCE OF HEAT AND CHALK FOR SHRINKAGE.

DISMOUNTING: Dismount cover plate (H1.34). Mount tool "E" on the hub by means of 8 screws M8 x 20 of quality 12.9 as shown. Take care that the O-ring and its back-up ring are undamaged and in place.

Connect the hose of the oil pressure pump to the centre of the tool "E" (1/4" RG). Loosen the pointed screw "A" and pump until oil without air bubbles oozes through "A". Tighten the pointed screw, continue pumping until gear wheel (R1.03) and its hub (R1.06) glide from the drive shaft "A". Avoid any bumps or scratches that may damage the teeth of the gear wheel. The pressure generated during pulling off must not exceed 1200 bar. It might take some time before the hub moves as the oil film must first penetrate. Dismount the tool.

MOUNTING: Clean the drive shaft and hub carefully, smear with lubricating oil. Check that the O-ring (R1.05) is undamaged in its groove on the hub. Heat the hub and gear wheel to MIN. 135°C and MAX. 170°C and place them in their right position on the drive shaft. If the complete unit is heated in an oven the temperature must on no account exceed 170°C as it may damage the gear wheel. Before shrinkage check that there is clearance between the hub (R1.06) and the sealing ring (T1.01).

5.16 TORQUE MOMENTS

Unless stated otherwise torque moments for bolts and screws used in HV-TURBO compressors and gearboxes are as mentioned below (ISO-m). The values apply for ordinary bolts of quality 8.8. and for UNBRACO-(INSEX) bolts and screws.

M	5	6	8	10	12	14	16	20	24	30
kgm	0.62	1.05	2.55	5.06	8.83	14.11	21.95	39.20	67.74	114.00

WRENCH WIDTH: (HEXAGON SCREWS)

Spanner size across flats for Hexagon Screws

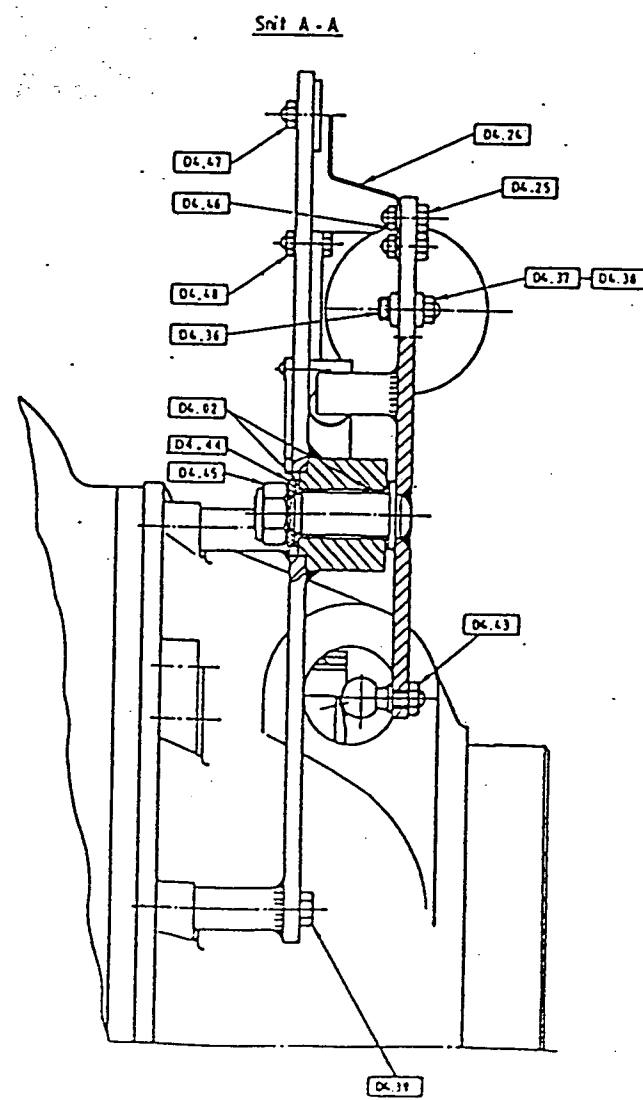
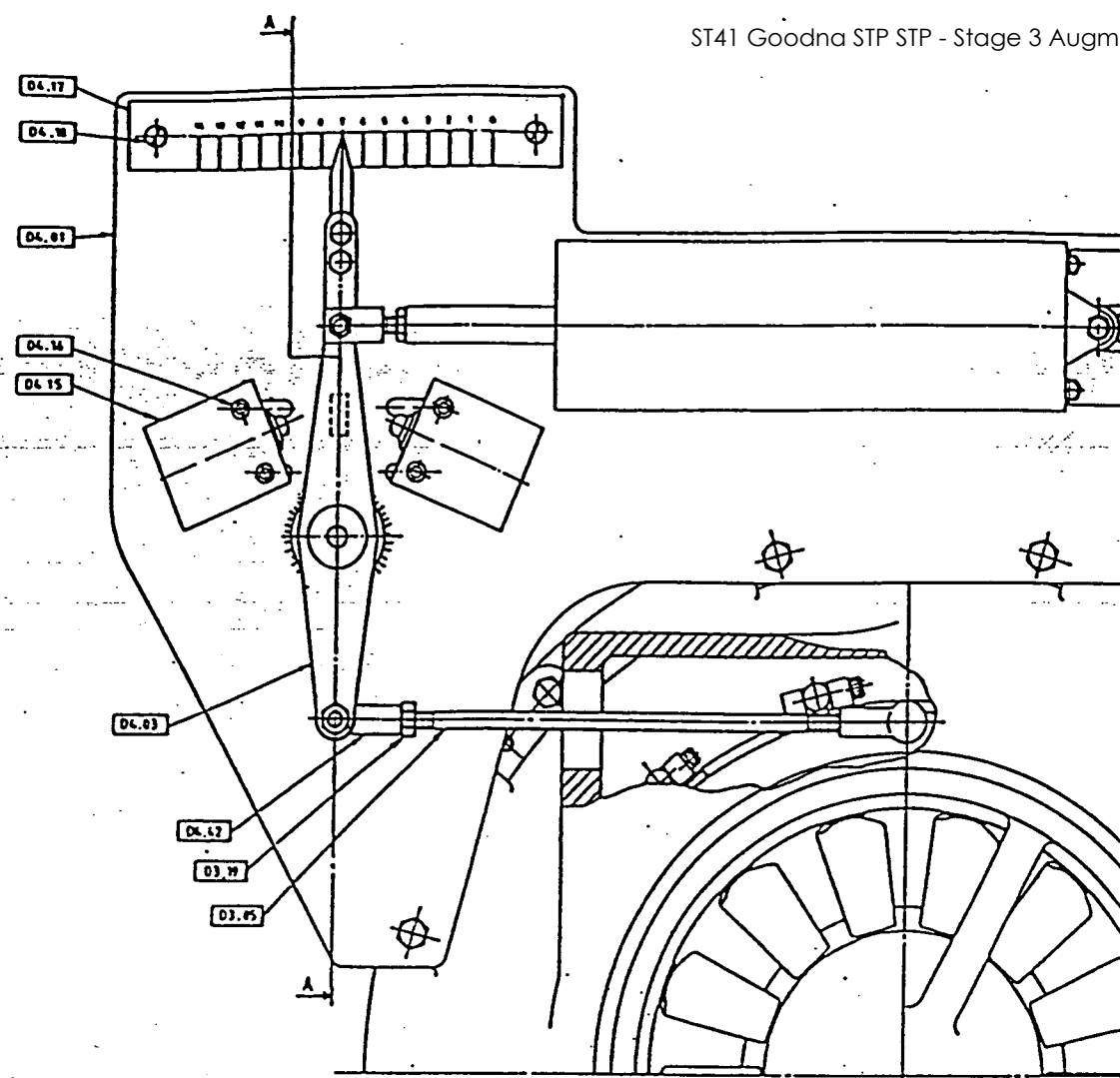
M	5	6	8	10	12	14	16	20	24	30
Width	8	10	13	17	19	22	24	30	36	46

ALLEN KEY WIDTH FOR SOCKET HEAD SCREWS

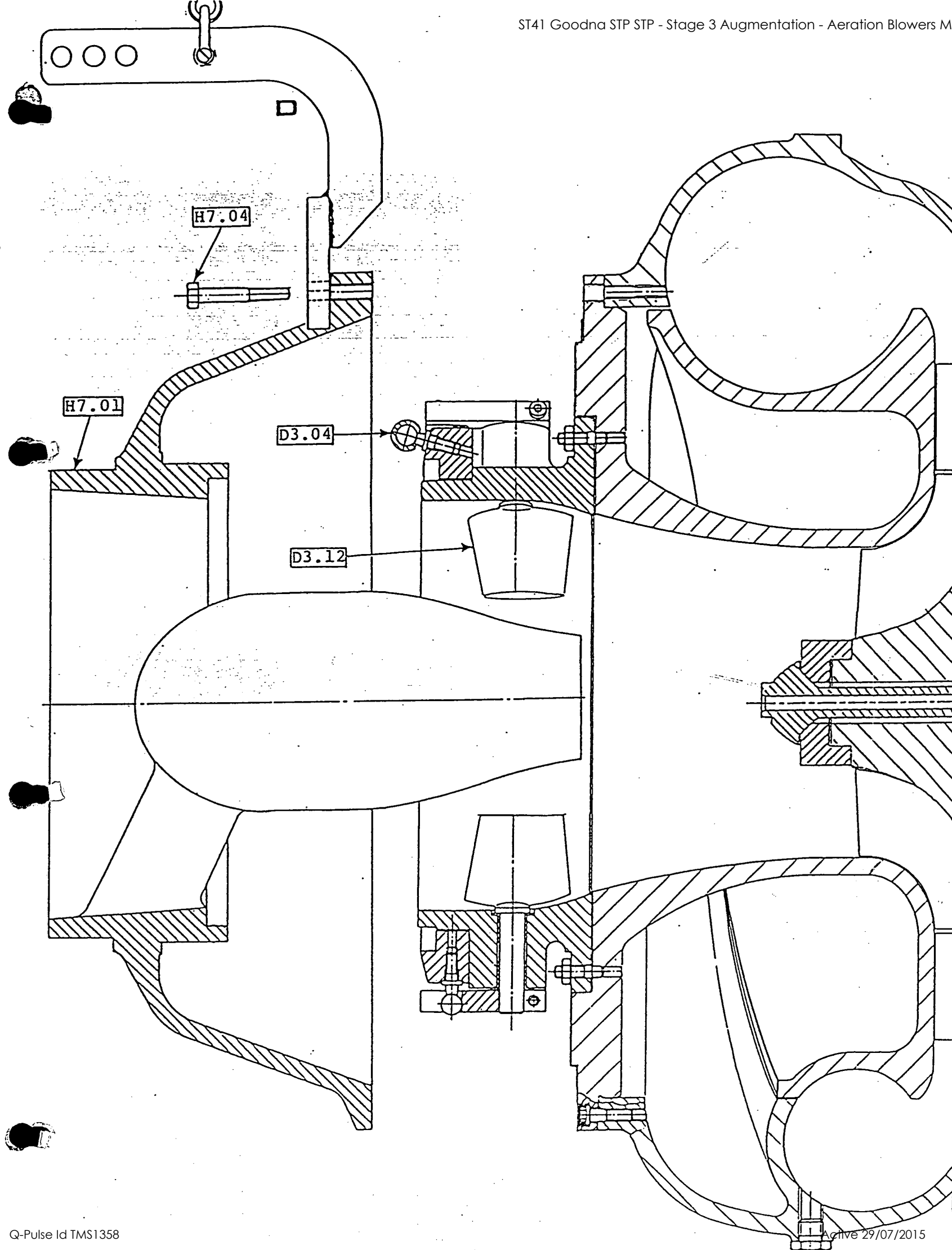
M	5	6	8	10	12	14	16	20	24	30
Width	4	5	6	8	10	12	14	17		

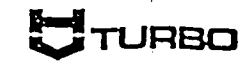


DISMOUNTING AND MOUNTING
OF
OUTER PRERETOTATION DRIVE D4.00

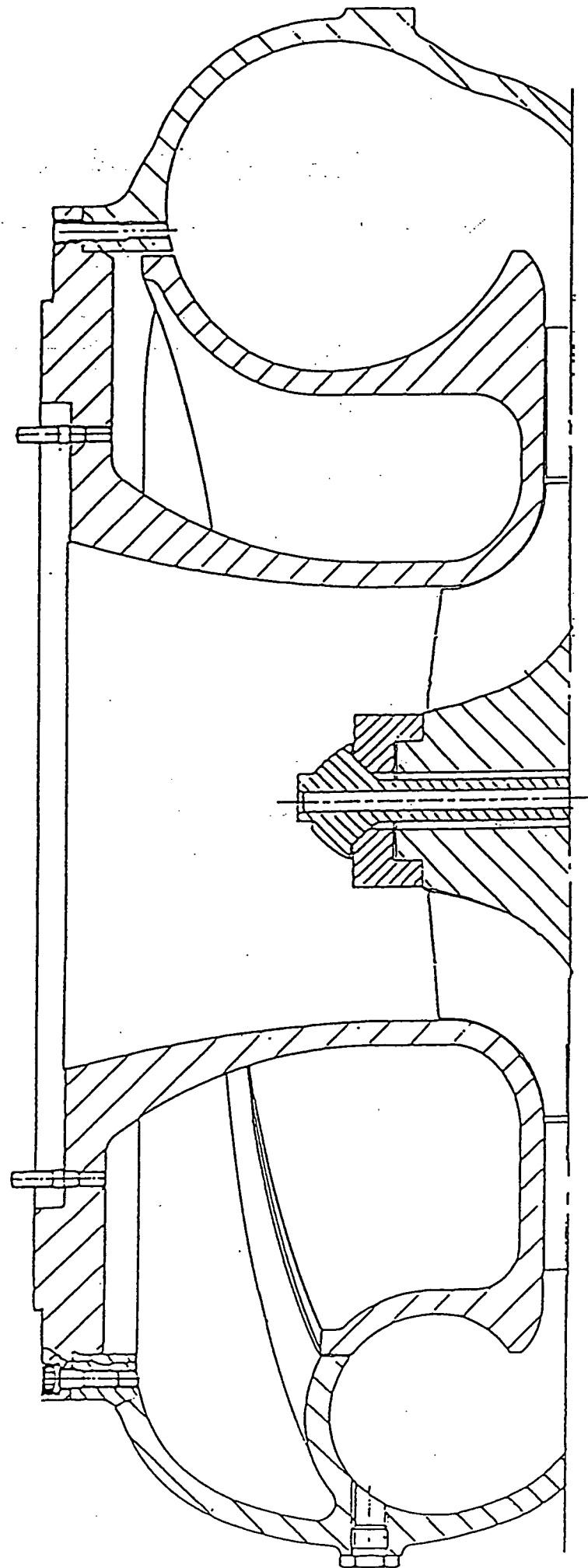
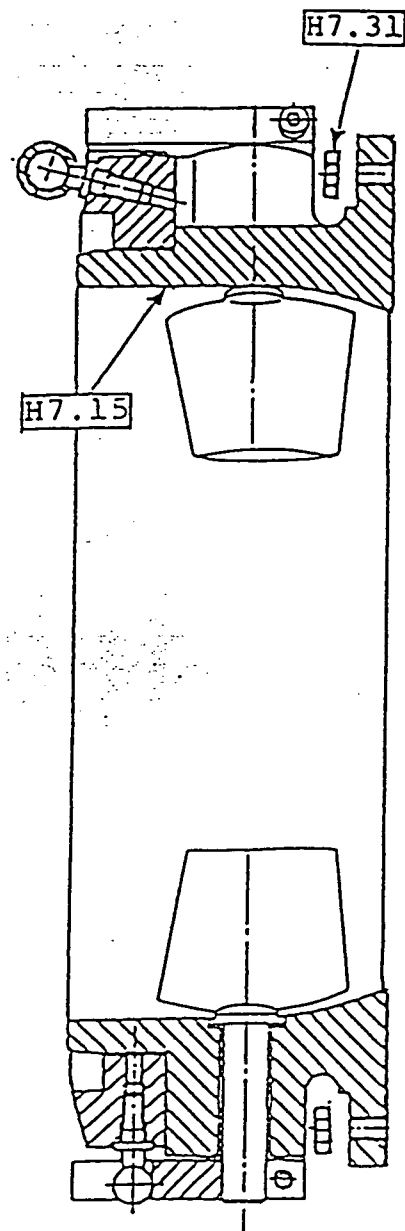


DISMOUNTING MOUNTING
OF
INLET H7.01

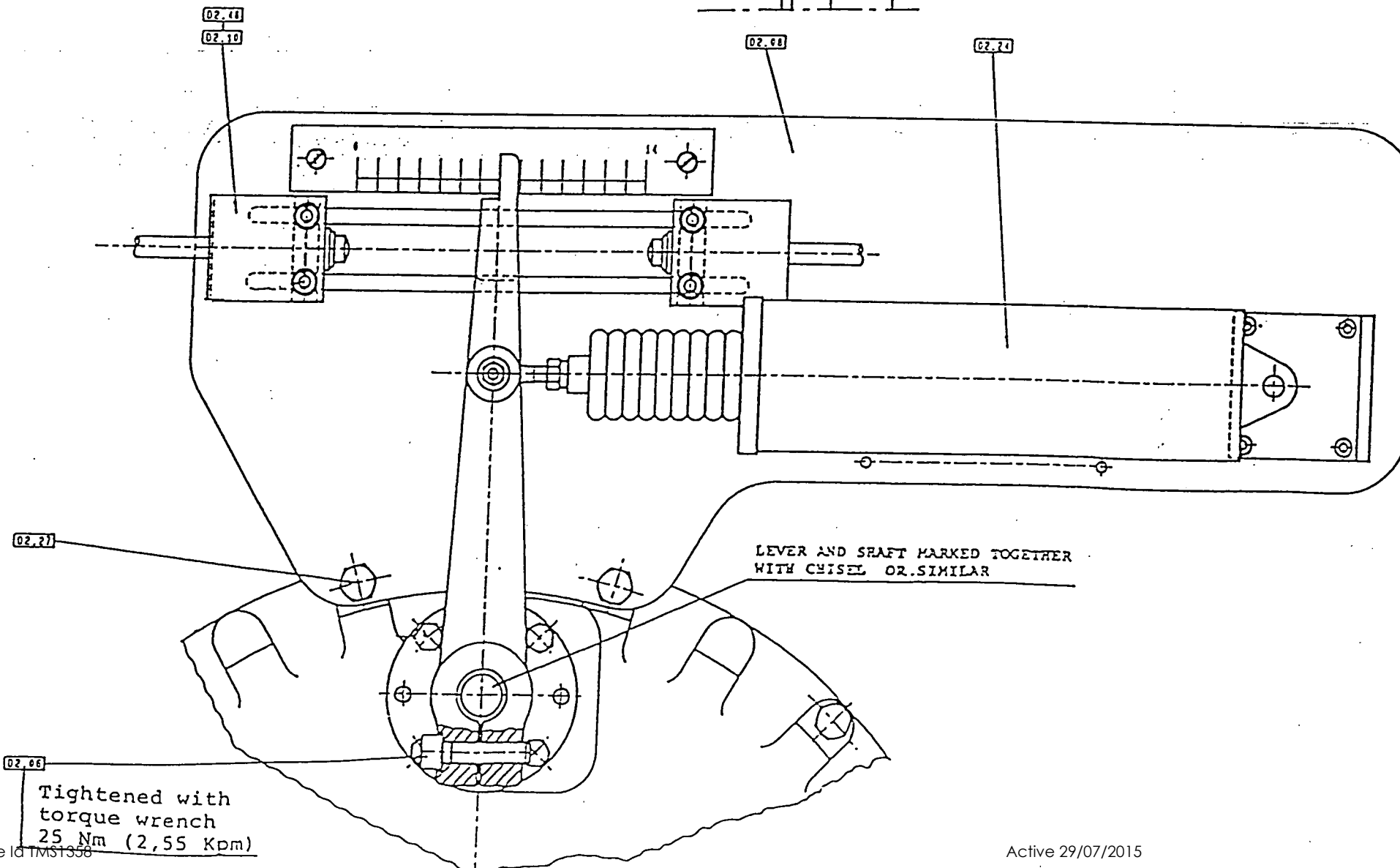
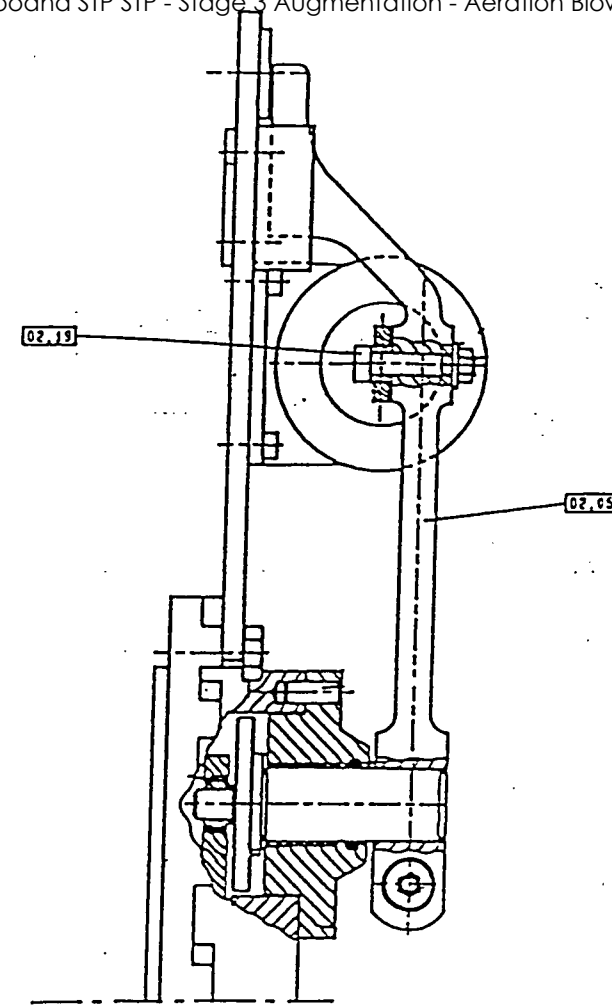




DISMOUNTING AND MOUNTING
OF
GUIDE PLATE H7.15



DISMOUNTING AND MOUNTING
OF
OUTER DIFFUSER DRIVE D2.00

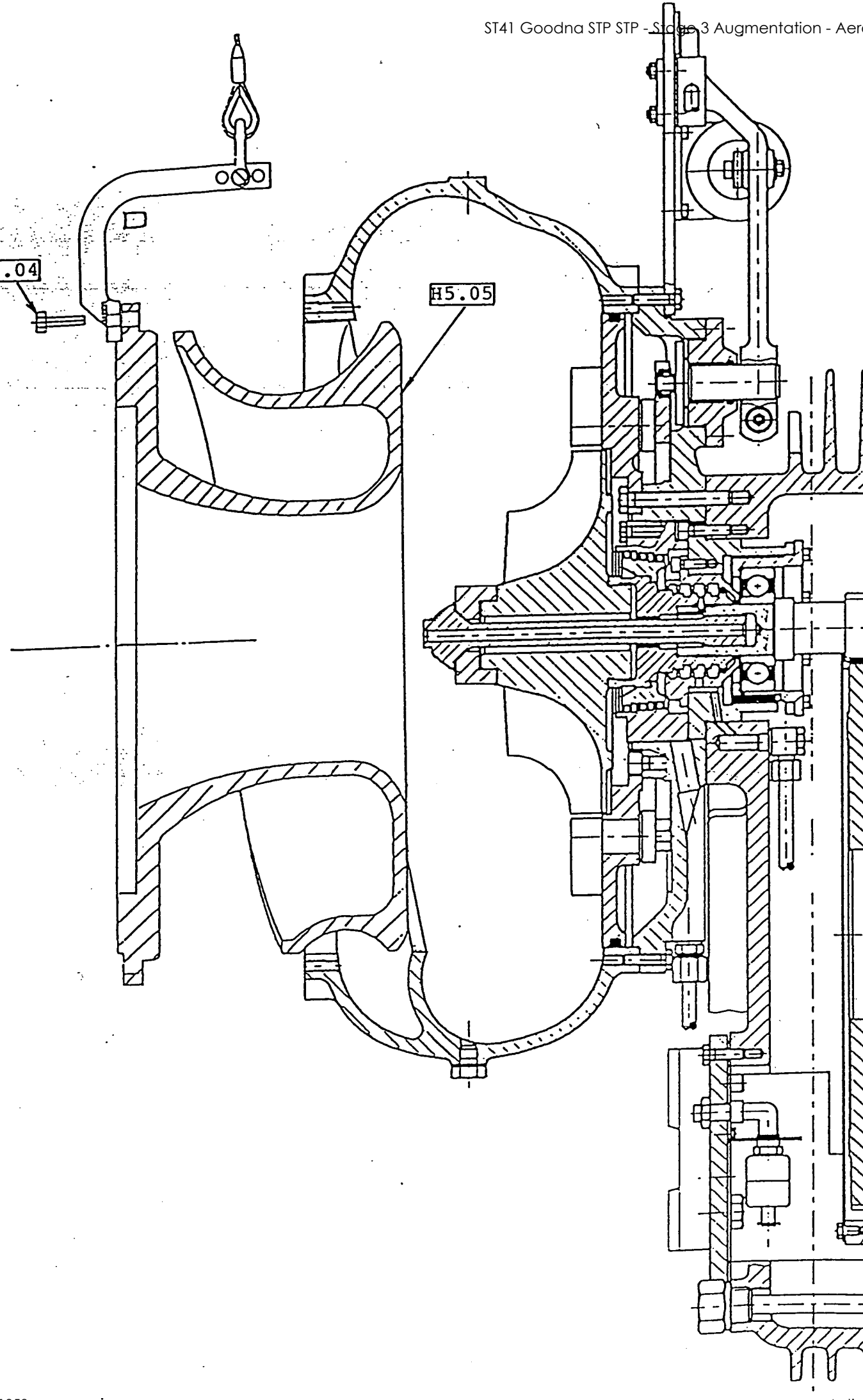




DISMOUNTING AND MOUNTING
OF
INLET H5.05

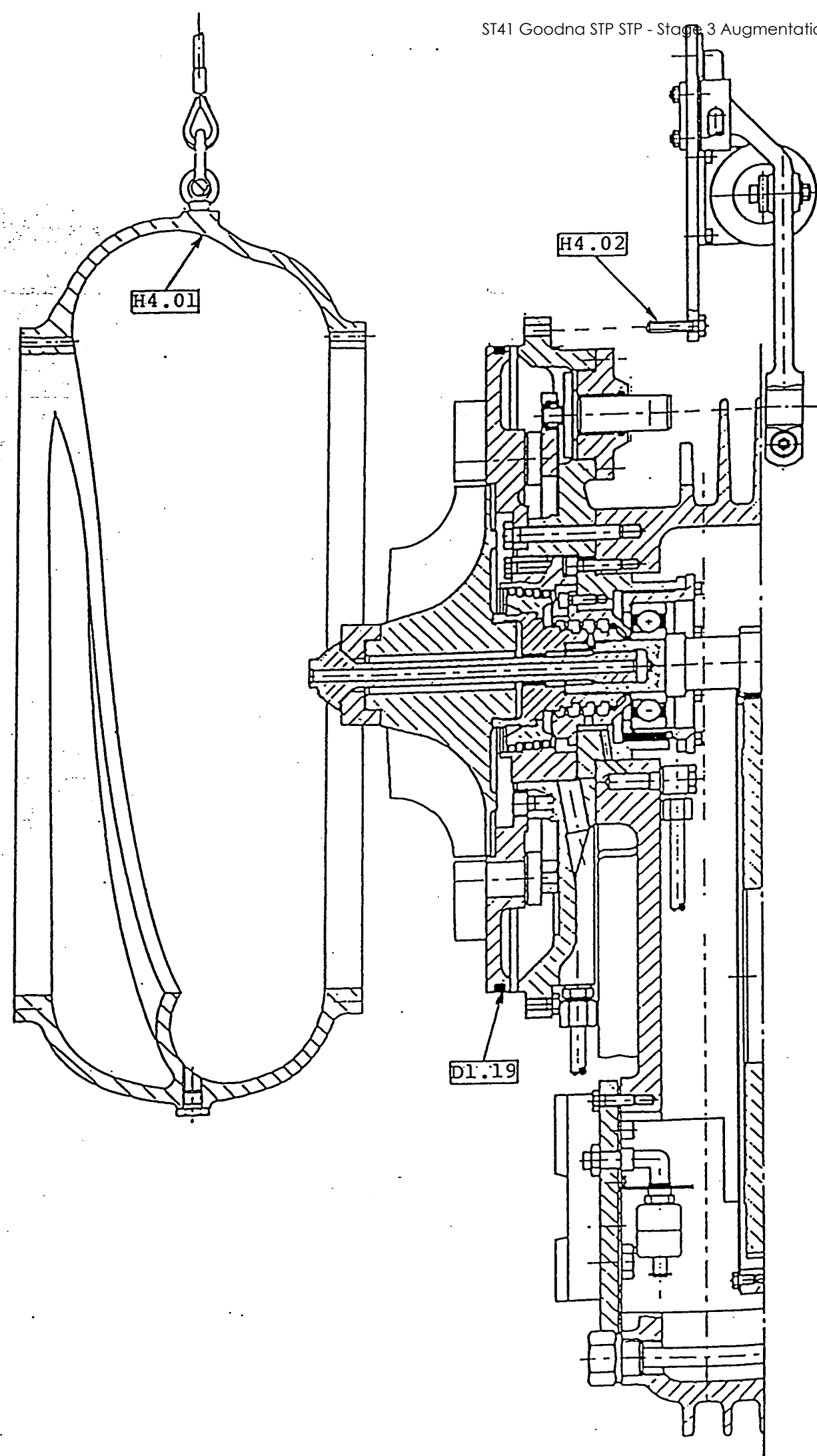
H7.04

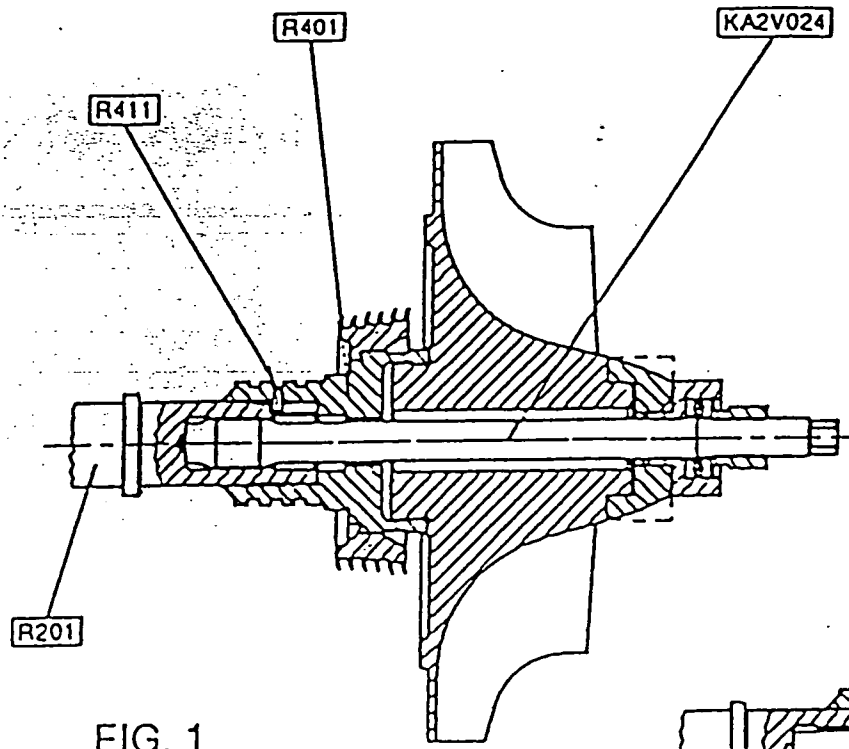
H5.05



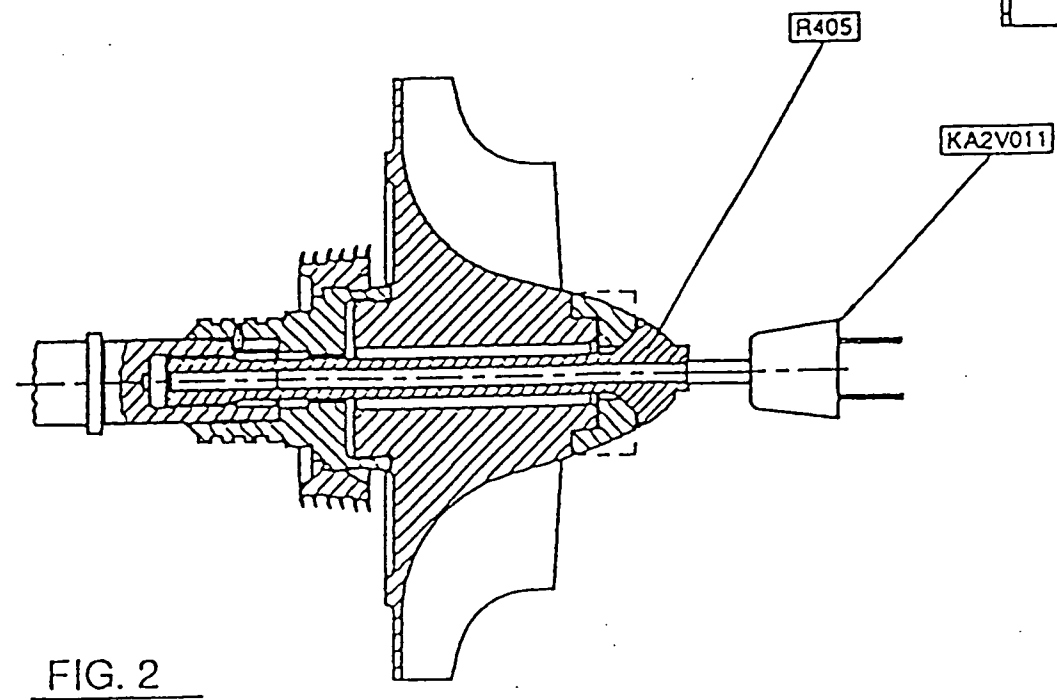
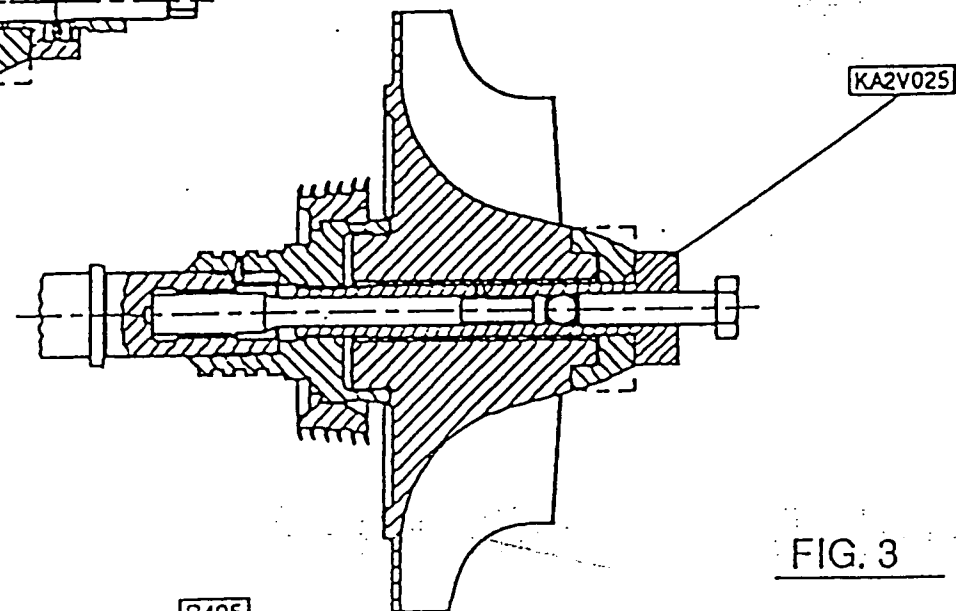


DISMOUNTING AND MOUNTING
OF
SPIRAL CASING H4.01



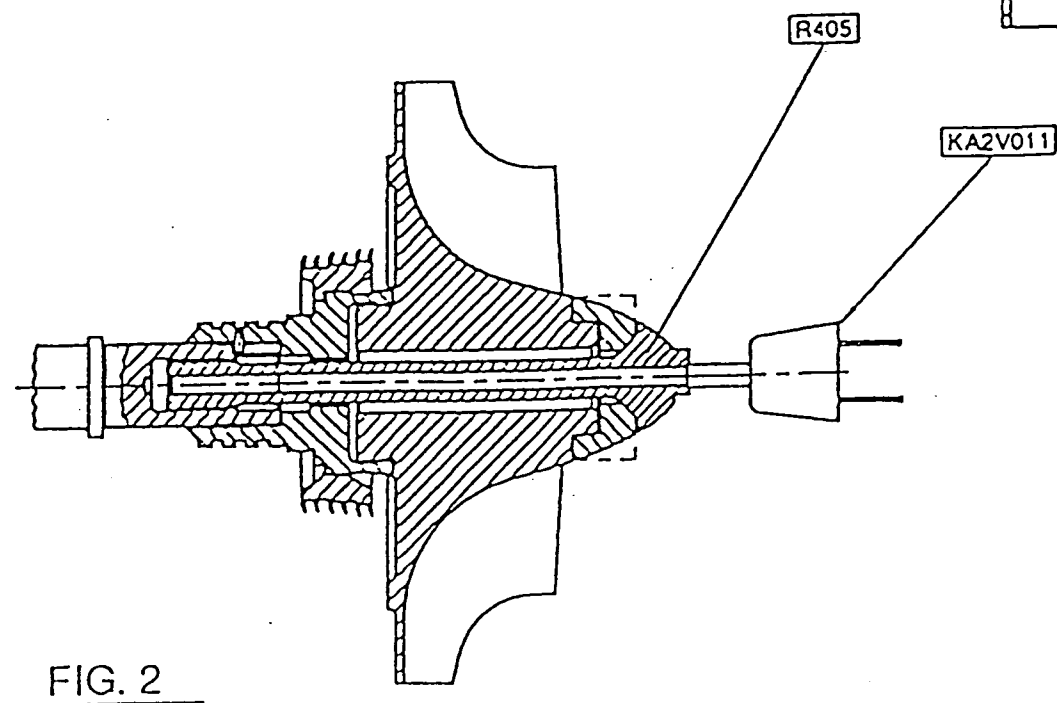
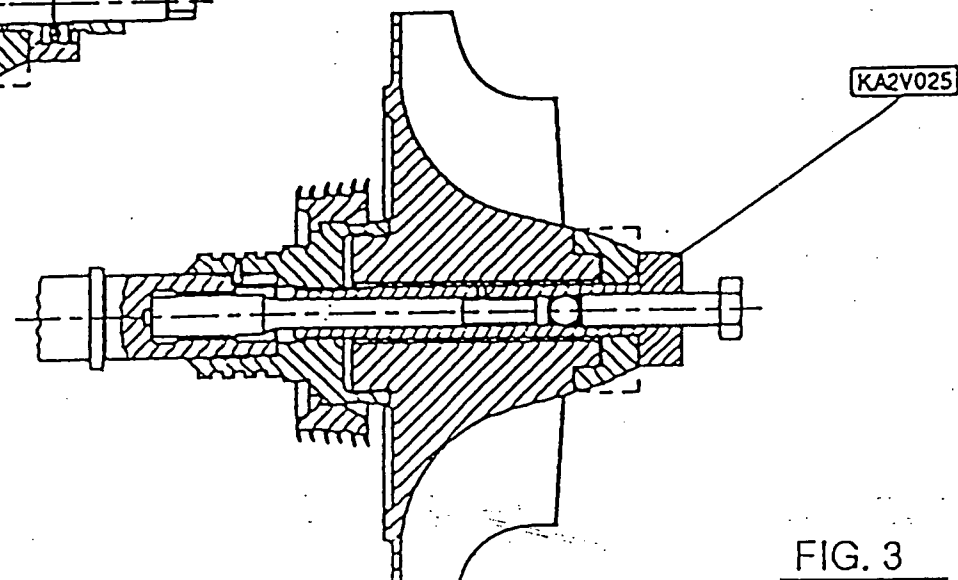
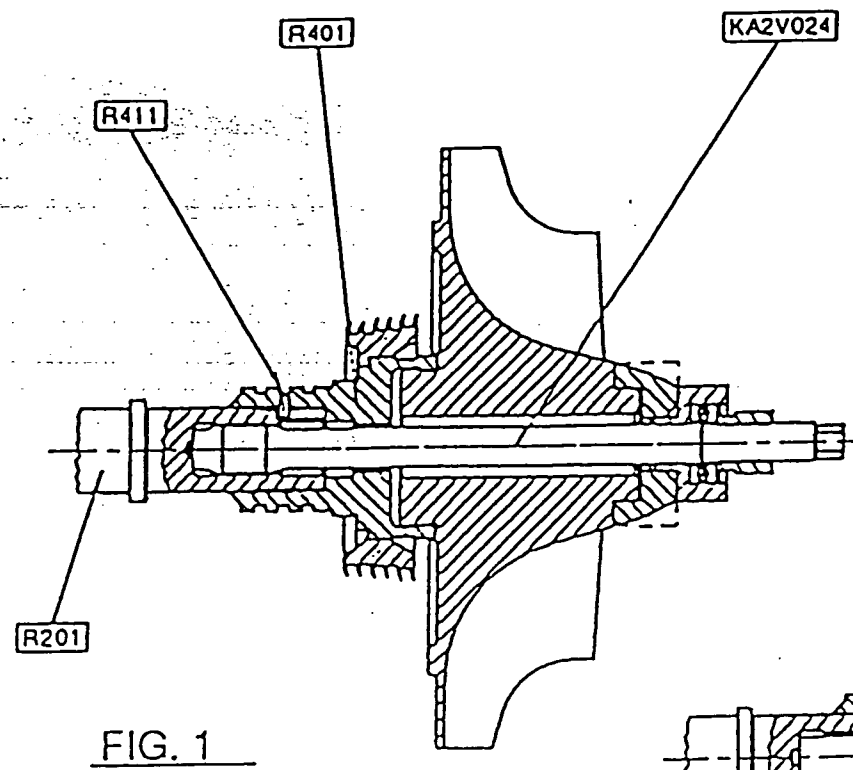


PHASE 4: DISMOUNTING OF IMPELLER COMPLETE (FIG. 3)

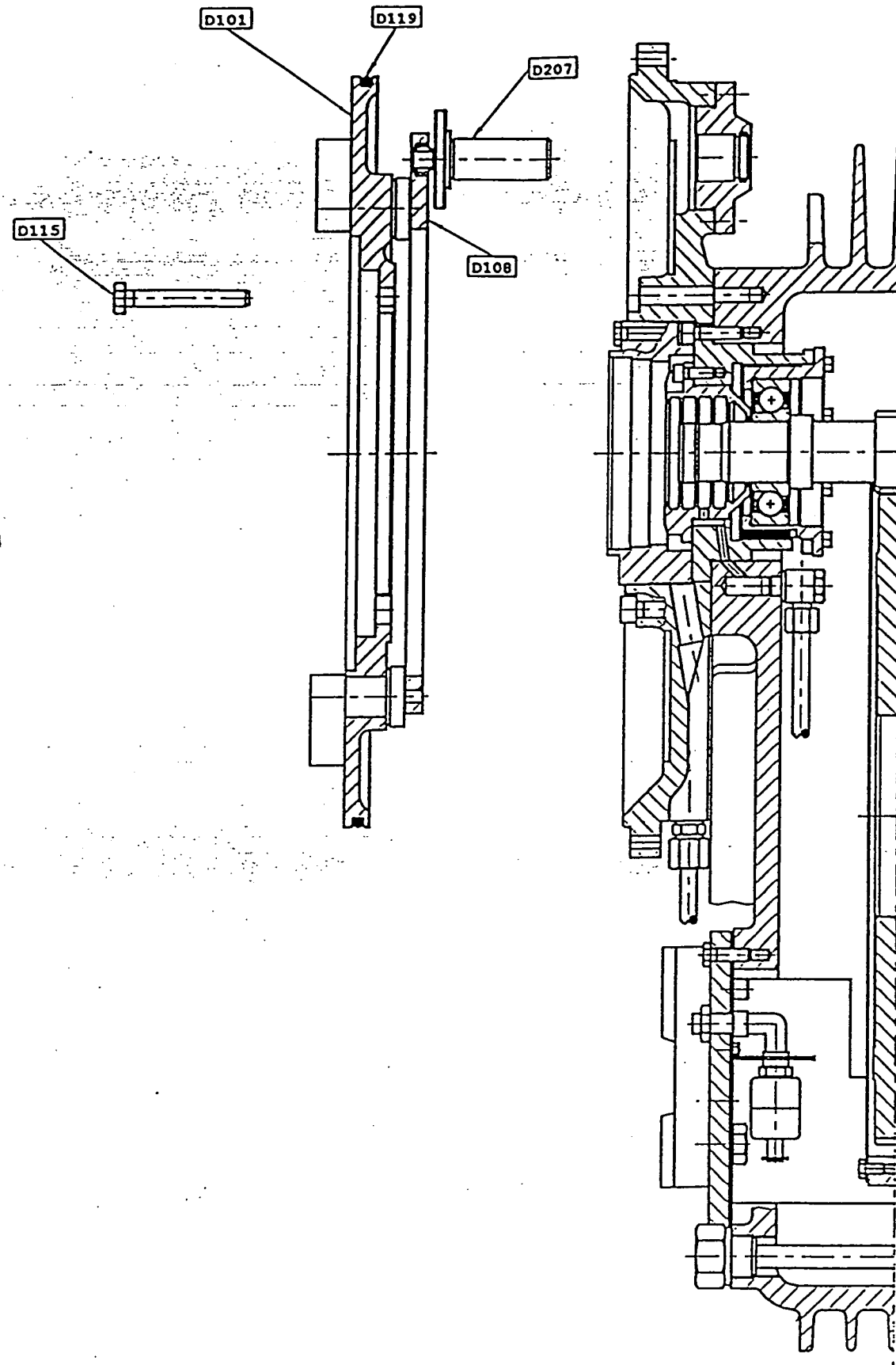


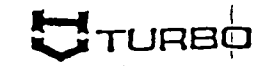
PHASE 15:

MOUNTING OF IMPELLER COMPLETE ON PINION SHAFT (FIG. 1-2)

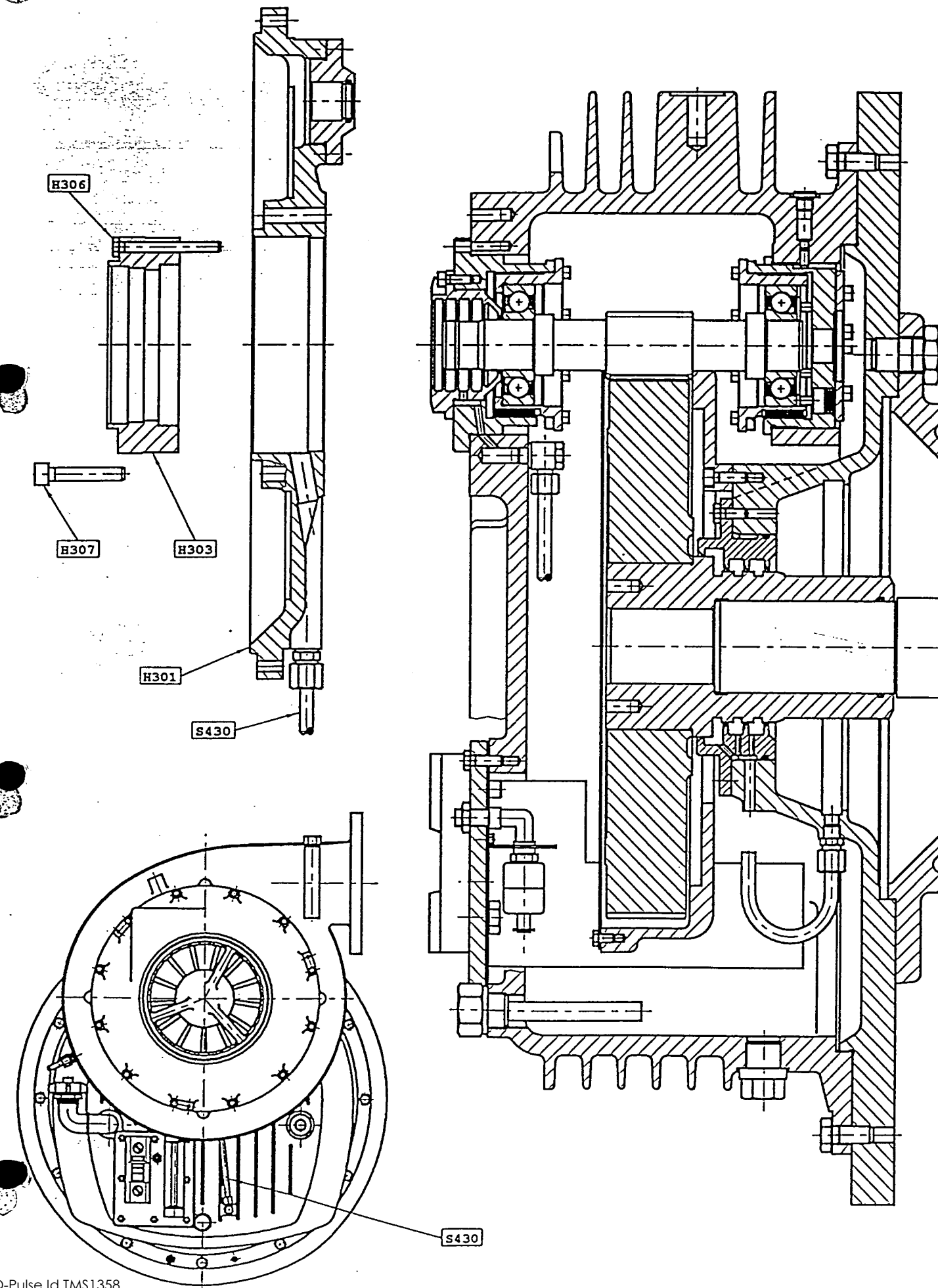


DISMOUNTING AND MOUNTING
OF
DIFFUSER UNIT D1.01

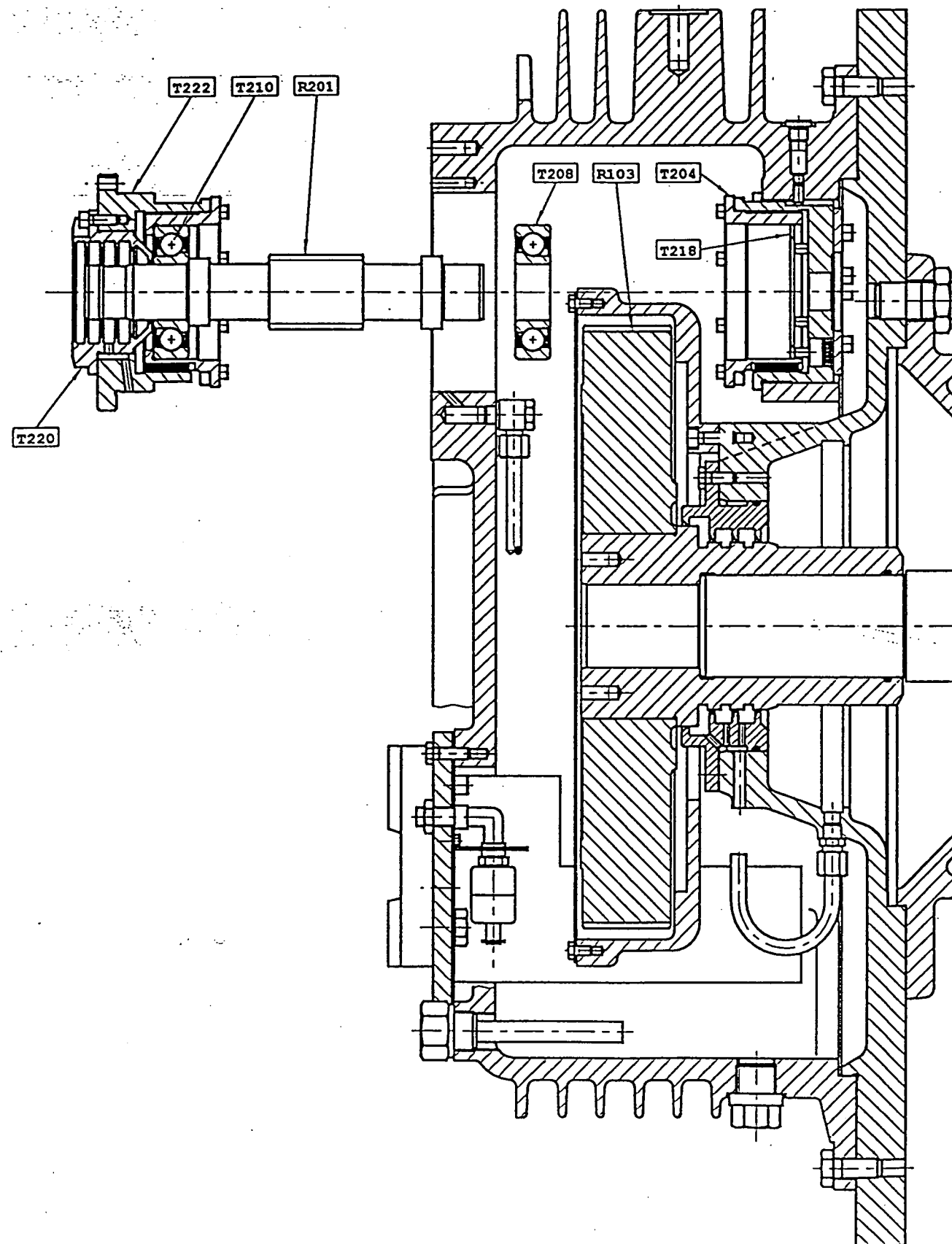




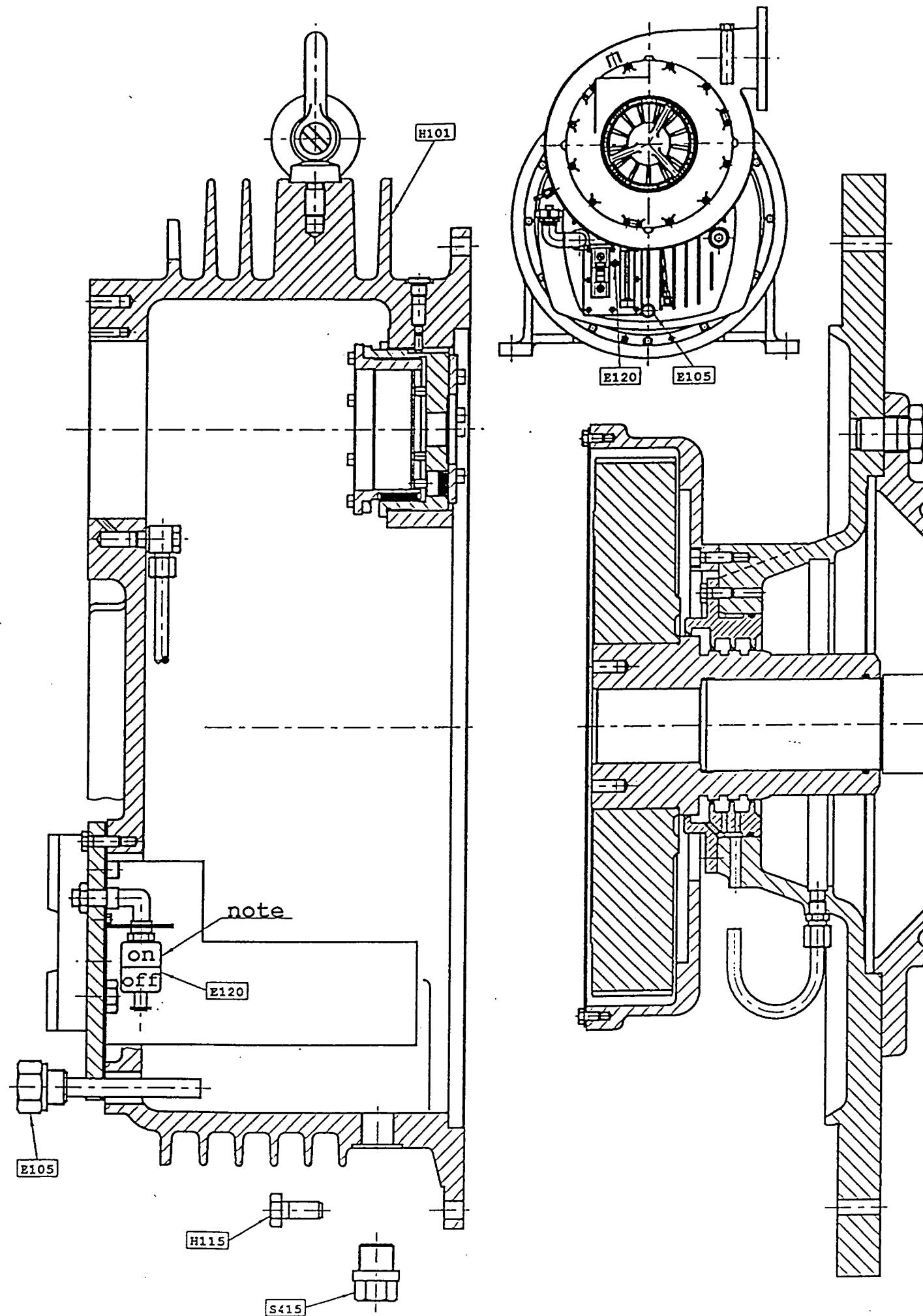
DISMOUNTING AND MOUNTING
OF
REAR PLATE H3.01



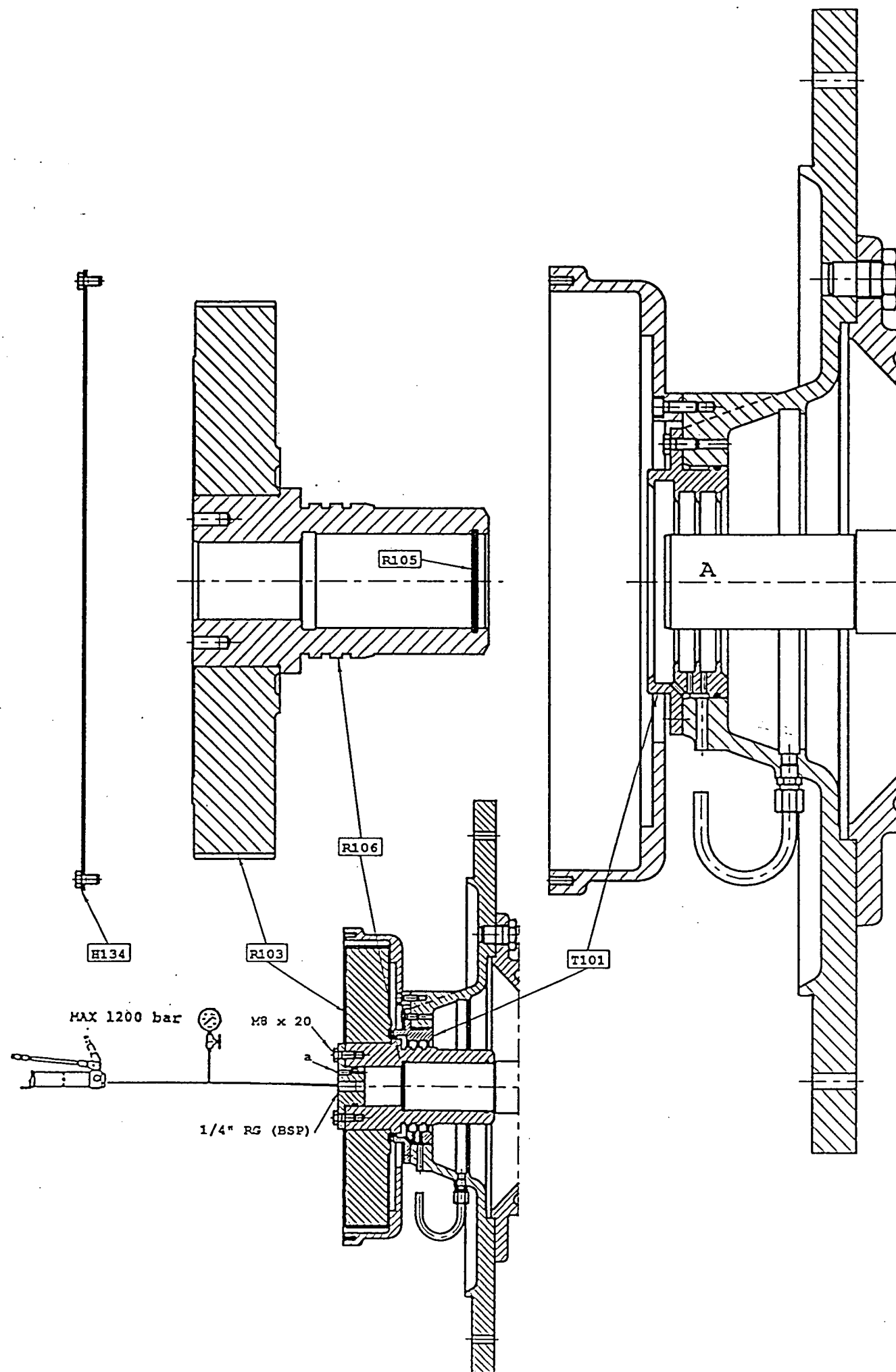
DISMOUNTING AND MOUNTING
OF
IMPELLER-SHAFT R2.01
(PINION SHAFT)



DISMOUTING AND MOUNTING
OF
GEAR HOUSING H1.01



DISMOUNTING AND MOUNTING
OF
GEAR WHEEL R1.03



6.00 PARTS LIST AND SPECIAL TOOLS

6.1 INDEX

Parts List for Compressor/Gearbox

Reference drawing for parts list: KA2M012.1

Drg. KA2 D 031 Variable Pre-rotation External Drive }

Drg. KA2 D 008.1 Inner Diffuser Drive }

Drg. KA2 D 022 Variable Prerotation Internal Drive }

Drg. KA2 D 053.0 Outer Diffuser Drive }

Special Tools }

Parts are listed on drawings
following Section 2

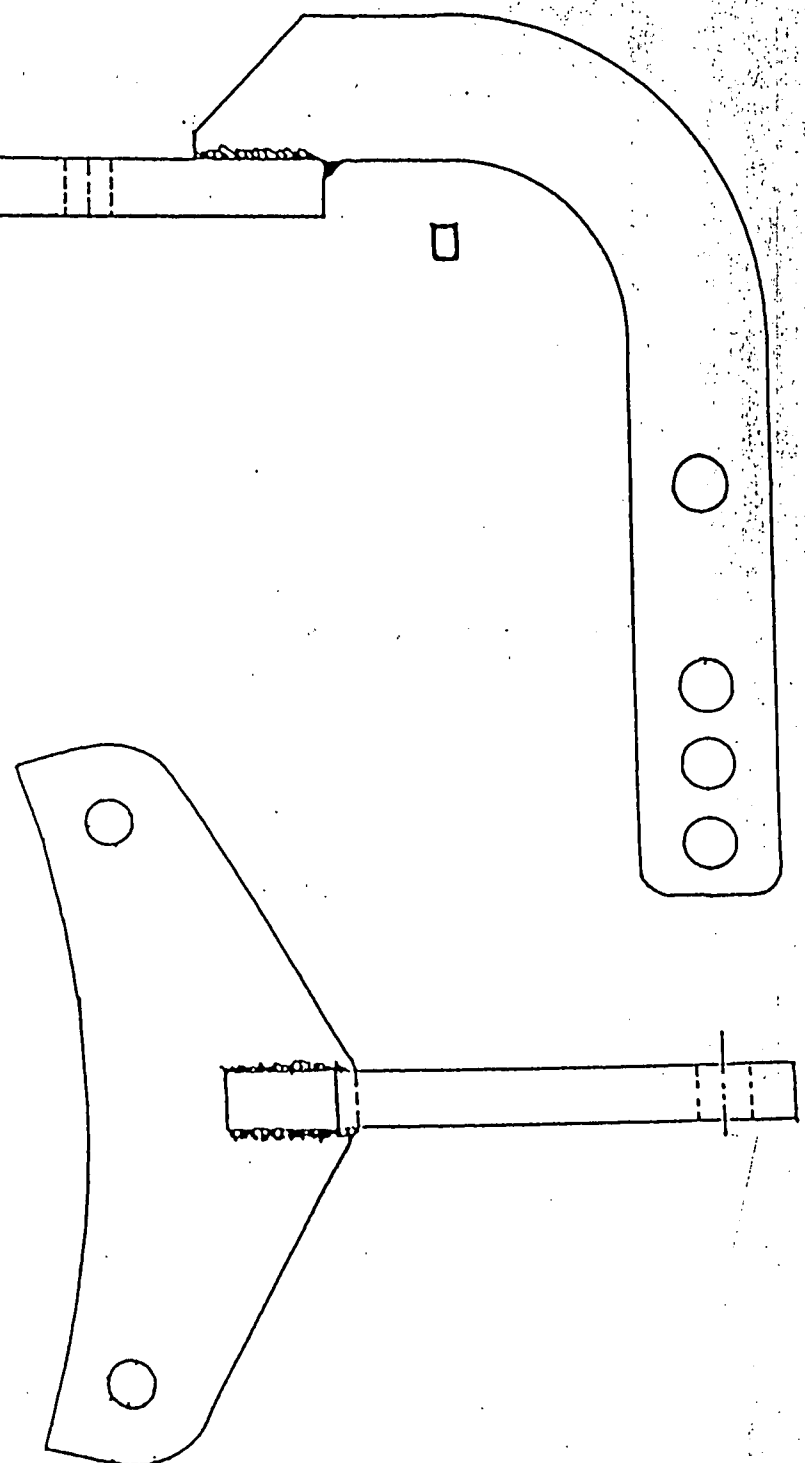
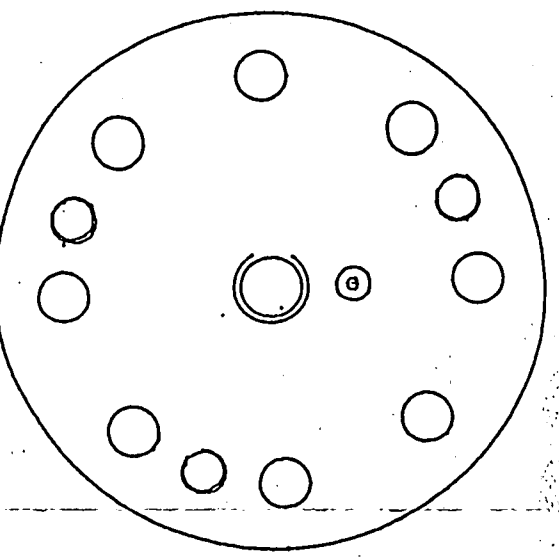
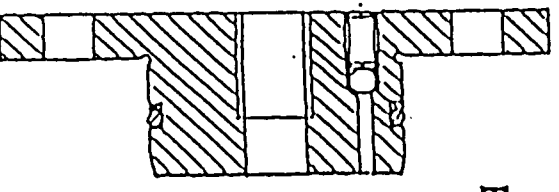
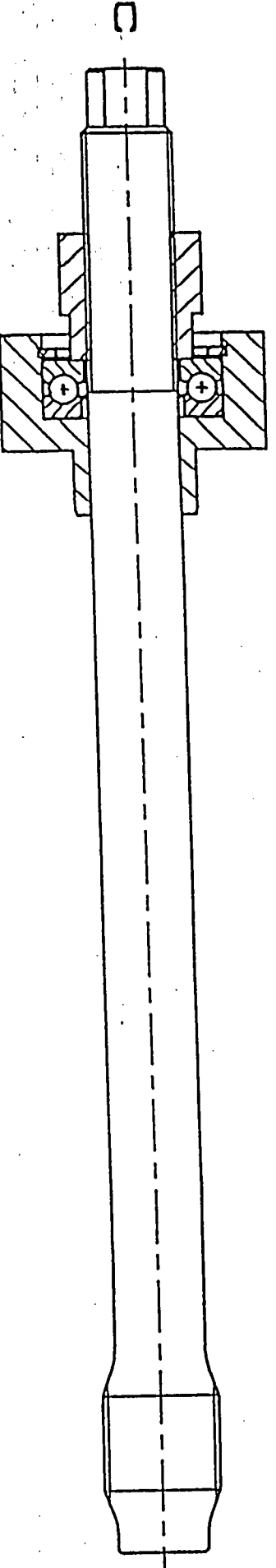
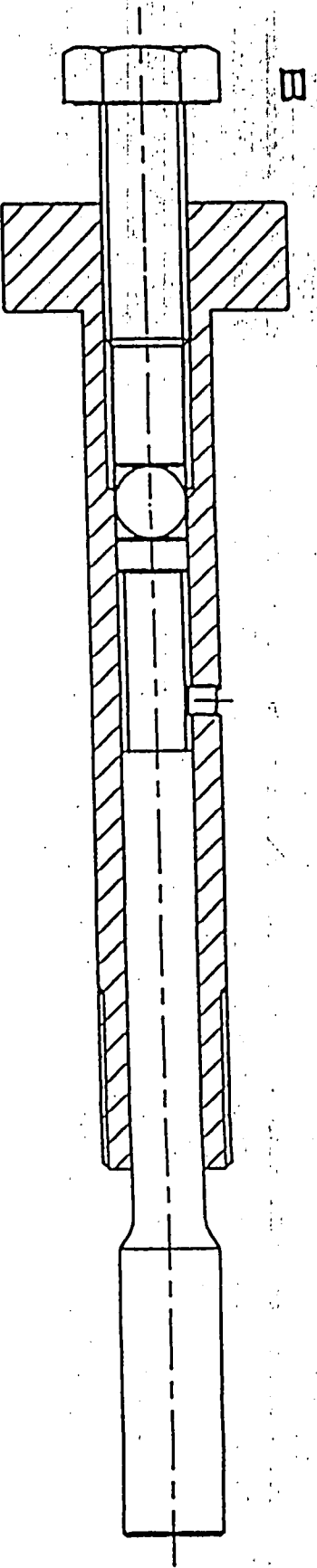
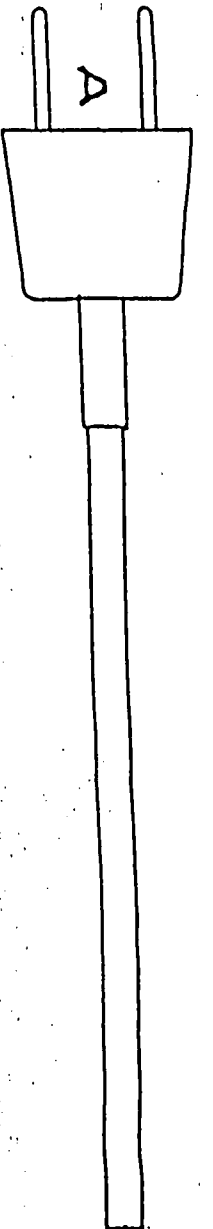
6.2 COMPRESSOR/GEARBOX DRG. NO. KA2M012.1

<u>Pos No.</u>	<u>Description</u>
A4.01	Electric motor
D1.00	Inner diffuser drive
D1.15	Screw for D1.01/H3.01/H1.01
D2.00	Outer diffuser drive
D2.07	Eccentric shaft
D3.00	Inner prerotation drive
D4.00	Outer prerotation drive
E1.05	Sensor pocket (oil temperature)
E1.14	Fitting
E1.16	Pipe
E1.20	Oil level switch
E1.22	Thermometer (oil temperature)
E1.30	Sight glass (oil level)
E1.31	Angle fitting
E1.32	Fitting
E1.34	Sensor pocket
H1.01	Gear housing (part A)
H1.02	Gear housing (part B)
H1.15	Screw for H1.01/H1.02
H1.16	Dowel for H1.01/H1.02
H1.24	Plug
H1.30	Cover
H1.31	Shield
H1.32	Oil shield
H1.33	Screw for H1.32/H1.02
H1.34	Cover plate for oil shield
H1.35	Screw for H1.34/H1.32
H1.39	Screw for H1.30/H1.01
H1.40	Gasket for H1.30/H1.01
H1.43	Plug
H1.44	Nut
H3.01	Rear plate
H3.03	Labyrinth sealing
H3.06	Screw for H3.03/T2.22/H1.01
H3.07	Screw for H3.01/H1.01
H4.01	Outer volute casing
H4.02	Screw for H4 . 01/H3 . 01
H4.03	Screw for spiral casing positions
H4.04	Plug for H4 . 01
H4.09	Gasket for H4 . 04/H4 . 01

H5.01	Inner volute casing
H6.02	Screw for H5.01/H4.01
H7.01	Inlet housing
H7.04	Screw for H7.01/H4.01
R1.03	Gear-wheel
R1.05	O-ring
R1.06	Hub
R2.01	Pinion shaft
R2.06	Pump disc
R4.00	Rotor complete
S1.12	Filler stud
S1.13	Cover for S1.12
S1.24	Angle fitting
S4.09	Drain pipe for T2.20
S4.10	Fitting
S4.11	Pipe strap for S4.09
S4.12	Screw for S4.11
S4.13	Pipe
S4.14	Fitting, straight
S4.15	Magnetic plug
S4.16	Gasket for S4.15
S4.29	Fitting, straight
S4.30	Pipe
D4.31	Angle fitting
T1.01	Sealing ring
T1.02	Screw for T1.01
T1.12	O-ring for T1.01
T2.04	Bearing housing, motor end
T2.08	Journal bearing, motor end
T2.10	Journal bearing, compressor end
T2.18	Shims for T2.08
T2.19	Plate springs for T2.08
T2.20	Sealing ring
T2.21	Screw for T2.20/T2.22
T2.22	bearing housing, compressor end
T2.34	Screw for T2.2 2/HI.01

DRAWING No.KA2A096.0 UNIT DRAWINGS

<u>Pos. No.</u>	<u>Description</u>
A401	Drive motor
D224	Linear motor/Diffuser
E104	Thermostat
E111	Thermostat
E113	Pressure switch
E120	Oil level switch
E123	Local control panel
E146	Thermostat - heating element
E302	Differential pressure transmitter
E303	Temperature transmitter
G100	Gear complete
K100	Compressor
L101	Silencer
L102	Filter box
S319	Heater for oil tank



- "A" Heater for centre screw
- "B" Pull rod for impeller
- "C" Mounting tools for impeller
- "D" Lever for inlet
- "E" Pull rod for inlet shaft

- KA2V011
- KA2V025
- KA2V024
- KA2V017
- GK2V002

LC-1D

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FILE : 3809L

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Dato	05.05.1995	Total	

Endring	Dato	Sign.

IPSWICH
ORDER NO. 62.3809

Tegn. nr.
937.123.111.0.0

IPSWICH: 3809L

PAGE:	DESCRIPTION:	DATE:
001		05.05.1995
002:	LIST OF CONTENTS	05.05.1995
003:	PANEL LAY-OUT FOR LC-1D	05.05.1995
005:	ARRANGEMENT FOR LC-1D	05.05.1995
007:	LIST OF ITEMS FOR LC-1D	05.05.1995
008:	LIST OF ITEMS FOR LC-1D	05.05.1995
010:	KEY DIAGRAM FOR LC-1D	05.05.1995
011:	KEY DIAGRAM FOR LC-1D	05.05.1995
012:	KEY DIAGRAM FOR LC-1D	05.05.1995
013:	KEY DIAGRAM FOR LC-1D	05.05.1995
014:	KEY DIAGRAM FOR LC-1D	05.05.1995
015:	KEY DIAGRAM FOR LC-1D	05.05.1995
016:	KEY DIAGRAM FOR LC-1D	05.05.1995
017:	KEY DIAGRAM FOR LC-1D	05.05.1995
018:	KEY DIAGRAM FOR LC-1D	05.05.1995
019:	KEY DIAGRAM FOR LC-1D	05.05.1995
020:	KEY DIAGRAM FOR LC-1D	05.05.1995
021:	KEY DIAGRAM FOR LC-1D	05.05.1995
100:	CABEL PLAN FOR LC-1D	05.05.1995
150:	TERMINAL LIST: S0	09.05.1995
151:	TERMINAL LIST: X0	09.05.1995
152:	TERMINAL LIST: X1	09.05.1995
153:	TERMINAL LIST: X2	09.05.1995
154:	TERMINAL LIST: X3	09.05.1995
155:	TERMINAL LIST: X4	09.05.1995
156:	TERMINAL LIST: X5	09.05.1995
157:	TERMINAL LIST: X6	09.05.1995
158:	TERMINAL LIST: X7	09.05.1995
159:	TERMINAL LIST: Y7	09.05.1995
200:	OPERATING INSTRUCTIONS	09.05.1995
201:	OPERATING INSTRUCTIONS	09.05.1995
202:	OPERATING INSTRUCTIONS	09.05.1995
203:	OPERATING INSTRUCTIONS	09.05.1995
204:	MEMBRANE SWITCH	09.05.1995



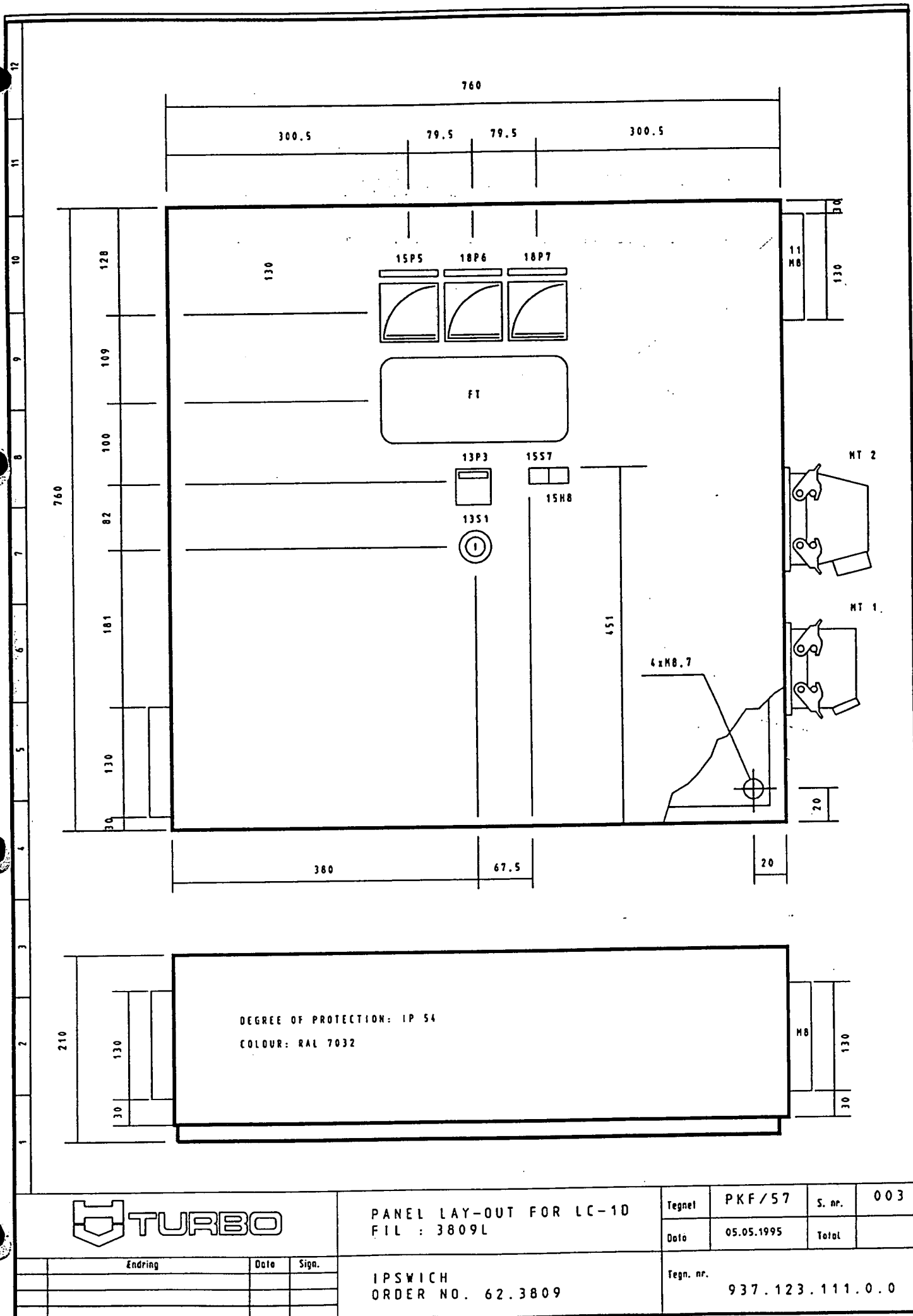
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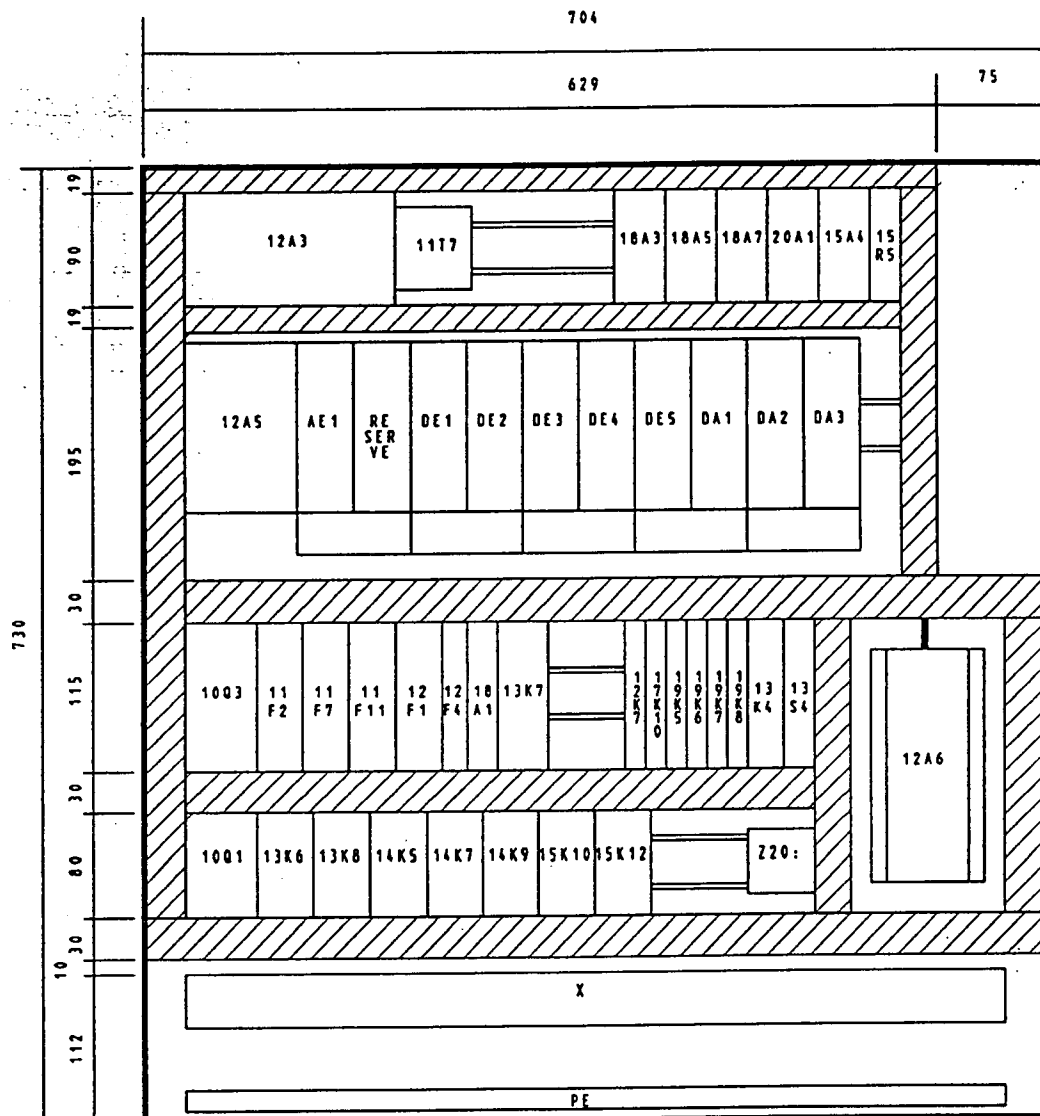
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ARRANGEMENT FOR LC-1D
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Data	05.05.1995	Total	

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PAGE	PLAC	COMP.	FUNCTION	TYPE	MAKER
			PANEL	AE 1077	RITTAL
010	1	10Q1	MAIN SWITCH	KG41 K400VE2+M160/4-2	KRAUS & NAIMER
010	3	10Q3	OVERLOAD RELAY	3VU13-1MF00	SIEMENS
011	2	11F2	CIRCUIT BREAKER	5SX2 204-7	SIEMENS
011	7	11F7	CIRCUIT BREAKER	5SX2 201-7	SIEMENS
011	8	11T7	THERMOSTAT	SK 3112	RITTAL
011	8	11M8	FAN MOTOR	SK3150-1S+SK3160-1S	RITTAL
011	11	11F11	CIRCUIT BREAKER	5SX2 202-7	SIEMENS
012	1	12F1	CIRCUIT BREAKER	5SX2 206-7	SIEMENS
012	3	12A3	POWER SUPPLY 24VDC	S-24/3.6	BENTRON
012	4	12F3	CIRCUIT BREAKER	5SX2 104-7	SIEMENS
012	5	12A5	CPU UNIT 102	6ES5 102-8MA22	SIEMENS
012	6	12A6	SINEC L1 BUSTERM.	6ES5 777-0BC01	SIEMENS
012	7	12K7	RELAY	G2R-1SND-24VDC	OMRON
013	1	13S1	EMERGENCY STOP	XB2-BS9445	TELEMECANIQUE
013	3	13P3	HOURLY COUNTER	BW 40.28	MÜLLER
013	4	13K4	RELAY	RY4SLD-DC24V	IZUMI
013	4	13S4	SWITCH	STE7 161-0B	SIEMENS
013	6	13K6	CONTACTOR	3TF2001-0BB4 + 3TX4490-3A	SIEMENS
013	7	13K7	TIMER	S113 166 724	ELECTROMATIC
013	8	13K8	CONTACTOR	3TF2001-0BB4 + 3TX4490-3A	SIEMENS
014	5	14K5	CONTACTOR	3TF2001-0AU0 + 3TX4490-3J	SIEMENS
014	7	14K7	CONTACTOR	3TF2001-0BB4 + 3TX4490-3A	SIEMENS
014	9	14K9	CONTACTOR	3TF2001-0BB4 + 3TX4490-3A	SIEMENS
015	4	15A4	LIMITSWITCH	PR 2234 B1C	PR ELECTRONICS
015	5	15R5	RESISTOR 0.2 OHM	TYPE 7029	PR ELECTRONICS
015	5	15P5	A-METER	EQ72-si 150/5A	CELSA
015	7	15S7	KEY SWITCH	548038/493060 TH25	ELECTROMATIC
015	8	15H8	SIGNAL LAMP PRC	551008/460021 TH25	ELECTROMATIC
015	10	15K10	CONTACTOR	3TF2001-0BB4 + 3TX4490-3A	SIEMENS
015	12	15K12	CONTACTOR	3TF2001-0BB4 + 3TX4490-3A	SIEMENS
017	10	17K10	RELAY	G2R-1SND-24VDC	OMRON
018	1	18A1	THERMISTORRELAY	3UN2 100-0AN7	SIEMENS
018	3	18A3	R/I AMPLIFIER	PR 3471	HV-TURBO
018	6	18P6	o/o-METER	PQ72-si 4-20mA/ 0-1000/o	CELSA
018	5	18A5	I/I AMPLIFIER	PR 2204 B2	PR ELECTRONICS
018	7	18A7	R/I AMPLIFIER	PR 3471	HV-TURBO
018	7	18P7	o/o-METER	PQ72-si 4-20mA/ 0-1000/o	CELSA
019	5	19K5	RELAY	G2R-1SND-24VDC	OMRON
019	6	19K6	RELAY	G2R-1SND-24VDC	OMRON
019	7	19K7	RELAY	G2R-1SND-24VDC	OMRON
019	8	19K8	RELAY	G2R-1SND-24VDC	OMRON
020	1	20A1	I/I AMPLIFIER	PR 2285 B1	PR ELECTRONICS



LIST OF ITEMS FOR LC-1D
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Dato	05.05.1995	Total	

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021	1	21AE1	ANALOGUE INPUT	6ESS 464-8ME11	SIEMENS
021	3	21DE1	DIGITAL INPUT	6ESS 421-8MA12	SIEMENS
021	4	21DE2	DIGITAL INPUT	6ESS 421-8MA12	SIEMENS
021	5	21DE3	DIGITAL INPUT	6ESS 421-8MA12	SIEMENS
021	6	21DE4	DIGITAL INPUT	6ESS 421-8MA12	SIEMENS
021	7	21DE5	DIGITAL INPUT	6ESS 421-8MA12	SIEMENS
021	8	21DA1	DIGITAL OUTPUT	6ESS 441-8MA11	SIEMENS
021	9	21DA2	DIGITAL OUTPUT	6ESS 441-8MA11	SIEMENS
021	10	21DA3	DIGITAL OUTPUT	6ESS 441-8MA11	SIEMENS
			BACK-UP BATTERY	6ESS 980-0MA11	SIEMENS
			EPROM	6ESS 375-1LA15	SIEMENS
			5 x BUSMODULE	6ESS 700-8MA11	SIEMENS
			1 X RELAY SOCKETS	SY4S-05C	IZUMI
			6 X RELAY SOCKETS	SR3P-05C	IZUMI
			6 X RELAY SOCKETS	P2RF-05C	OMRON
		FT:	MEMBRAN SWITCH	LC-3A	HV-TURBO
		SO:	TERMINAL	WDU 4 10201.0	WEIDMÜLLER
		X: Y:	TERMINAL	WDU 2.5 10200.0	WEIDMÜLLER
		:PE	EARTH TERMINAL	WPE 6 10102.0	WEIDMÜLLER
		Z20:	TEST TERMINAL	WDU 1.5 10237.0	WEIDMÜLLER
		MT1:	MULTI CONNECTOR	HAN 24E	HARTING
		MT2:	MULTI CONNECTOR	HAN 48E	HARTING
			GROUND BAR	NSCH + 20 stck.	
				D3/MS8,5x1	WEXØE
			CABELKANAL	BA6	WEXØE

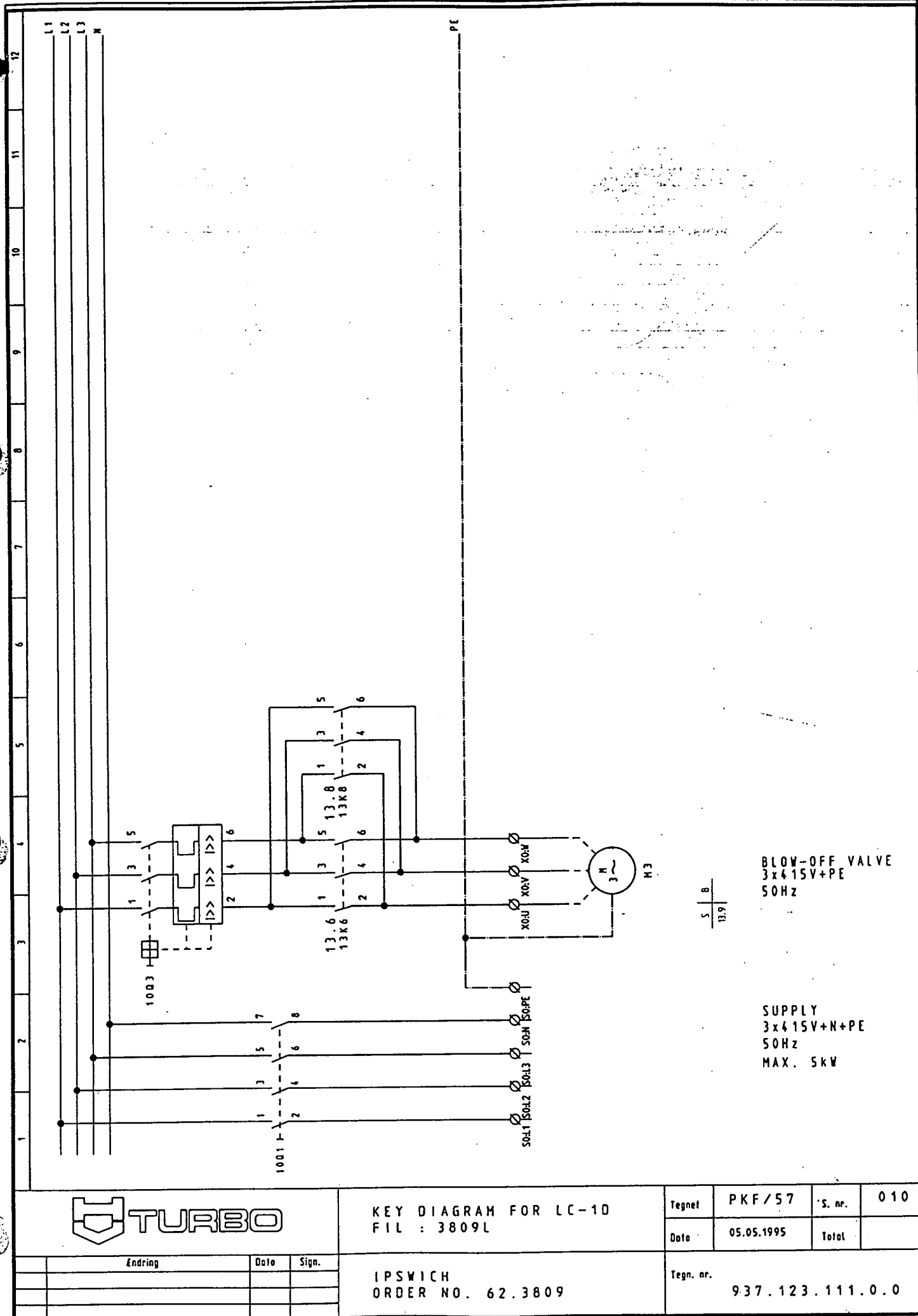


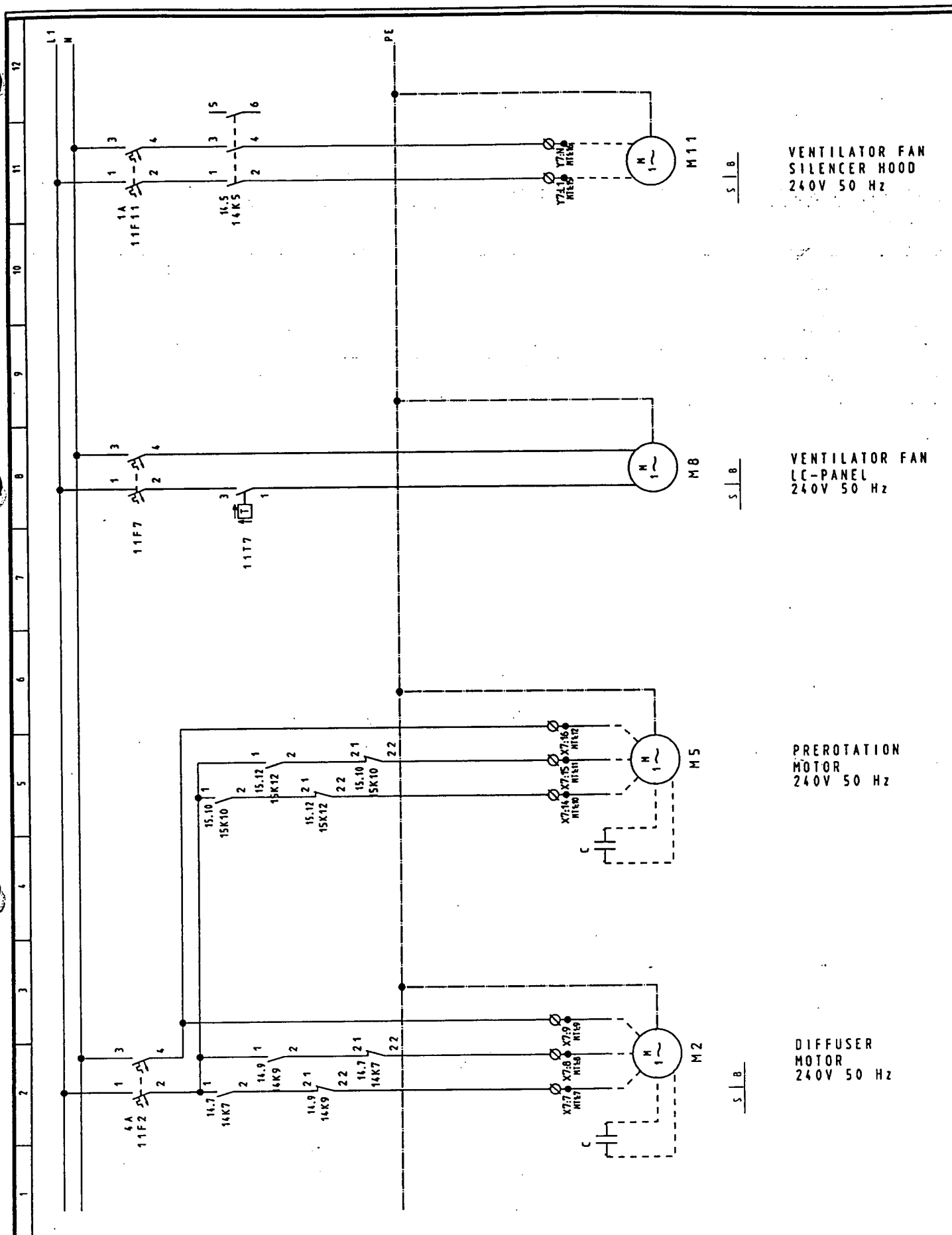
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FIL : 3809L

Tegnet	PKF/57	S. nr.	008
Dato	05.05.1995	Total	

Tegn. nr. 937.123.111.0.0

IPSWICH
ORDER NO. 62.3809



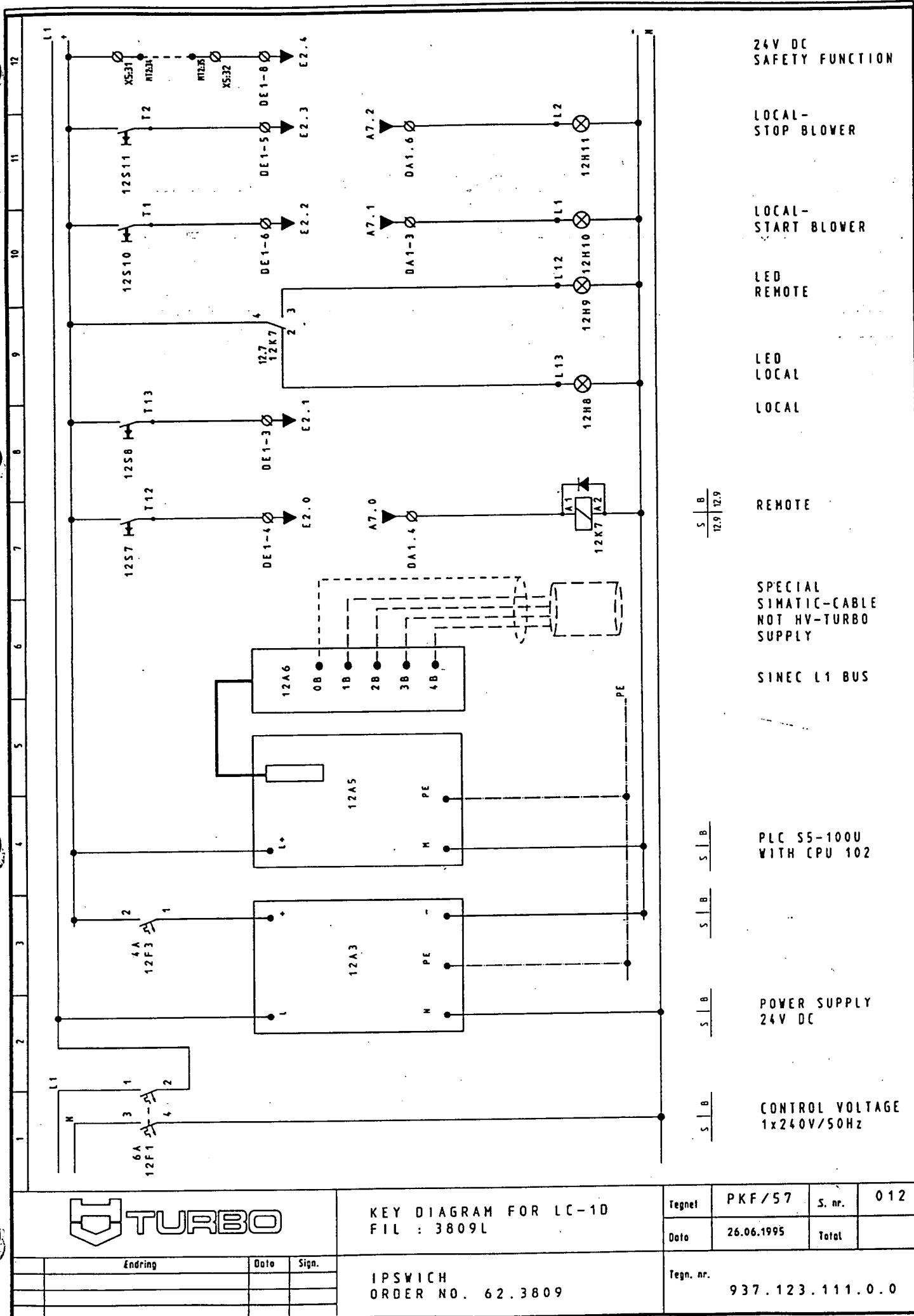


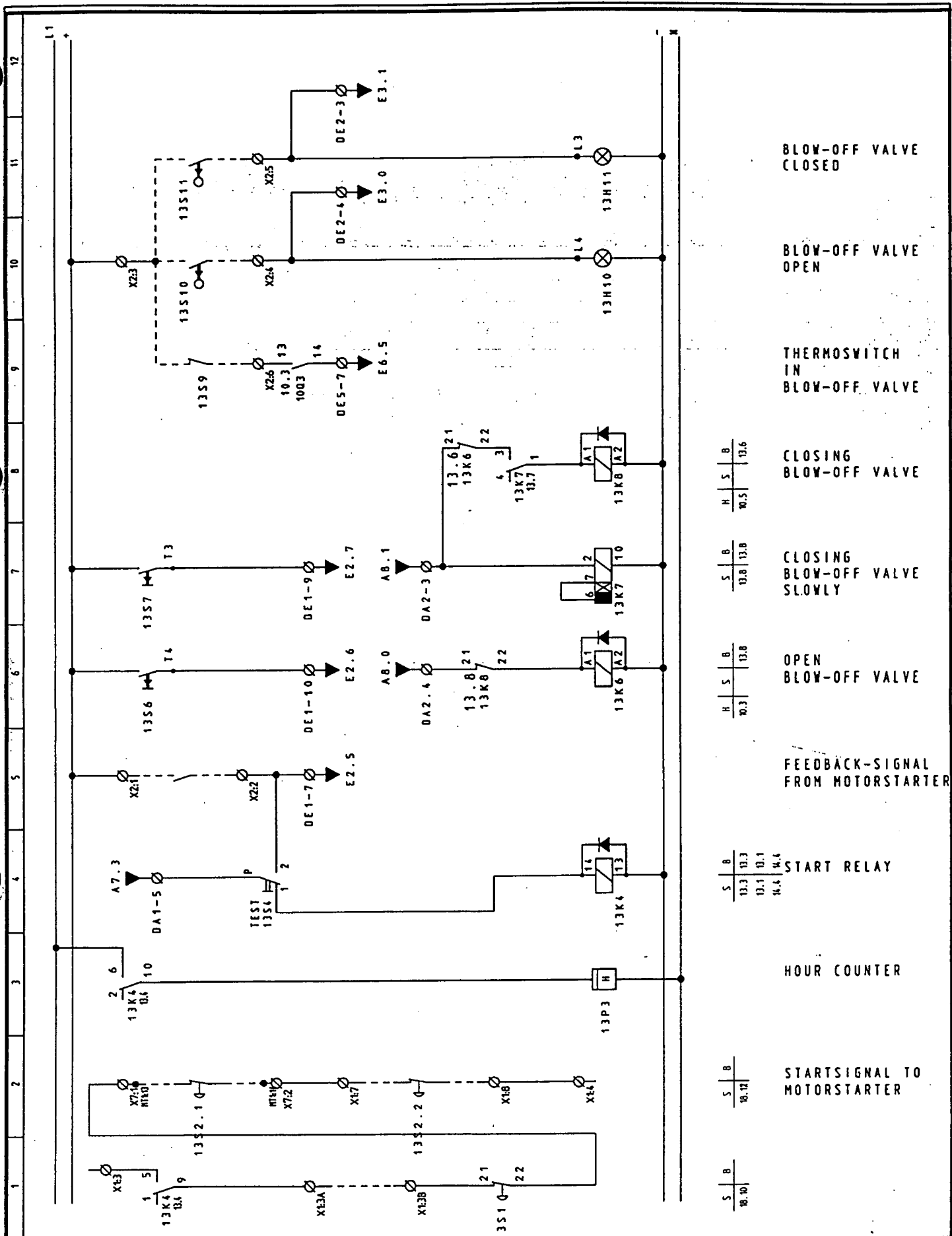
KEY DIAGRAM FOR LC-1D
FIL : 3809L

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Dato	05.05.1995	Total	
Tegn. nr.	937.123.111.0.0		

Endring	Dato	Sign.

IPSWICH
ORDER NO. 62.3809

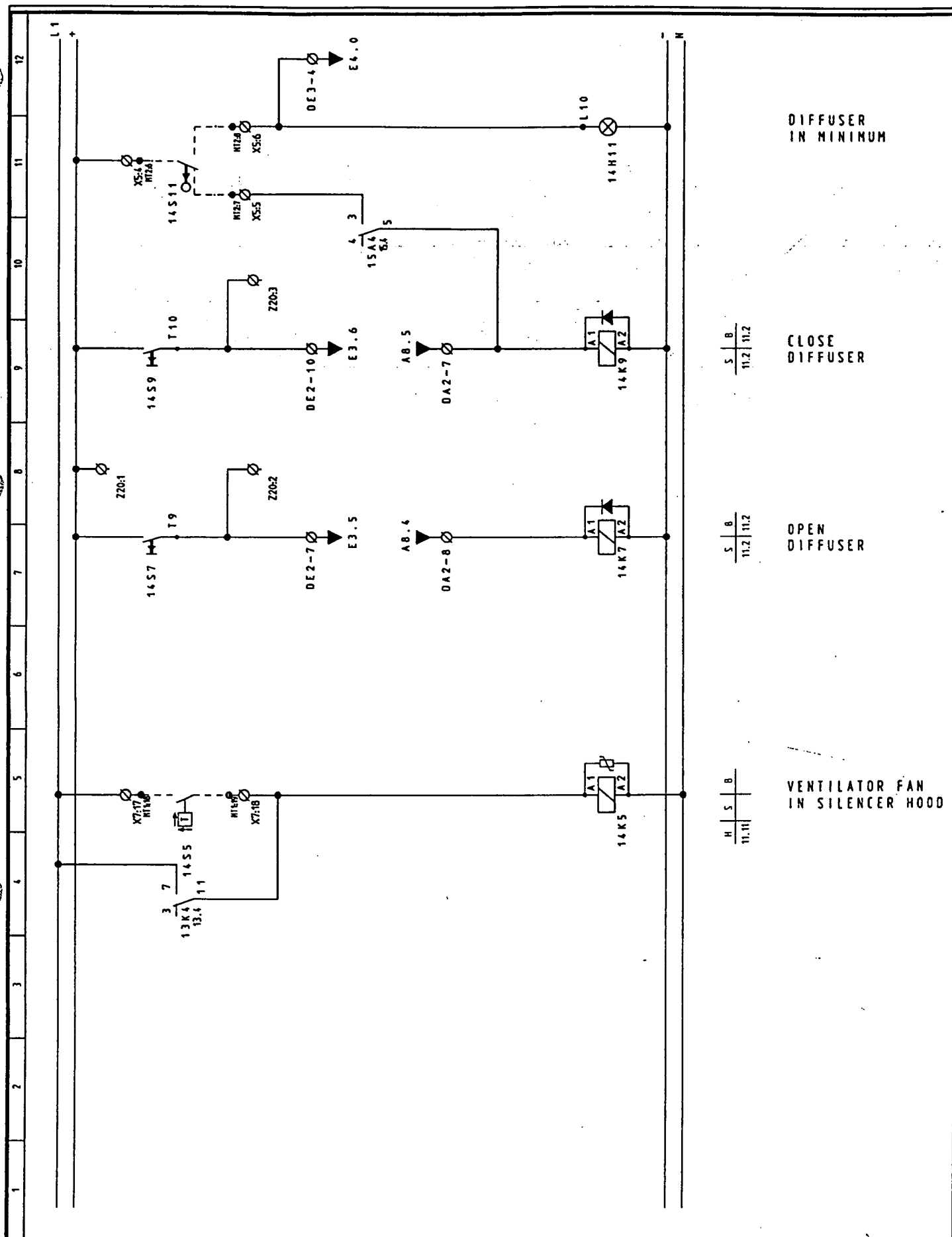




KEY DIAGRAM FOR LC-10
FIL : 3809L

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Dato	05.05.1995	Total	
Tegn. nr.	937.123.111.0.0		

IPSWICH
ORDER NO. 62.3809



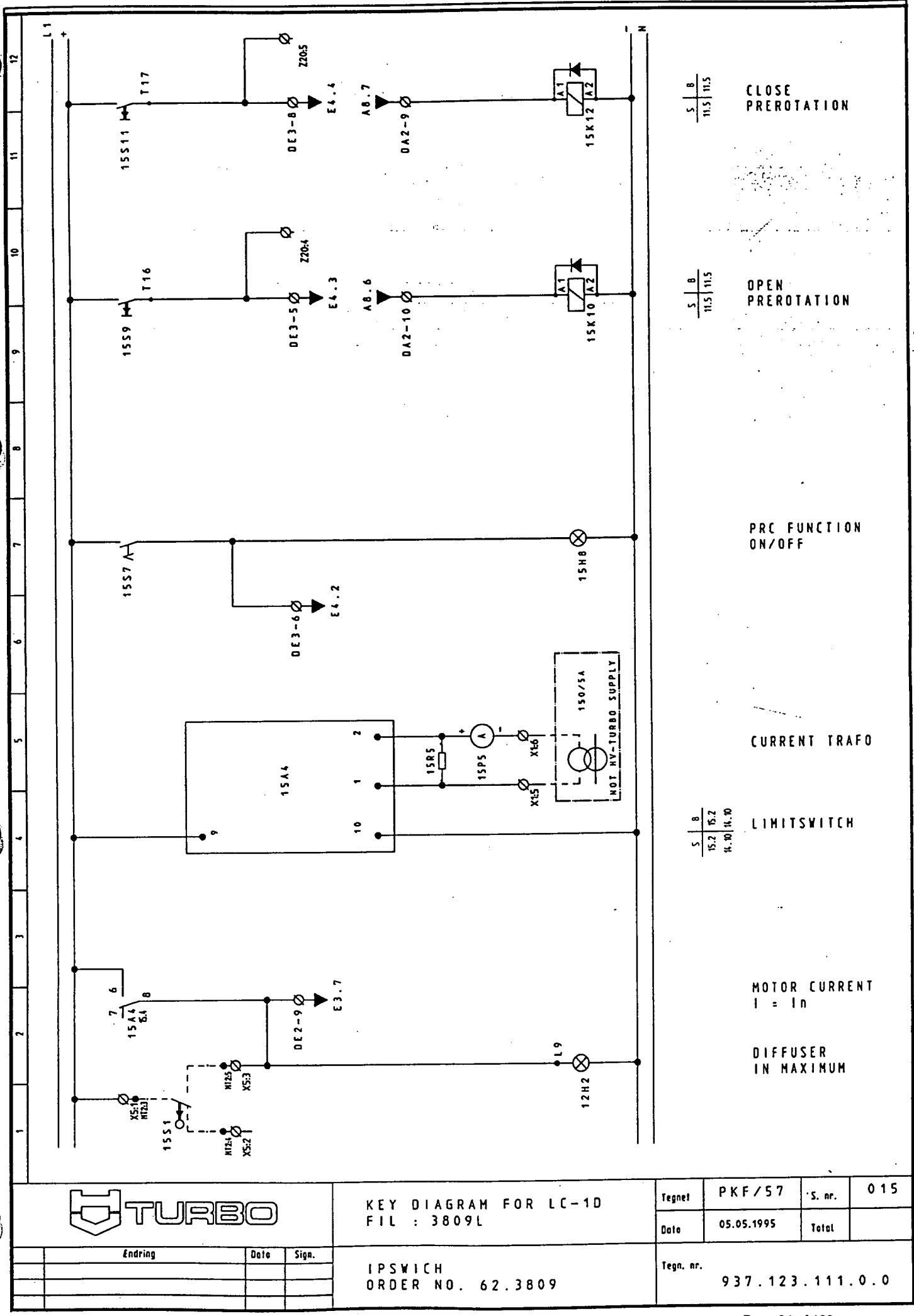
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Dato	05.05.1995	Total	

Tegn. nr. 937.123.111.0.0

Ändring	Dato	Sign.

IPSWICH
ORDER NO. 62.3809

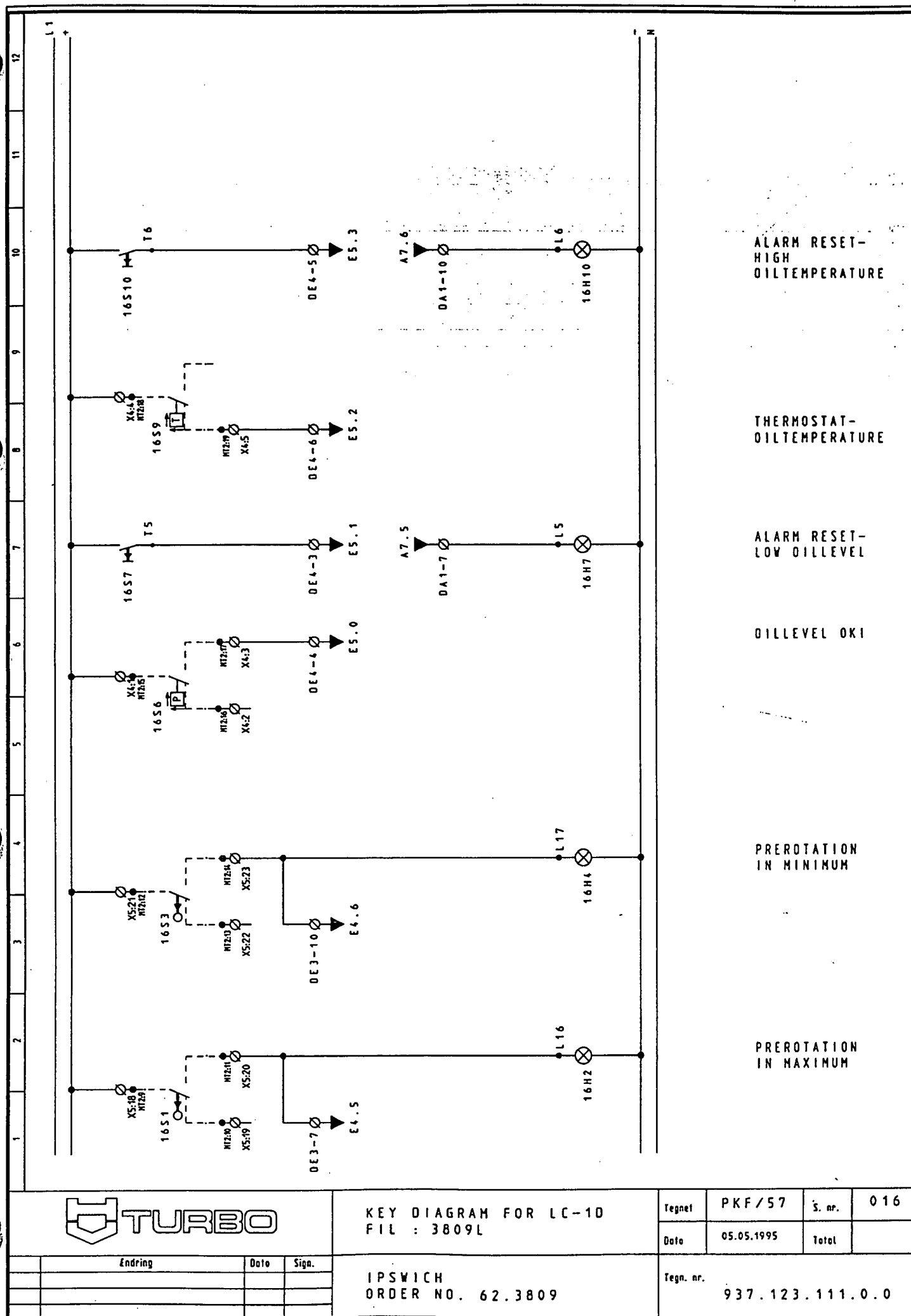


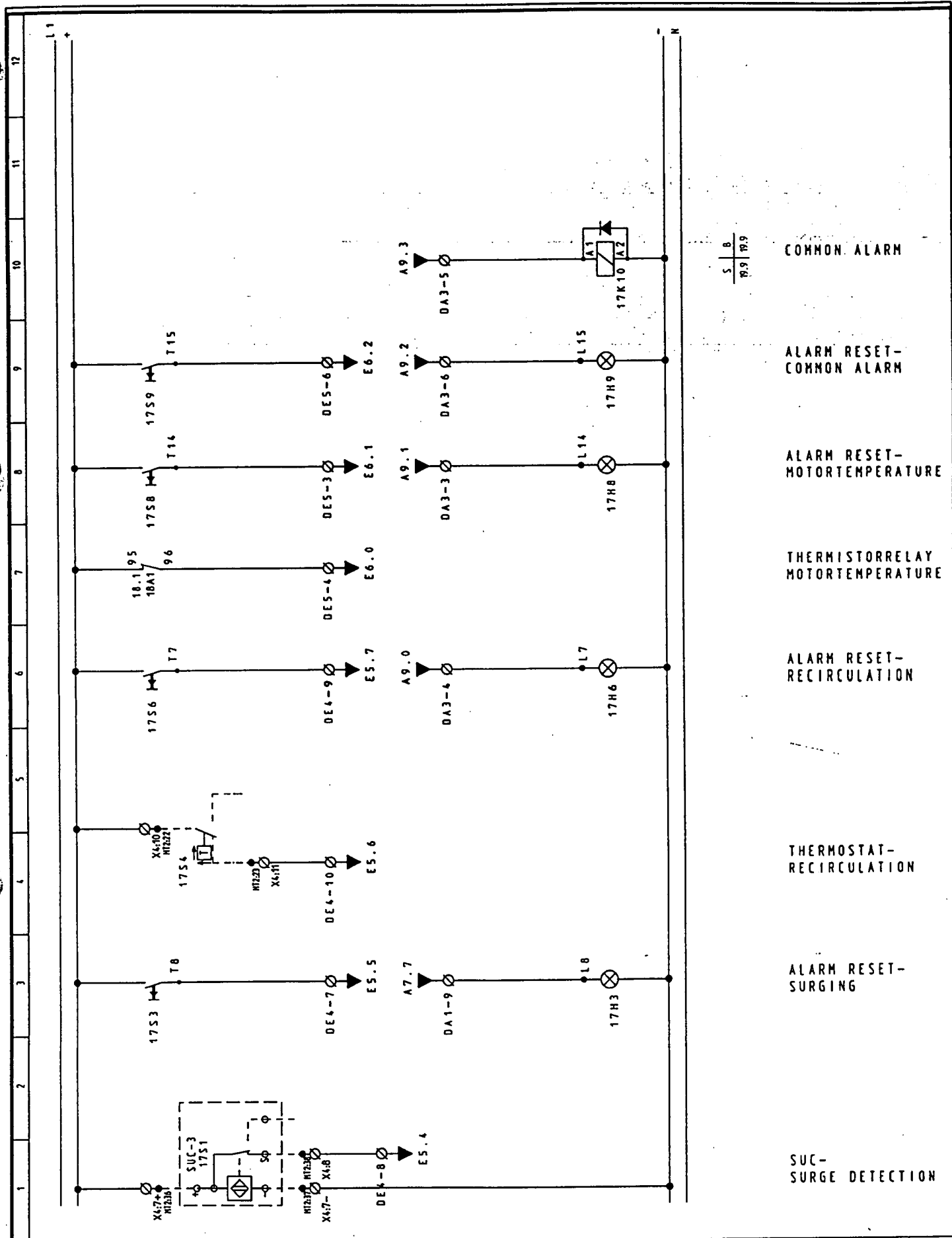
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FIL : 3809L

Tegnet	PKF/57	S. nr.	015
Date	05.05.1995	Total	
Tegn. nr.	937.123.111.0.0		

Endring	Date	Sign.

IPSWICH
ORDER NO. 62.3809



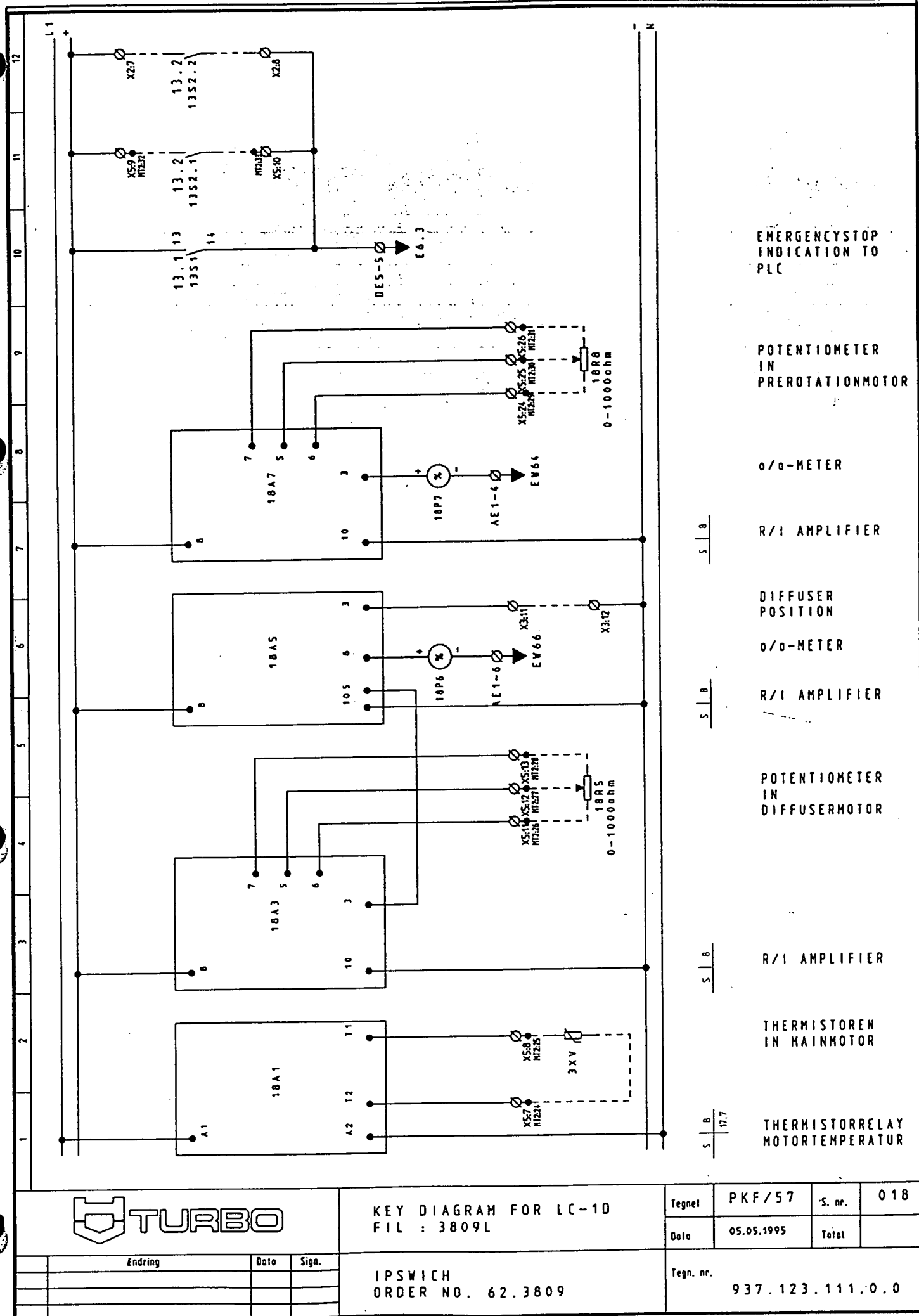


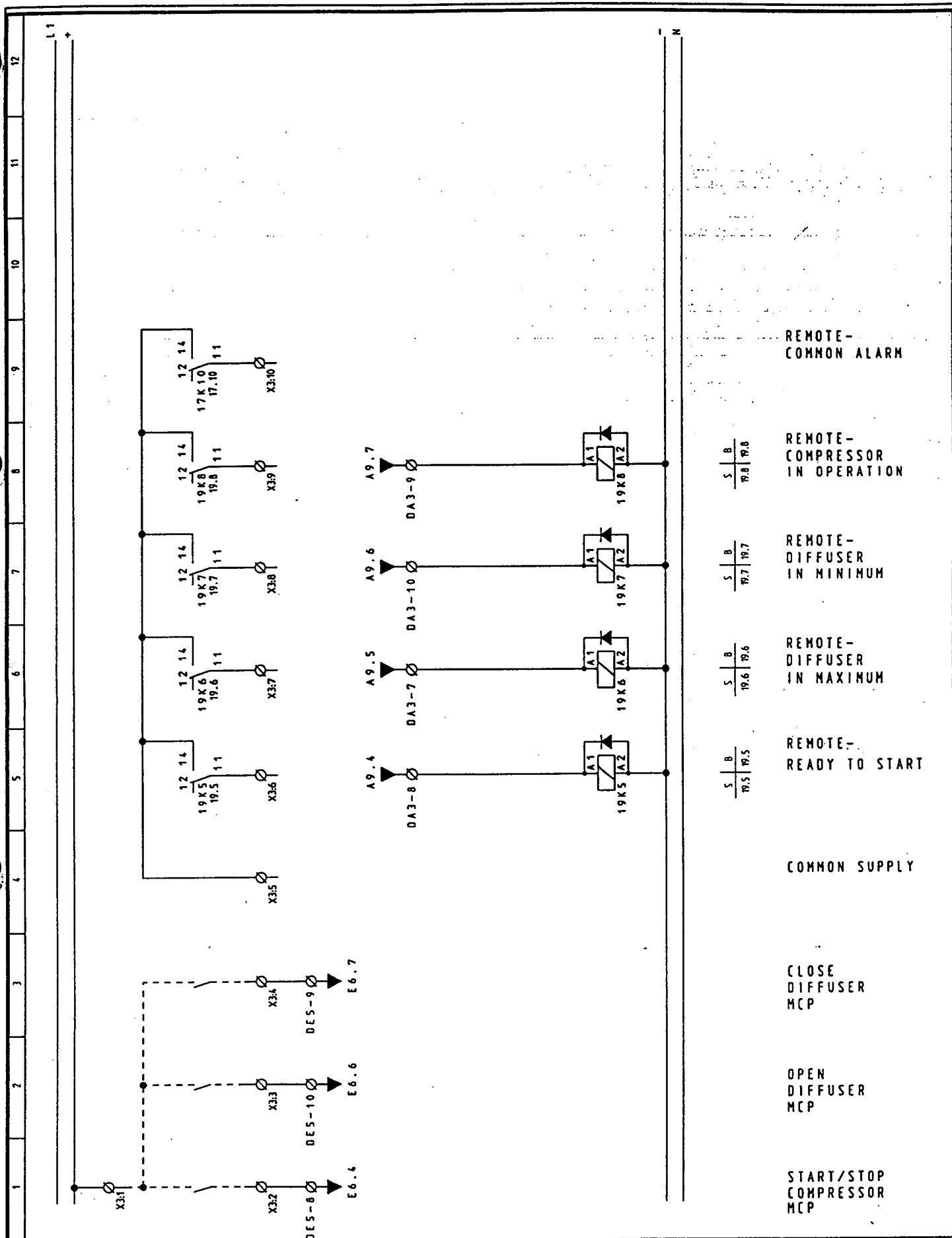
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FIL : 3809L

Regnet	PKF/57	S. nr.	017
Dato	05.05.1995	Total	

Tegn. nr. 937.123.111.0.0

IPSWICH
ORDER NO. 62.3809





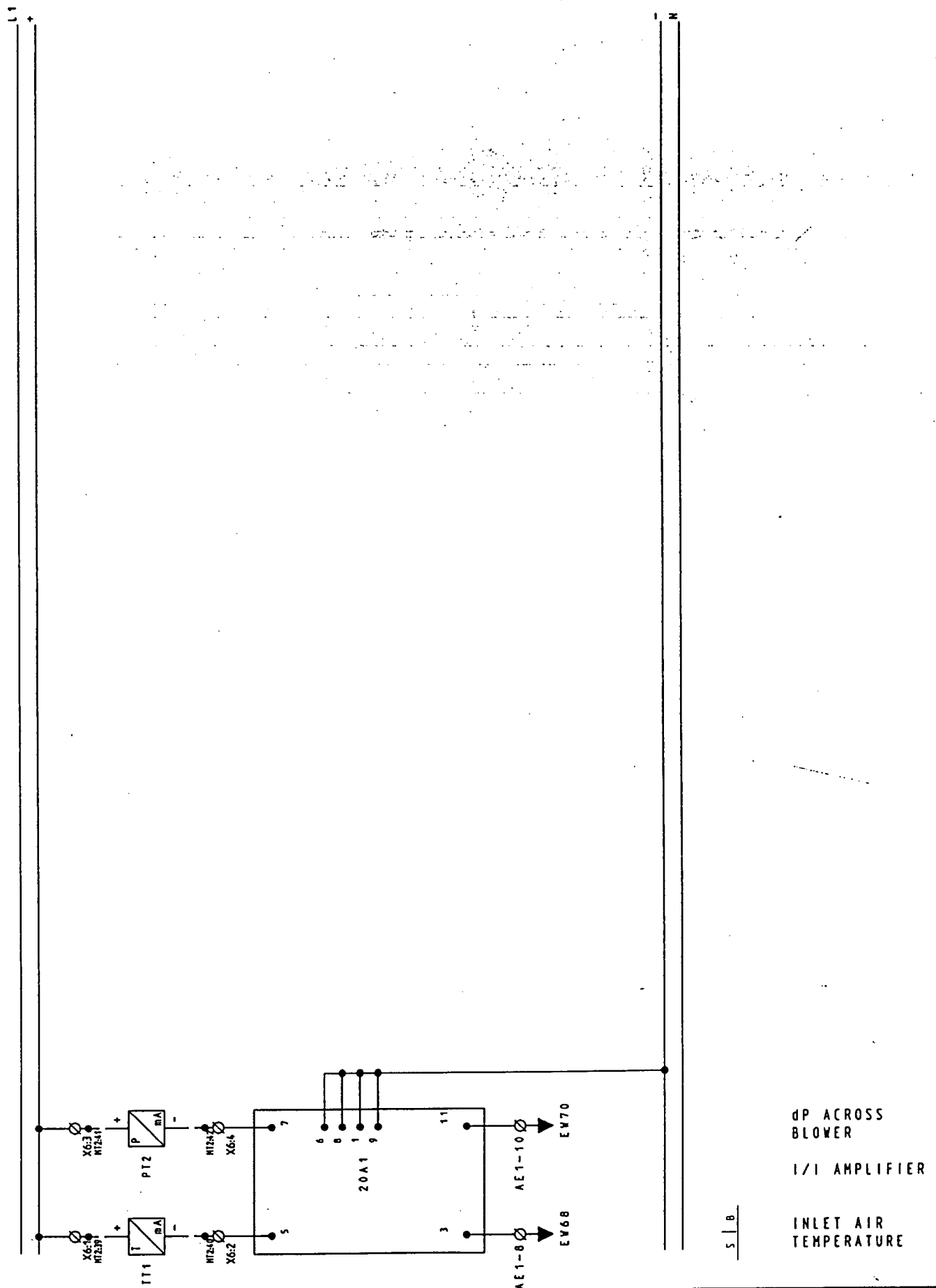
KEY DIAGRAM FOR LC-10
FIL : 3809L

Tegnet	PKF/57	S. nr.	0.19
Date	05.05.1995	Total	

Ending	Date	Sign.

IPSWICH
ORDER NO. 62.3809

Tegn. nr.
937.123.111.0.0

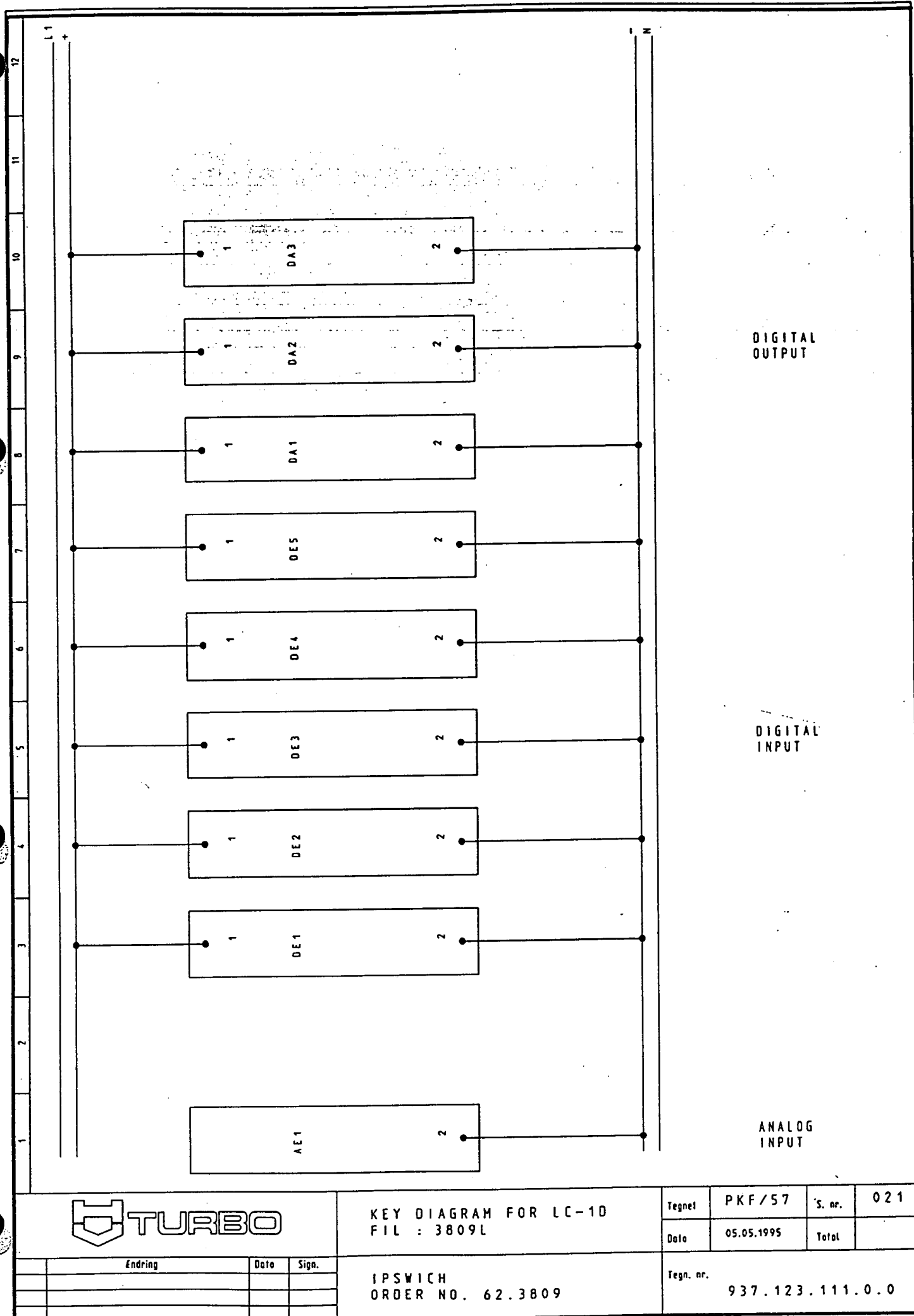


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FIL : 3809L

Tegnet	PKF/57	S. nr.	020
Dato	05.05.1995	Total	
Tegn. nr.	937.123.111.0.0		

Endring	Dato	Siga.

IPSWICH
ORDER NO. 62.3809

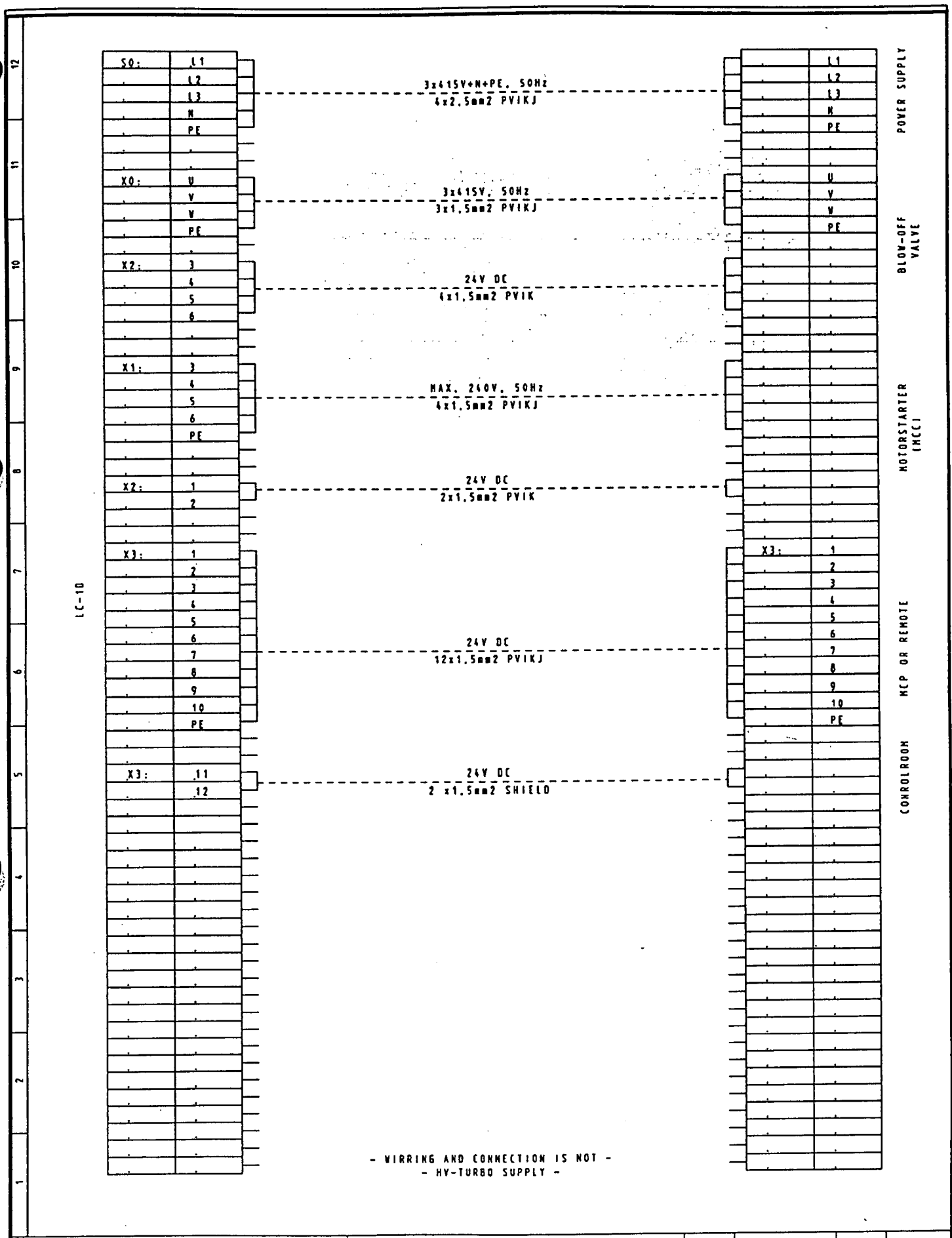


KEY DIAGRAM FOR LC-10
FIL : 3809L

Tegnel	PKF/57	S. nr.	021
Dato	05.05.1995	Total	
Tegn. nr.	937.123.111.0.0		

Ending	Date	Sign.

IPSWICH
ORDER NO. 62.3809



CABEL PLAN FOR LC-10
FIL : 3809L

Tegnel	PKF/57	S. nr.	100
Dato	05.05.1995	Total	

Ändring	Dato	Sign.

IPSWICH
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Tegn. nr.
937.123.111.0.0

TERMINAL LIST : S0


COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)			
POWER SUPPLY 3X415V+N+PE.50Hz FUSE MAX.10 A	L1 L2 L3 N PE	010 2 010 2 010 2 010 2 010 2		N N N N N			
				</			

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TERMINAL LIST : X1

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)															
START SIGNAL +	3	013 1	1	N															
	3A	013 1		N															
	3B	013 1		N															
START SIGNAL -	4	013 2		N															
CURRENT TRAF0	5	015 5		N															
..150/5A	6	015 5		N															
EXTERNAL EMERG. STOP	7	013 2		N															
..240VAC (N.C)	8	013 2		N															
<div></div> <div>FIL : 3809L</div>				Tegnet	PKF/57	S. nr	152												
				Date	09.05.1995	Total	..												
				Tegn. nr. 937.123.111.0.0															
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Ending	Date	Sign.																	

TERMINAL LIST : X2


COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)			
FEED-BACK FROM	1	013 5		N			
..MOTOR STARTER (MCC)	2	013 5		N			
BLOW-OFF VALVE	3	013 10		N			
..OPEN	4	013 10		N			
..CLOSED	5	013 11		N			
..THERMOSWITCH	6	013 9		N			
EXTERNE EMERG.STOP	7	018 12		N			
..24VDC (N.O)	8	018 12		N			
				Tegnet	PKF/57	S. nr.	153
FIL : 3809L				Dato	09.05.1995	Total	..
Endring	Dato	Sign.	IPSWICH ORDER NO. 62.3809				
				Tegn. nr. 937.123.111.0.0			

TERMINAL LIST : X3

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)			
MCP 24VDC FROM LC	1	019 1		N			
..START/STOP	2	019 1		N			
..DIFFUSER OPEN	3	019 2		N			
..DIFFUSER CLOSE	4	019 3		N			
LC 24VDC FROM MCP	5	019 4		N			
..READY FOR START	6	019 5		N			
..DIFFUSER IN MAXIMUM	7	019 6		N			
..DIFFUSER IN MINIMUM	8	019 7		N			
..COMPR. IN OPERATION	9	019 8		N			
..COMMON ALARM	10	019 9		N			
DIFFUSER POSITION +	11	018 6		N			
..4-20MA -	12	018 6		N			
				Tegnet	PKF/57	š. nr	154
FIL : 3809L				Data	09.05.1995	Total	..
Endring Dato Sign.				Tegn. nr.			
IPSWICH				937.123.111.0.0			
ORDER NO. 62.3809							

TERMINAL LIST : X4


COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)
LEVEL SWITCH OIL	1	016 6		MT2:15/.
..OIL LEVEL TO LOW	2	016 5		MT2:16/.
..OIL LEVEL OK	3	016 6		MT2:17/.
THERMOSTAT OIL TEMP.	4	016 9		MT2:18/.
..OIL TEMP. OK	5	016 8		MT2:19/.
SURGING 24VDC+	7+	017 1		MT2:36/.
..-	7-	017 1		MT2:37/.
..OK	8	017 1		MT2:38/.
THERMOSTAT RECIRCULATION	10	017 5		MT2:22/.
..OK	11	017 4		MT2:23/.

	FIL : 3809L			Tegnet	PKF/57	S. nr	155
				Date	09.05.1995	Total	..


Endring	Date	Sign.	IPSWICH ORDER NO. 62.3809	Tegn. nr. 937.123.111.0.0

TERMINAL LIST : X5


COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)
LIMIT SWITCH DIFFUSER	1	015 1		MT2:3/.
..NOT IN MAXIMUM	2	015 1		MT2:4/.
..IN MAXIMUM	3	015 2		MT2:5/.
LIMIT SWITCH DIFFUSER	4	014 11		MT2:6/.
..NOT IN MINIMUM	5	014 11		MT2:7/.
..IN MINIMUM	6	014 11		MT2:8/.
THERMISTORS IN	7	018 1		MT2:24/.
..MAIN MOTOR	8	018 2		MT2:25/.
EMERG.STOP ON COMPR.	9	018 11		MT2:32/.
..24VDC (N.O)	10	018 11		MT2:33/.
POTENTIOMETER IN	11	018 4		MT2:26/.
..IN DIFFUSER MOTOR	12	018 5		MT2:27/.
..0<R<1000 OHM	13	018 5		MT2:28/.
LIMIT SWITCH PREROTATION	18	016 2		MT2:9/.
..NOT IN MAXIMUM	19	016 1		MT2:10/.
..IN MAXIMUM	20	016 2		MT2:11/.
LIMIT SWITCH PREROTATION	21	016 4		MT2:12/.
..NOT IN MINIMUM	22	016 3		MT2:13/.
..IN MINIMUM	23	016 4		MT2:14/.
POTENTIOMETER IN	24	018 9		MT2:29/.
..IN PREROTATION MOTOR	25	018 9		MT2:30/.
..0<R<1000 OHM	26	018 9		MT2:31/.
24VDC	31	012 12		MT2:34/.
..SAFETY STOP	32	012 12		MT2:35/.

		FIL : 3809L		Regnet	PKF/57	S. nr	156
				Date	09.05.1995	Total	..
Ending	Date	Sign.	IPSWICH ORDER NO. 62.3809		Regn. nr. 937.123.111.0.0		

TERMINAL LIST : X6

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNCTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)															
TEMPERATURE TRANS. + ..4-20MA - PRESSURE TRANS. + ..4-20MA -	1 2 3 4	020 1 020 1 020 2 020 2		MT2:39/. MT2:40/. MT2:41/. MT2:42/.															
<div></div>				<table><tr><td>Tegnet</td><td>PKF/57</td><td>S. nr</td><td>157</td></tr><tr><td>Date</td><td>09.05.1995</td><td>Total</td><td>..</td></tr></table>	Tegnet	PKF/57	S. nr	157	Date	09.05.1995	Total	..							
Tegnet	PKF/57	S. nr	157																
Date	09.05.1995	Total	..																
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Endring	Date	Sign.																	
FIL : 3809L																			
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TERMINAL LIST : X7

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNCTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)															
EMERG.STOP ON COMPR.	1	013 2		MT1:13/.															
..240VAC (N.C)	2	013 2		MT1:14/.															
DIFFUSER 240VAC OPEN	7	011 2		MT1:7/.															
..240VAC CLOSE	8	011 2		MT1:8/.															
..N	9	011 3		MT1:9/.															
PREROTATION 240VAC OPEN	14	011 5		MT1:10/.															
..240VAC CLOSE	15	011 5		MT1:11/.															
..N	16	011 6		MT1:12/.															
THERMOSTAT IN	17	014 5		MT1:18/.															
..SILLENCER HOOD	18	014 5		MT1:19/.															
<div></div> <div>FIL : 3809L</div>				Tegnel	PKF/57	S. nr.	158												
				Data	09.05.1995	Total	..												
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Endring	Date	Sign.																	

TERMINAL LIST : Y7

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)			
SILLENT HOOD ..FAN	L1 N	011 11 011 11		MT1:15/. MT1:16/.			

OPERATING INSTRUCTIONS FOR LC-1D

The control panel consists of the following modes of operation:

1. LOCAL/MANUAL
2. REMOTE/AUTOMATIC
3. SERVICE

1. LOCAL/MANUAL

LOCAL/MANUAL operation is selected by activating finger-touch (f-t) T13. LED in T13 will then be on while LED in T12 is off.

START CONDITIONS:

- a. No alarm signal should be on, i.e. none of the red LEDs in the yellow section should be alight.
- b. The blow-off valve must be open, i.e. LED L4 "BOV OPEN" must be on and LED L3 "BOV CLOSED" off.
- c. Diffuser must be in minimum position, i.e. LED L10 "DIFF IN MIN" must be on and LED L9 "DIFF IN MAX" off.
- d. The prerotation must be in minimum position, i.e. LED L17 "IGV IN MIN" must be on.

When these conditions are fulfilled, the compressor can be started by activating T1 (f-t). LED L1 "COMPR IS STARTED" will now flash indicating that automatic start-up has begun.

After start-up of motor and before the blow-off valve closes, the prerotation will run towards maximum and LED L16 "IGV IN MAX" be alight.

After closing of blow-off valve, LED L3 "BOV CLOSED" must be on. Regulation of the variable diffuser and the prerotation is now permitted.

When the start sequence is completed and the compressor starts up, LED L1 "COMPR IS STARTED" will be permanently alight.

Stop compressor by activating T2 (f-t), whereby the stop sequence is initiated. LED L2 "COMPR IS STOPPED" will be on when the stop sequence has begun.

STAGES OF STOP SEQUENCE:

- Diffuser runs towards minimum.
- When the diffuser is in minimum, the blow-off valve starts to open.
- When the blow-off valve is open, the compressor stops.
- If the blow-off valve is not open within 100 sec. of the stop signal having been given, the compressor will stop nevertheless.
- The prerotation runs towards minimum.

Diffuser is operated by activating T10 and T9 (f-t) for the closing and opening functions respectively.

LED L10 "DIFF IN MIN" and LED L9 "DIFF IN MAX" will be alight to indicate that the diffuser is in minimum and maximum position respectively.

Prerotation is operated by activating T17 and T16 (f-t) for the closing functions respectively. When the key switch 16S1 is turned on and LED 16H2 is alight, it is a sign that the prerotation is now controlled by the PRC-control system. (Only when PRC has been installed).



OPERATING INSTRUCTIONS
FIL : 3809L

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2. REMOTE/AUTOMATIC

REMOTE/AUTOMATIC operation is selected by activating T12 (f-1). LED L12 "REMOTE/AUTO" will then be on while LED L13 "LOCAL/MAN" simultaneously is off.

Start conditions are the same as for LOCAL/MANUAL.

When the start conditions are fulfilled, the compressor can be started by a PERMANENT signal from the master control panel "MCP" on terminal X3:2 (potential-free contact or MCP). Resetting of this signal will bring the compressor to stop.

The diffuser is controlled by signals on terminal X3:3 and X3:4 respectively (Potential-free contact or MCP).

Prerotation: See LOCAL/MANUAL.

3. SERVICE

By repair or the like, the control panel can be adjusted for service by activating T13 (f-1) "LOCAL/MAN" during more than 5 seconds. LEDs L12 "REMOTE/AUTO" and L13 "LOCAL/MAN" will then flash as a sign that the control panel is in service. This makes it possible to operate the blow-off valve, the diffuser and the prerotation independantly, by using the T-Ts on the panel front.

TEST

By setting switch 13S10, placed inside the panel, on position 2, a start-up sequence can be run through to test all functions without starting the main motor. This applies to all 3 service functions.

NOTE!!!

Before renewed start-up of the compressor, the control panel must be brought out of service operation by activating once more T13 (f-1), while 13S10 must be reset on position 1.

See "F-T symbols" for identification of finger-touches and diodes.

Switch "Test - 13S10" is shown on the Arrangement drawing.

ALARM

An error in the operating procedure will bring the compressor to stop. In the yellow section - which symbolizes the error - the LED will go on, indicating the error in question. When the stop sequence is completed, the alarm is reset by activating the F-T corresponding to the LED. Unless the error has NOT been corrected, the LED will go off.

In case of an alarm signal, the blow-off valve at once begins to open, and 8 seconds later the compressor will stop.

In case of an emergency stop, the compressor will stop immediately without waiting for the blow-off valve to open.

Five special alarms are symbolized on the panel, and they will be alight when the corresponding error occurs. In addition, there is a general alarm signalling whenever an error occurs.



OPERATING INSTRUCTIONS
FIL : 3809L

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Endring	Dato	Sign.

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INDICATION OF ERRORS:

1. ONE OF THE SPECIAL ALARM SIGNALS IS PERMANENTLY ALIGHT SIMULTANEOUSLY WITH "GENERAL ALARM".

The alarm signal in question must be reset before renewed start-up of the compressor.

2. "GENERAL ALARM" SIGNAL IS PERMANENTLY ALIGHT. NO OTHER ALARM SIGNALS ARE ON.

One of the following alarm signals occurs:

- a. Start conditions have not been established.
- b. Emergency stop has been activated.

These alarm signals need not be reset, the lights will go off when the error has been corrected.

3. "GENERAL ALARM" FLASHES. NO OTHER ALARM SIGNALS ARE ON.

One of the following errors occurs:

- a. Feed-back signal has not been received within 1 min. from start signal to drive motor.
- b. Blow-off valve has not closed 5 min. after start-up.
- c. Feed-back signal has disappeared during operation.

Resetting of these alarm signal is required before renewed start-up.

4. "GENERAL ALARM" PERMANENTLY ALIGHT. STOP SIGNAL FLASHES.

Blockade of restart!

In order to protect the motor from overloading, start-up is blocked. This occurs when there have been too many start-ups during too short a time (in the case of most compressors max. 4 start-ups in 1 hour).

The blockade will disappear when 1 hour has lapsed since the first start-up.

5. LED L5 + L6 + L14 AND L7 + L8 FLASH SIMULTANEOUSLY.

The battery of the PLC must be renewed. Stop of compressor is not necessary. After exchange of batteries, the alarm signal is reset by activating (f-1) "General Alarm".

NOTE! IN CASE OF MAINS FAILURE

WITHOUT SUPERVISION - NO OPERATION!

In case of mains failure, the LC (Local Control Panel) will pass on a stop signal. Motoren skal stoppe med samme!

When the voltage returns, the LC will re-establish starting conditions. The operating procedure is the same as before mains failure.

When in position LOCAL/MANUAL, activate (f-1) "START" to restart compressor.



OPERATING INSTRUCTIONS
FIL : 3809L

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When in position REMOTE/AUTOMATIC the LC requires an electric signal to start up compressor again. If connected to an MCP (Master Control Panel from HV-TURBO) the LC will automatically receive a start signal, depending on the priority choice, the air demand and the re-establishing of start conditions for each compressor.

IMPORTANT: For reasons of safety, the main switch of the drive motor must be switched off or blocked prior to working on or near the compressor.
This also applies in case of mains failure.

INSTALLATION:

The standard LC-panels are designed according to IEC standard 204-1, i.e. for installation in an ambient temperature of max. 40°C. This temperature is the absolute max. and must NOT be exceeded.

In case of doubt, ask HV-Turbo to install additional panel coolers.

If installed in tropical environment, additional heating equipment is required to avoid formation of condensed water during stand-still periods.



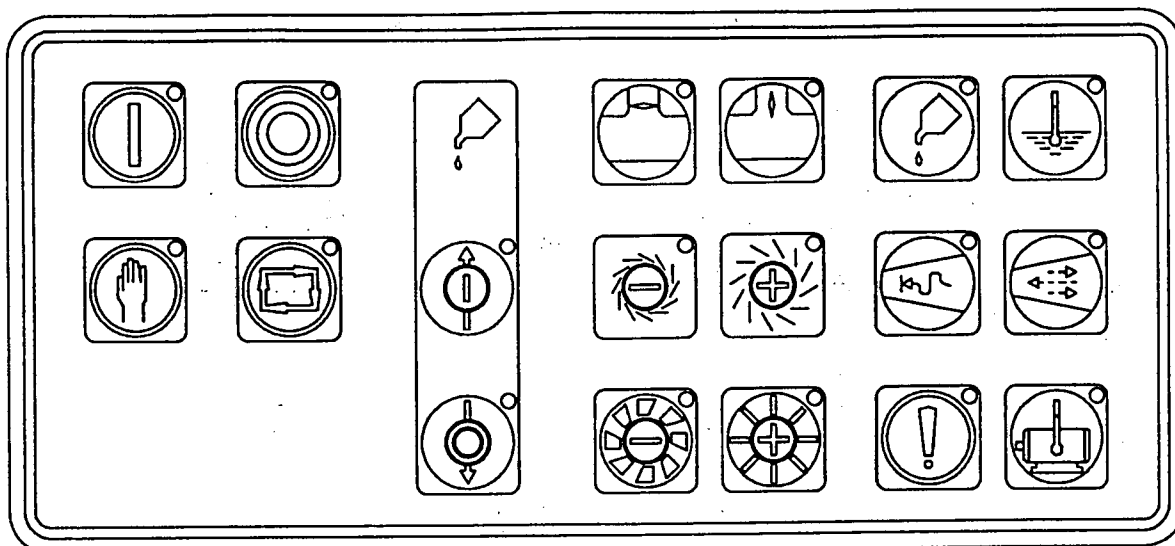
OPERATING INSTRUCTIONS
FIL : 3809L

Tegnet	PKF/57	S. nr.	203
Dato	09.05.1995	Total	

Endring	Dato	Sign.

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	L1: COMPRESSOR IS STARTED T1: START COMPRESSOR		L10: DIFFUSER IN MIN. T10: CLOSE DIFFUSER		L8: SURGING T8: RESET
	L2: COMPRESSOR IS STOPPED T2: STOP COMPRESSOR		L9: DIFFUSER IN MAX. T9: OPEN DIFFUSER		L7: RECIRCULATION T7: RESET
	L13: LOCAL/MANUAL T13: IN LOCAL/MANUAL		L17: IGV IN MIN. T17: CLOSE IGV		L15: GENERAL ALARM T15: RESET
	L12: REMOTE/AUTO T12: IN REMOTE/AUTO		L16: IGV IN MAX. T16: OPEN IGV		L14: MOTOR TEMP. TOO HIGH T14: RESET
	L3: BLOW-OFF VALVE CLOSED T3: CLOSE BLOW-OFF VALVE		L5: OIL PRESS. TOO LOW T5: RESET		L11: NOT USED T11: NOT USED
	L4: BLOW-OFF VALVE OPEN T4: OPEN BLOW-OFF VALVE		L6: OIL TEMP. TOO HIGH T6: RESET		L18: NOT USED T18: NOT USED



MEMBRANE SWITCH
FIL : 3809L

Regnet	PKF/57	\$ nr.	204
Date	09.05.1995	Total	

IPSWICH
ORDER NO. 62.3809

Tegn. nr.
937.123.111.0.0

MCP - 3

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FIL : 3809M

Regnet	PKF/57	S. nr.	001
Data	04.05.1995	Total	

Ending	Date	Sign.

IPSWICH
ORDER NO. 62.3809

Regn. nr.
937.323.069.0.0

IPSWICH: 3809M

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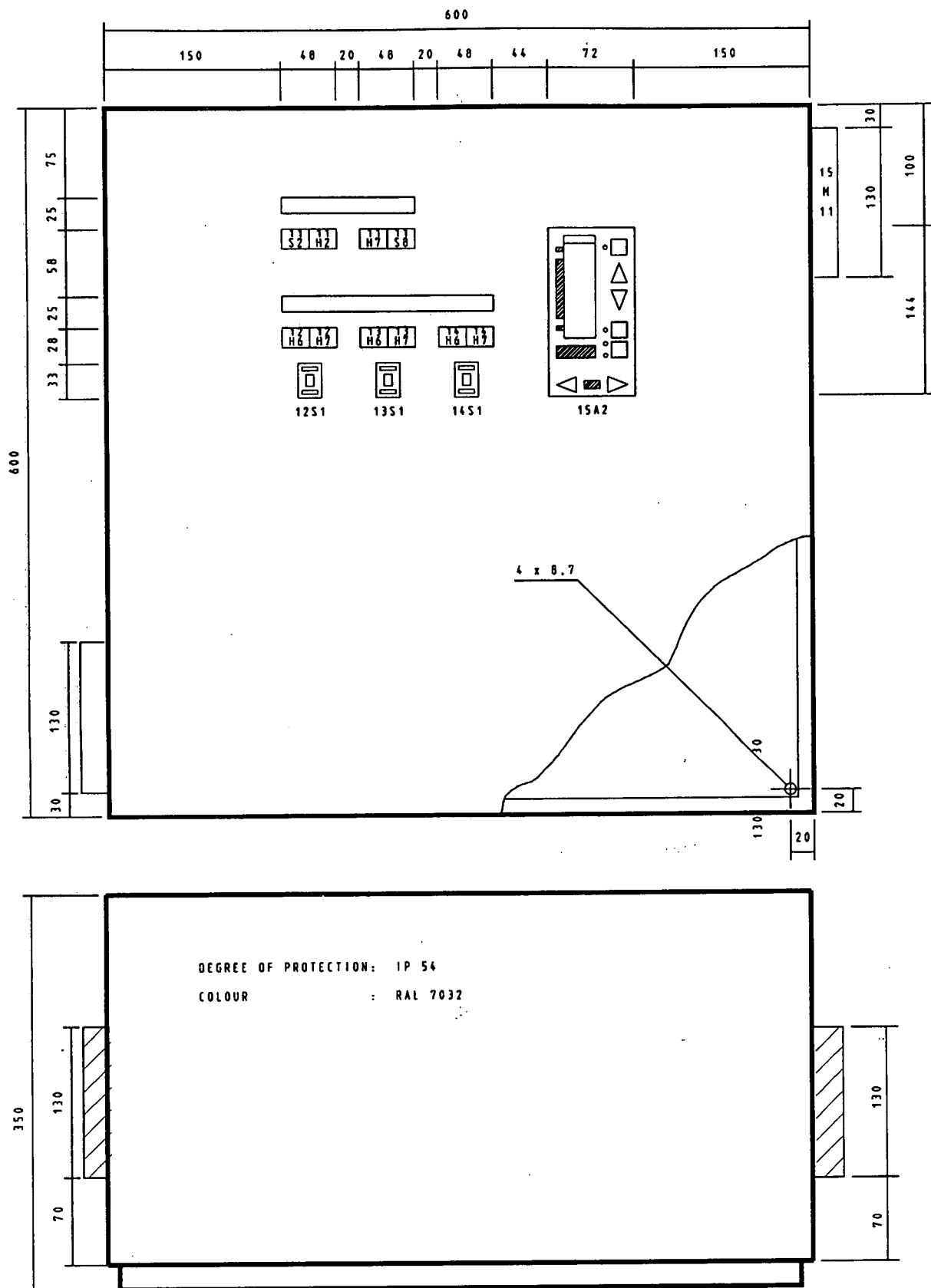
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Tegn. nr.
937.323.069.0.0



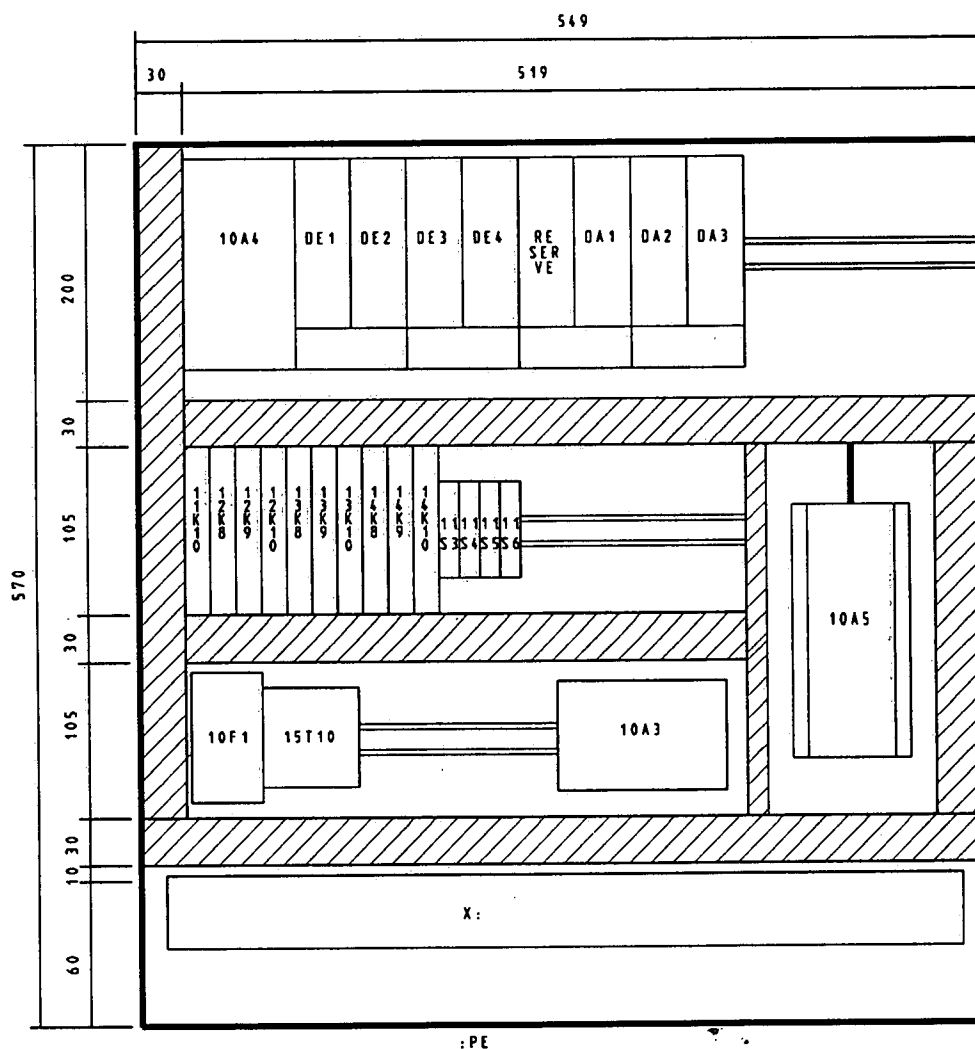
PANEL LAY-OUT FOR MCP-3
FIL : 3809M

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Endring	Dato	Sign.

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Tegn. nr.
937.323.069.0.0



ARRANGEMENT FOR MCP-3
FIL : 3809M

Tegnet	PKF/57	S. nr.	005
Dato	04.05.1995	Total	

Endring	Dato	Sign.

IPSWICH
ORDER NO. 62.3809

Tegn. nr.
937.323.069.0.0

PAGE	PLAC.	COMP.	FUNCTION	TYPE	MAKER
=====					
			PANEL	AE 1360	RITTAL
010	1	10F1	CIRCUIT BREAKER	5SX2 206-7	SIEMENS
010	3	10A3	POWER SUPPLY 24VDC	S-24/2.4	BENTRON
010	4	10A4	CPU UNIT 102	6ES5 102-8MA02	SIEMENS
010	5	10A5	SINEC L1 BUSTERM.	6ES5 777-0BC01	SIEMENS
010	6	DE1	DIGITAL INPUT	6ES5 421-8MA12	SIEMENS
010	7	DE2	DIGITAL INPUT	6ES5 421-8MA12	SIEMENS
010	8	DE3	DIGITAL INPUT	6ES5 421-8MA12	SIEMENS
010	9	DE4	DIGITAL INPUT	6ES5 421-8MA12	SIEMENS
010	10	DA1	DIGITAL OUTPUT	6ES5 441-8MA11	SIEMENS
010	11	DA2	DIGITAL OUTPUT	6ES5 441-8MA11	SIEMENS
010	12	DA3	DIGITAL OUTPUT	6ES5 441-8MA11	SIEMENS
			4 X BUSMODULE	6ES5 700-8MA11	SIEMENS
			EPROM	6ES5 375-1LA15	SIEMENS
011	2	11H2	SIGNAL LAMP	551008/460221	ELECTROMATIC
011	7	11H7	SIGNAL LAMP	551008/460121	ELECTROMATIC
011	2	11S2	KEY SWITCH	548038/493060 TH25	ELECTROMATIC
011	3	11S3	COMPONENT TERMINAL	WTR 2.5 10111.0	WEIDMÜLLER
011	4	11S4	COMPONENT TERMINAL	WTR 2.5 10111.0	WEIDMÜLLER
011	5	11S5	COMPONENT TERMINAL	WTR 2.5 10111.0	WEIDMÜLLER
011	6	11S6	COMPONENT TERMINAL	WTR 2.5 10111.0	WEIDMÜLLER
011	8	11S8	PUSHBUTTON	501008/460021 TH25	ELECTROMATIC
012	6	12H6	SIGNAL LAMP	551008/460221	ELECTROMATIC
012	7	12H7	SIGNAL LAMP	551008/460421	ELECTROMATIC
012	1	12S1	CODE SWITCH	DPS-10 131 AK2	ELECTROMATIC
012	8	12K8	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
012	9	12K9	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
012	10	12K10	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
013	6	13H6	SIGNAL LAMP	551008/460221	ELECTROMATIC
013	7	13H7	SIGNAL LAMP	551008/460421	ELECTROMATIC
013	1	13S1	CODE SWITCH	DPS-10 131 AK2	ELECTROMATIC
013	8	13K8	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
013	9	13K9	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
013	10	13K10	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
014	6	14H6	SIGNAL LAMP	551008/460221	ELECTROMATIC
014	7	14H7	SIGNAL LAMP	551008/460421	ELECTROMATIC
014	1	14S1	CODE SWITCH	DPS-10 131 AK2	ELECTROMATIC
014	8	14K8	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
014	9	14K9	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
014	10	14K10	RELAY	G2R-1SND24DC+P2RF-05E	OMRON
015	2	15A2	PI CONTROLLER	6DR 2001-1	HV-TURBO
015	10	15T10	THERMOSTAT	SK 3112	RITTAL
015	11	15M11	FAN MOTOR	SK3150-1S+SK3160-1S	RITTAL
		X:	TERMINALS	WDU 2.5 10200.0	WEIDMÜLLER
		:PE	EARTH TERMINAL	WPE 2.5 10100.0	WEIDMÜLLER
			CABLE CHANNEL	BA6	WEXÖE
			EARTH BAR	NSCH	WEXÖE

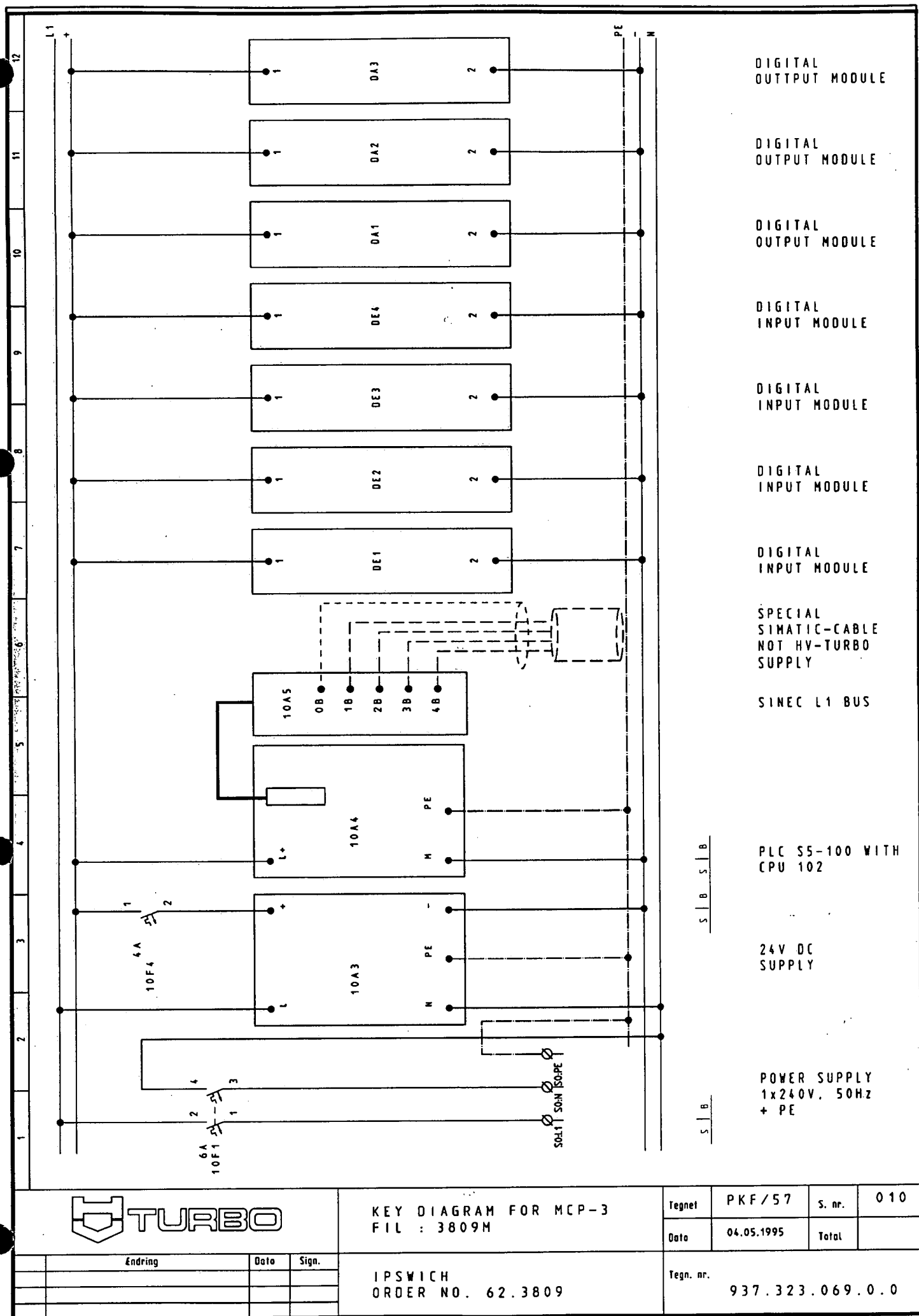


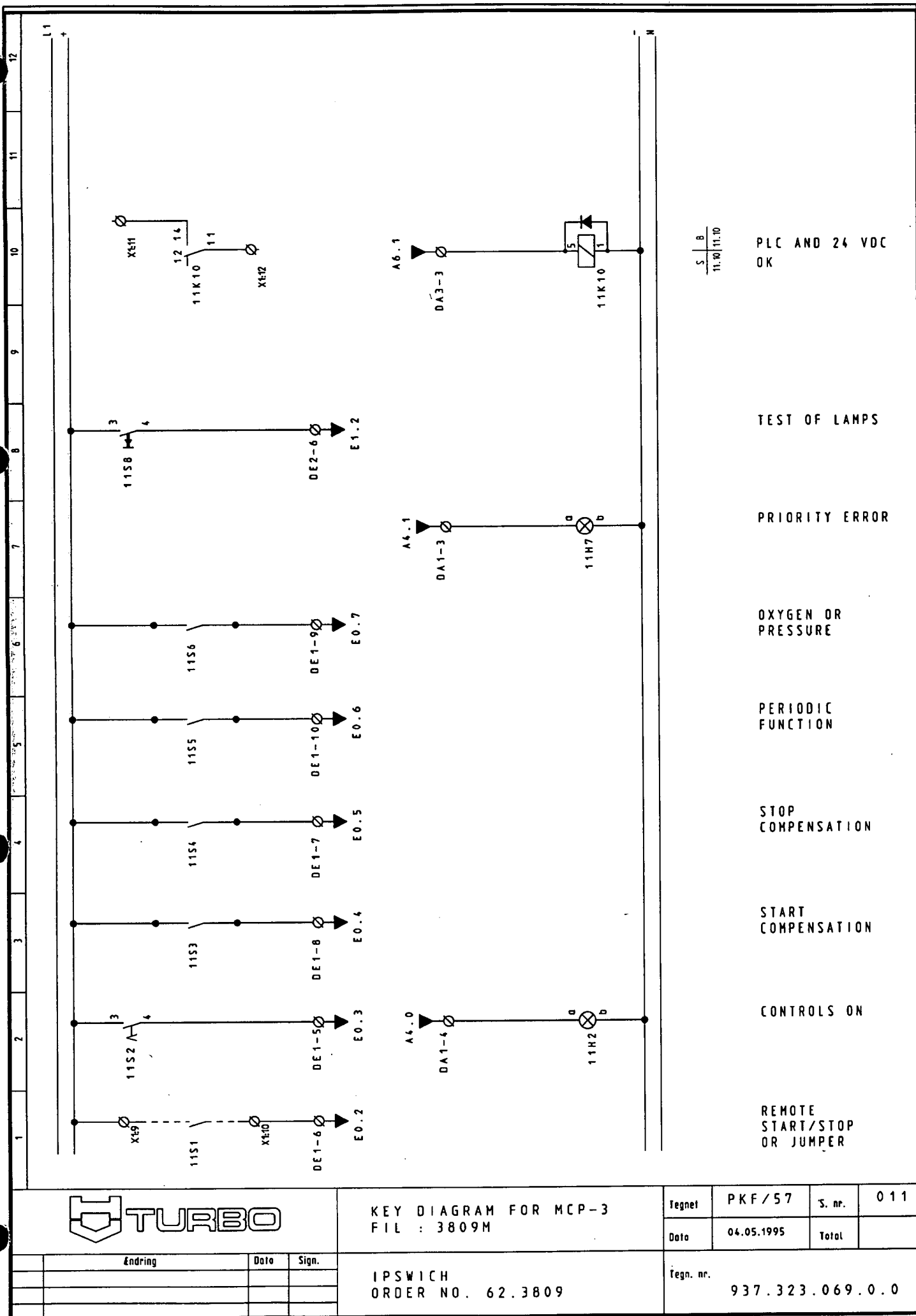
LIST OF ITEMS FOR MCP-3
FIL : 3809M

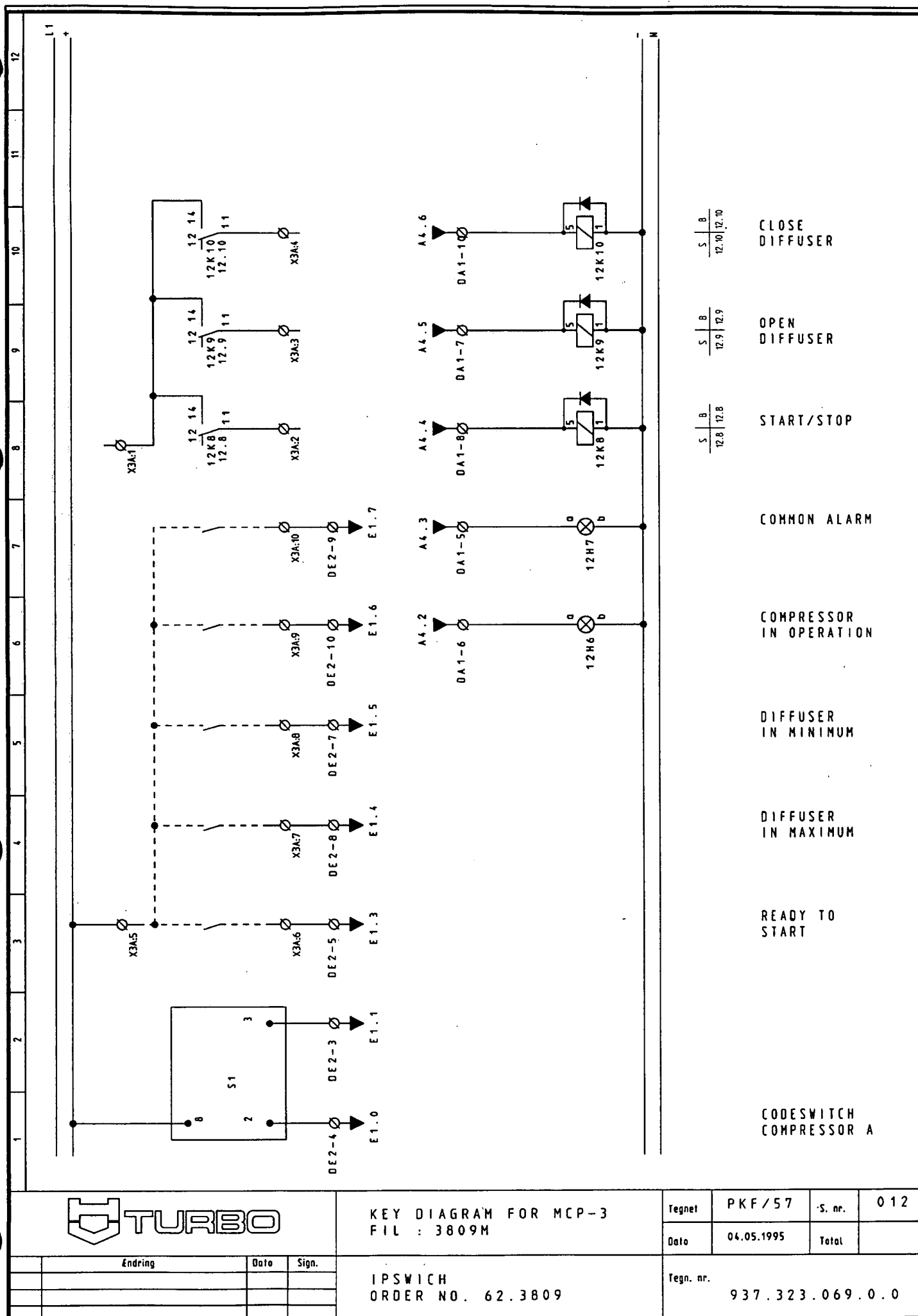
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Endring	Dato	Sign.

IPSWICH
ORDER NO. 62.3809





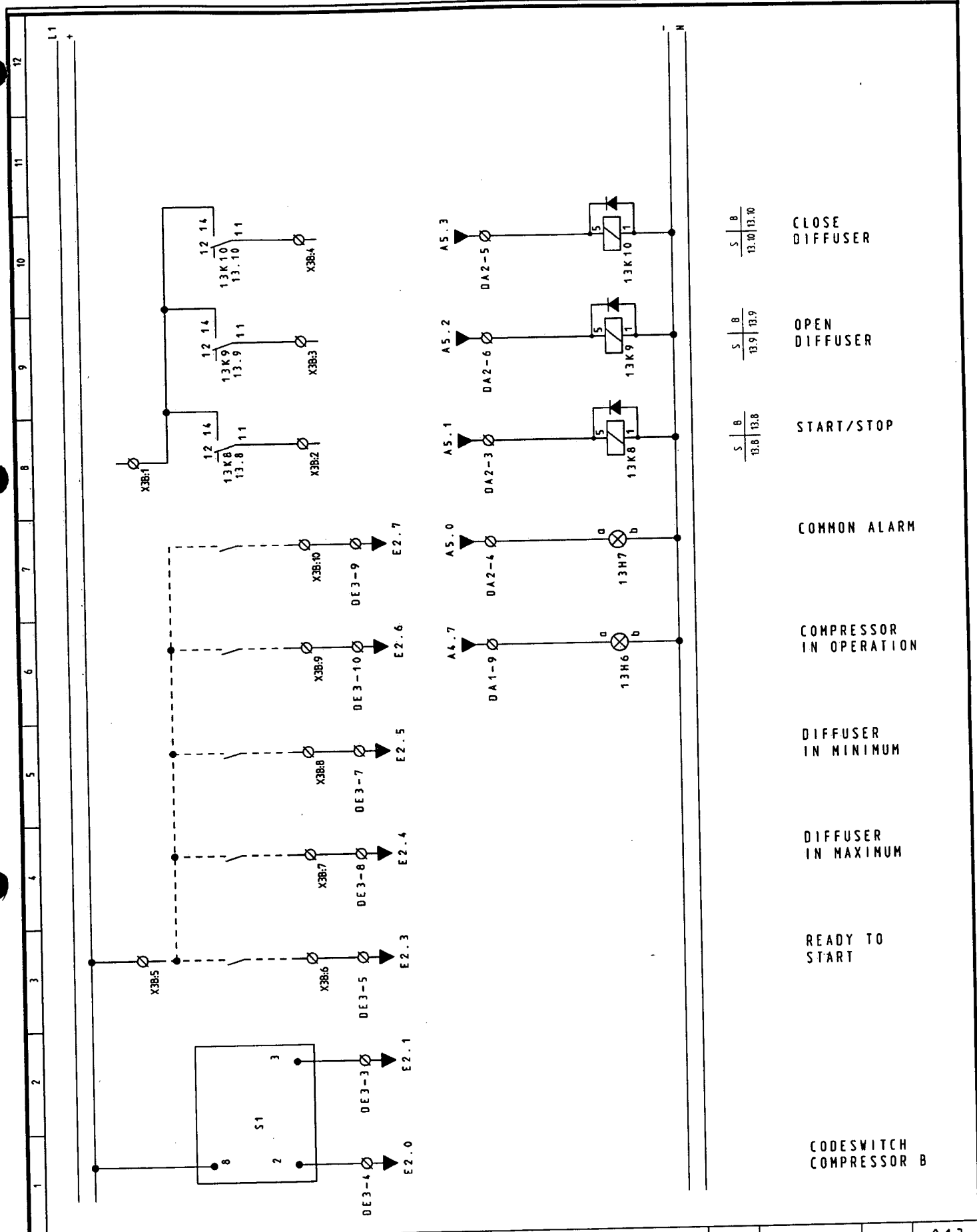


KEY DIAGRAM FOR MCP-3
FIL : 3809M

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Dato	04.05.1995	Total	

Tegn. nr.
937.323.069.0.0

IPSWICH
ORDER NO. 62.3809

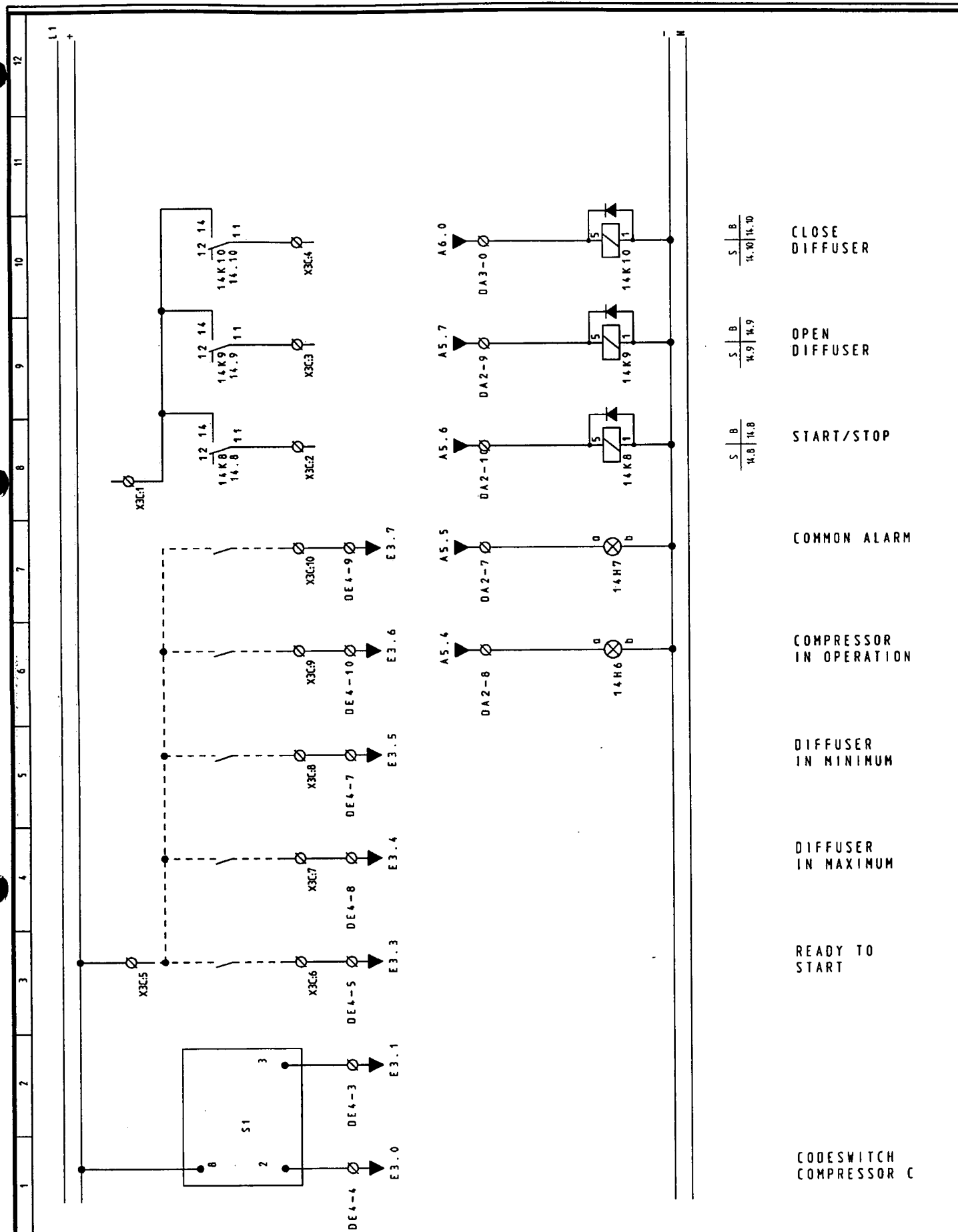


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FIL : 3809M

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Date	04.05.1995	Total	
Tegnet. nr.	937.323.069.0.0		

Ending	Date	Sign.

IPSWICH
ORDER NO. 62.3809

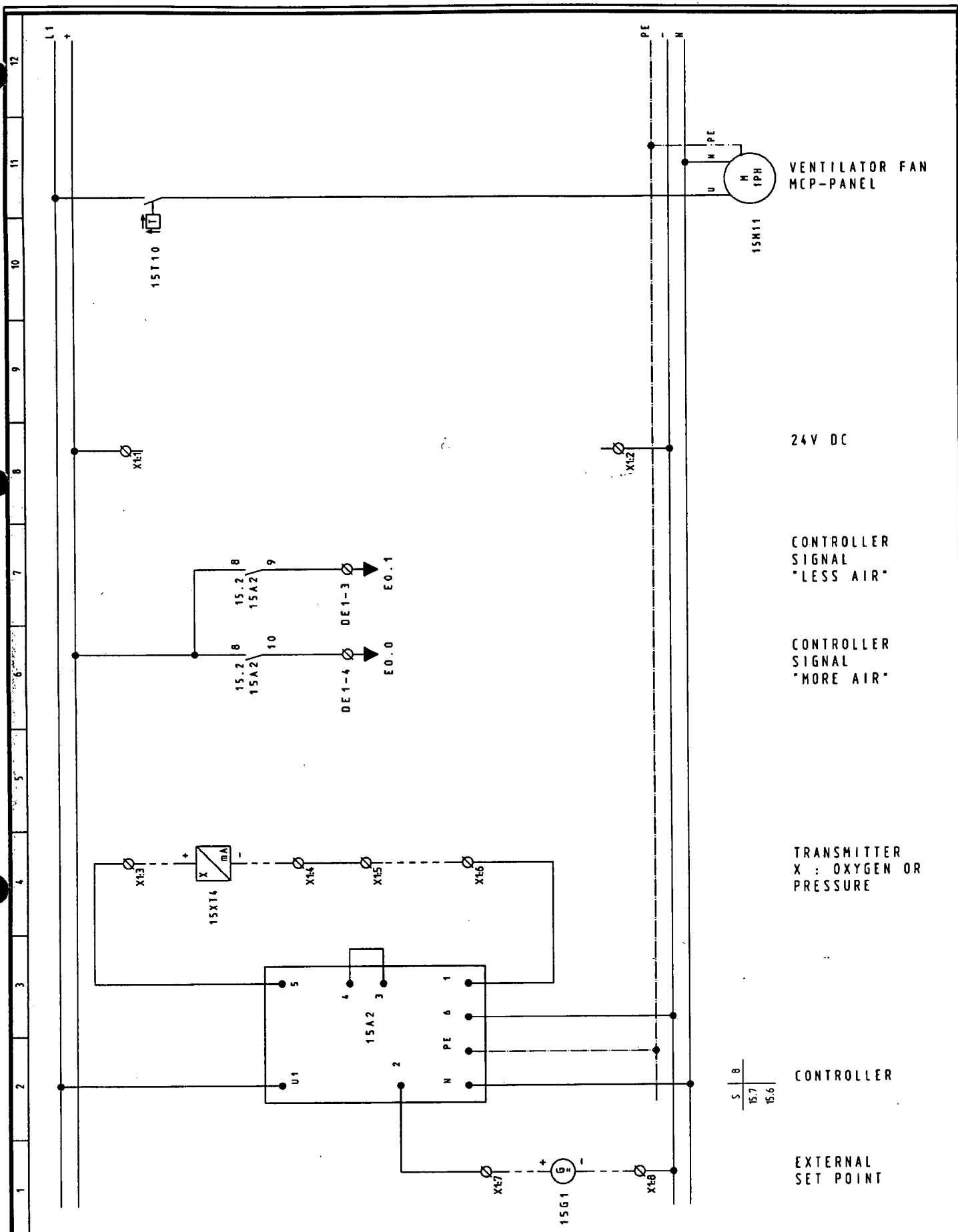


KEY DIAGRAM FOR MCP-3
FIL : 3809M

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Date	04.05.1995	Total	
Tegn. nr.	937.323.069.0.0		

Endring	Date	Sign.

IPSWICH
ORDER NO. 62.3809



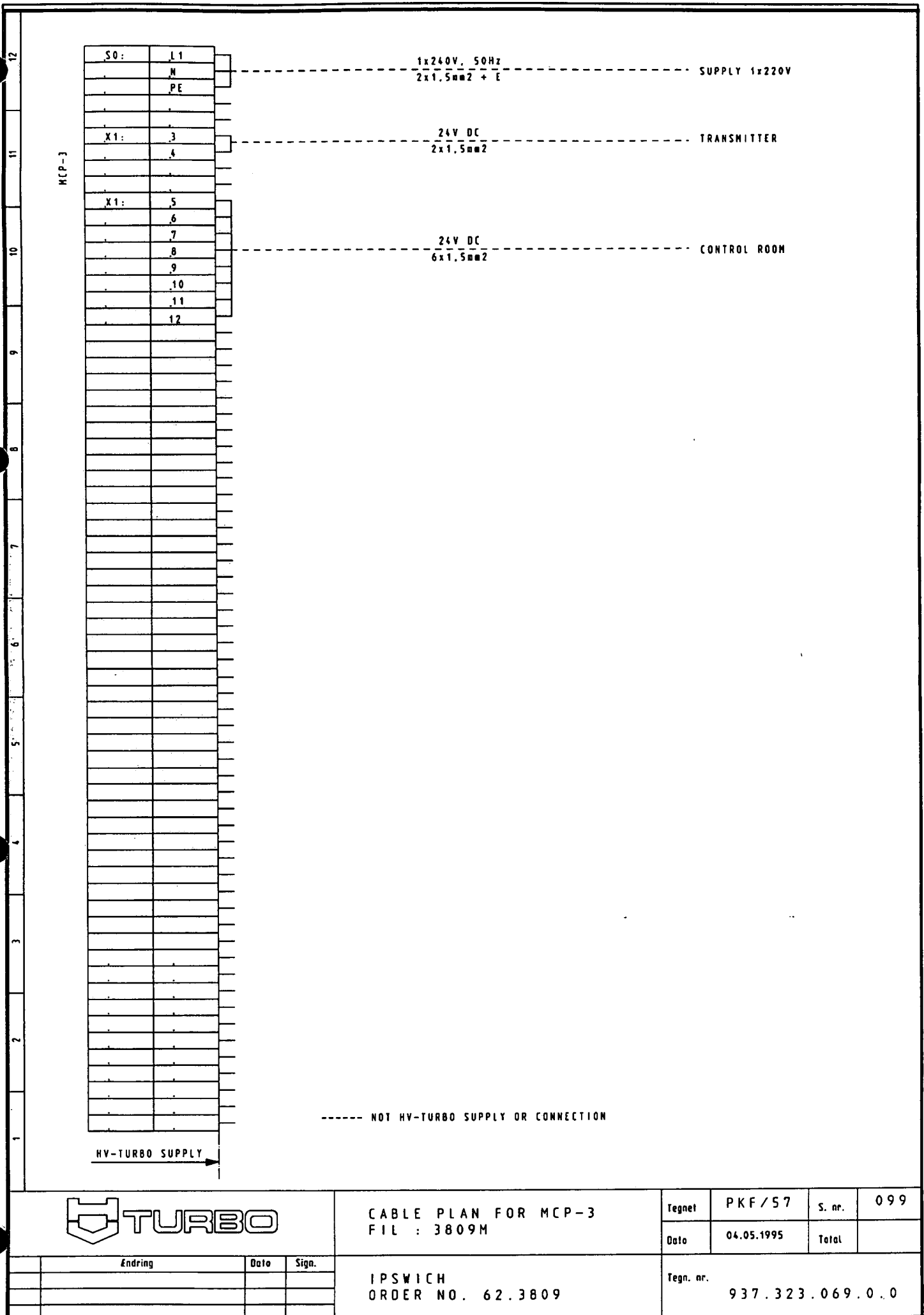
KEY DIAGRAM FOR MCP-3
FIL : 3809M

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Dato	04.05.1995	Total	

Endring	Dato	Sign.

IPSWICH
ORDER NO. 62.3809

Tegn. nr.	937.323.069.0.0
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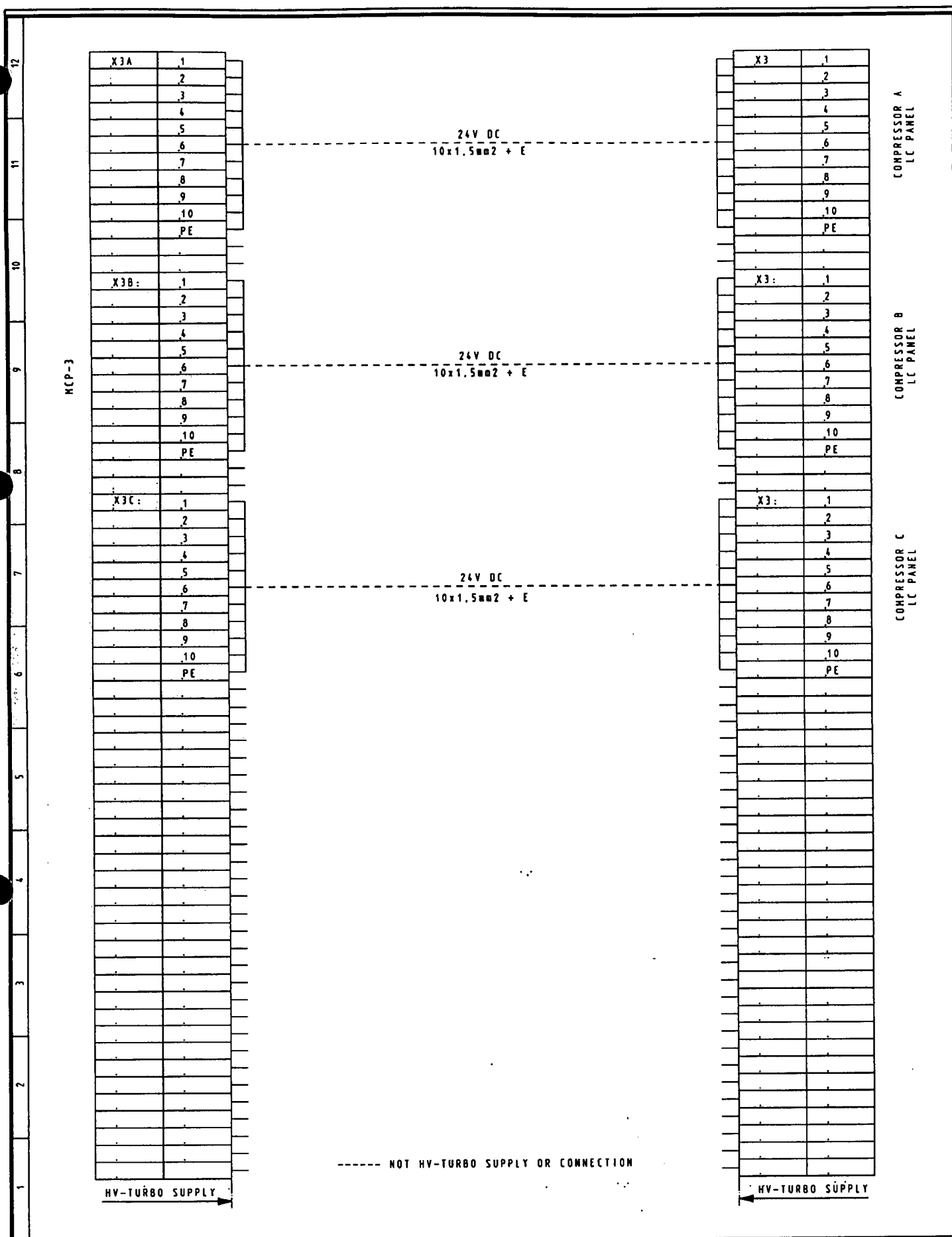
CABLE PLAN FOR MCP-3
FIL : 3809M

Tegnet	PKF/57	S. nr.	099
Dato	04.05.1995	Total	

Endring	Dato	Sign.

IPSWICH
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937.323.069.0.0



CABLE PLAN FOR MCP-3
FIL : 3809M


Tegnet	PKF/57	S. nr.	100
Dato	04.05.1995	Total	

Endring	Dato	Sign.

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ORDER NO. 62.3809


Tegn. nr.
937.323.069.0.0

TERMINAL LIST : S0

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)			
SUPPLY 1X240V, 50HZ	L1 N PE	010 1 010 2 010 2					
				Tegnet	PKF/57	S. nr.	150
FIL : 3809M				Dato	04.05.1995	Total	..
Endring	Dato	Sign.	IPSWICH ORDER NO 62.3809				
				Tegn. nr. 937.323.069.0.0			


TERMINAL LIST : X1

COMMENT		NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)
24VDC	+	1	015 8		
	-	2	015 8		
TRANSMITTER	+	3	015 4		
..0/4-20 mA	-	4	015 4		
REMOTE INDICATION	+	5	015 4		
..0/4-20 mA (OR JUMPER)	-	6	015 4		
EXTERNAL SET POINT	+	7	015 1		
..4-20 mA	-	8	015 1		
REMOTE START/STOP		9	015 1		
..OR JUMPER		10	015 1		
PLC AND 24 VDC		11	011 10		
..OK		12	011 10		


		FIL : 3809M		Tegnet	PKF/57	S. nr.	151
				Dato	04.05.1995	Total	..

Endring	Dato	Sign.	IPSWICH ORDER NO 62.3809	Tegn. nr. 937.323.069.0.0


TERMINAL LIST : X3A

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)			
COMMON.FROM.COMPR.A	1	012 8					
..START/STOP	2	012 8					
..DIFFUSER.OPEN	3	012 9					
..DIFFUSER.CLOSE	4	012 10					
24VDC.FROM.MCP	5	012 3					
..READY.FOR.START	6	012 3					
..DIFFUSER.IN.MAXIMUM	7	012 4					
..DIFFUSER.IN.MINIMUM	8	012 5					
..COMPR.IN.OPERATION	9	012 6					
..COMMON.ALARM	10	012 7					
				Tegnet	PKF/57	S. nr	152
FIL : 3809M				Date	04.05.1995	Total	..
Ending	Date	Sign.	IPSWICH ORDER NO 62.3809				
				Tegn. nr. 937.323.069.0.0			

TERMINAL LIST : X3B

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNCTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)																
COMMON.FROM.COMPR.B	1	013 8																		
..START/STOP	2	013 8																		
..DIFFUSER.OPEN	3	013 9																		
..DIFFUSER.CLOSE	4	013 10																		
24VDC.FROM.MCP	5	013 3																		
..READY.FOR.START	6	013 3																		
..DIFFUSER.IN.MAXIMUM	7	013 4																		
..DIFFUSER.IN.MINIMUM	8	013 5																		
..COMPR.IN.OPERATION	9	013 6																		
..COMMON.ALARM	10	013 7																		
<div></div>				<table><tr><td>Tegnet</td><td>PKF/57</td><td>S. nr</td><td>153</td></tr><tr><td>Data</td><td>04.05.1995</td><td>Total</td><td>..</td></tr></table>	Tegnet	PKF/57	S. nr	153	Data	04.05.1995	Total	..								
Tegnet	PKF/57	S. nr	153																	
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TERMINAL LIST : X3C

COMMENT	NUMBER	PAGE+POS.	BRIDGE	CONNECTED TO COMPRESSOR ? (Y/N OR MULTICONNECTOR)			
COMMON.FROM.COMPR.C	1	014 8					
..START/STOP	2	014 8					
..DIFFUSER.OPEN	3	014 9					
..DIFFUSER.CLOSE	4	014 10					
24VDC.FROM.MCP	5	014 3					
..READY.FOR.START	6	014 3					
..DIFFUSER.IN.MAXIMUM	7	014 4					
..DIFFUSER.IN.MINIMUM	8	014 5					
..COMPR.IN.OPERATION	9	014 6					
..COMMON.ALARM	10	014 7					
				Tegnet	PKF/57	S. nr	154
				Dato	06.05.1995	Total	..
Endring	Dato	Sign.	FIL : 3809M IPSWICH ORDER NO 62.3809				
			Tegn. nr.				
			937.323.069.0.0				

OPERATING INSTRUCTIONS MCP-3

The control panel is fitted with the following functions:

1. CHOICE OF PRIORITY
2. MONITORING CHOICE OF PRIORITY
3. ALLOCATION OF REGULATION
4. CHOICE OF PERIODIC REGULATING UP AND DOWN
5. CHOICE OF START COMPENSATION
6. CHOICE OF STOP COMPENSATION
7. CHOICE OF REMOTE CONTROL OF START/STOP
8. OXYGEN- OR PRESSURE-REGULATION BY MEANS OF INTEGRATED CONTROLLER

1. CHOICE OF PRIORITY

The control panel is equipped with a priority preselector for each compressor connected to: 12S1, 13S1 and 14S1. In this way the start/stop sequence of the connected compressors can be set. In order to avoid e.g. flow-back of water into the aeration system, the compressor of priority "1" does not stop.

Compressors which are not controlled by the MCP, will have priority "0".

Each priority can only be assigned ONCE, except for priority "0".

When the compressor in question is in operation, 12H6, 13H6 and 14H6 will be alight. In the case of operational failure, 12H9, 13H9 and 14H9 will be alight.

2. MONITORING CHOICE OF PRIORITY

After the selectors have been set, the key switch 11S2 must be turned back and forth rapidly (for max. 5 seconds) so that the lamp 11H2 does not go off. The choice of priority is now memorized, provided that the above rules have been observed.

Flashing of lamp 11H7 indicates incorrect allocation of priority and that memorizing has NOT taken place. 11H7 will continue to flash until correct priority has been allocated.

Key switch 11S2 furthermore acts as a delayed turn-off, which means that if switch 11S2 has been off for more than 5 seconds, the control panel will go out of operation and 11H2 simultaneously go off.

3. ALLOCATION OF REGULATION

The controller signals are generated on the basis of the set point values as well as the actual values in 15A2. The signals will be transformed by the MCP logic to an economically viable start/stop procedure for the compressors.

REGULATING UP (MORE AIR)

The compressor of priority "1" opens its diffuser until maximum position is reached, while the compressor of priority "2" will start up and begin to open its diffuser.

The same procedure applies to 2nd and 3rd priority.

REGULATING DOWN (LESS AIR)

The compressor of priority "3" closes its diffuser, whereupon the compressor of priority "2" will begin to close its diffuser. When both diffusers are in minimum position, the compressor of priority "3" will stop after a while.



OPERATING INSTRUCTIONS
FIL : 3809M

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The same procedure applies to 2nd and 1st priority.

As a general rule, a compressor indicating error will be ignored by the master control and all regulation passed on to the compressor of next priority.

4. CHOICE OF PERIODIC UP AND DOWN REGULATION

To avoid overloading of the compressor motors (electric motors) at falling ambient temperature, an optional postregulating function is at your disposal by means of which all diffusers will be regulated down for 3 seconds and up for 5 seconds once every operational hour. In this way the max. permissible load of the drive motor will be re-established.

This function is chosen by maintaining connection 11S5.

5. CHOICE OF START COMPENSATION

On choosing start compensation, the following will occur:

REGULATING UP

The compressor of priority "1" opens its diffuser until maximum position has been reached, acc. to the air consumption required. After a while the compressor of priority "2" receives a start signal, while the diffuser of priority "1" simultaneously begins to close. When the compressors of priority "1" and "2" have been in operation for a while with both diffusers in minimum, the diffuser of priority "1" will begin to open until maximum position has been reached. If more air consumption is still required, the diffuser of priority "2" will begin to open.

The same procedure applies to priorities "2" and "3".

This function is recommended for systems with very long time constants, e.g. large reservoirs with O₂-measuring.

This function is selected by maintaining connection 11S3.

6. CHOICE OF STOP COMPENSATION

On choosing stop compensation, the following will occur:

REGULATING DOWN

The compressor of priority "3" closes its diffuser until minimum position has been reached. The compressor of priority "2" will then begin to close its diffuser. When both diffusers have been in minimum position for a while, the compressor of priority "3" will receive a stop signal. At the same time the diffuser of priority "2" will begin to open. When diffuser of priority "2" is in maximum position, and the compressor of priority "3" has stopped, the diffusers of priority "2" will begin to close.

The same procedure applies to priority "2" and "1".

This function is selected by maintaining connection 11S4.

7. CHOICE OF REMOTE CONTROL OF START/STOP

For the functions "Remote Control of Start/Stop", terminals X1:9 and X1:10 can be used. Between these two e.g. a switch may be installed.



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8. OXYGEN- AND PRESSURE REGULATION BY MEANS OF INTEGRATED CONTROLLER

Due to the fact that the delay periods for start/stop of the subsequent compressor depend on the regulating system adopted (by oxygen or by pressure), there is a choice between these two:

If by oxygen: Maintain connection 11S6.

If by pressure: Remove connection 11S6.



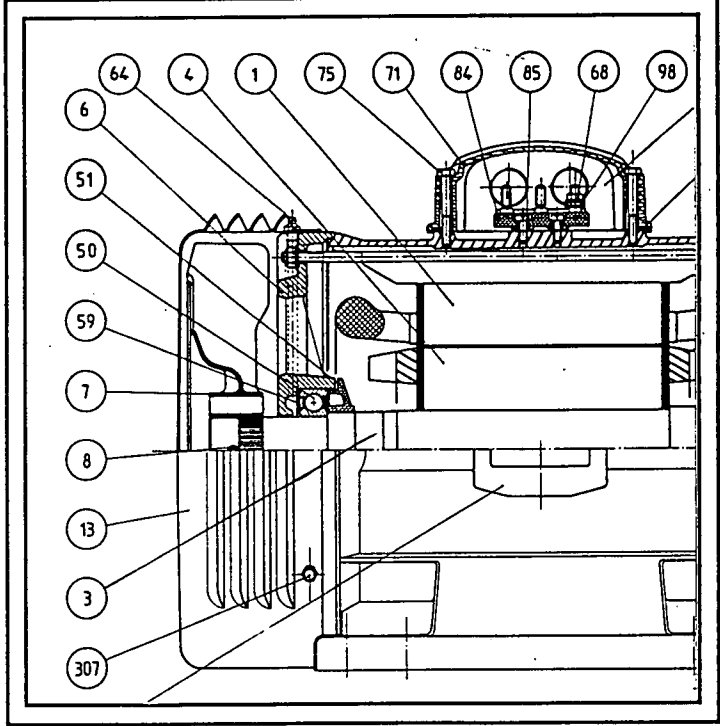
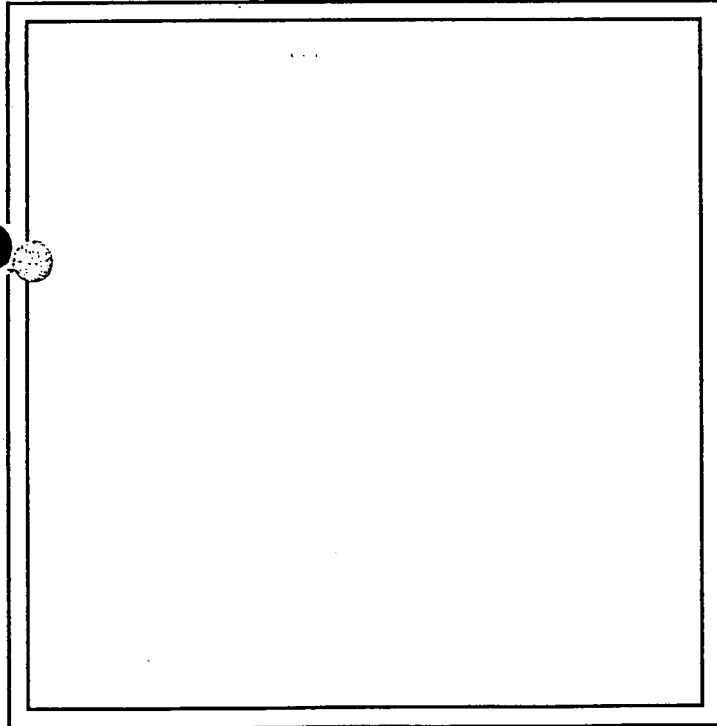
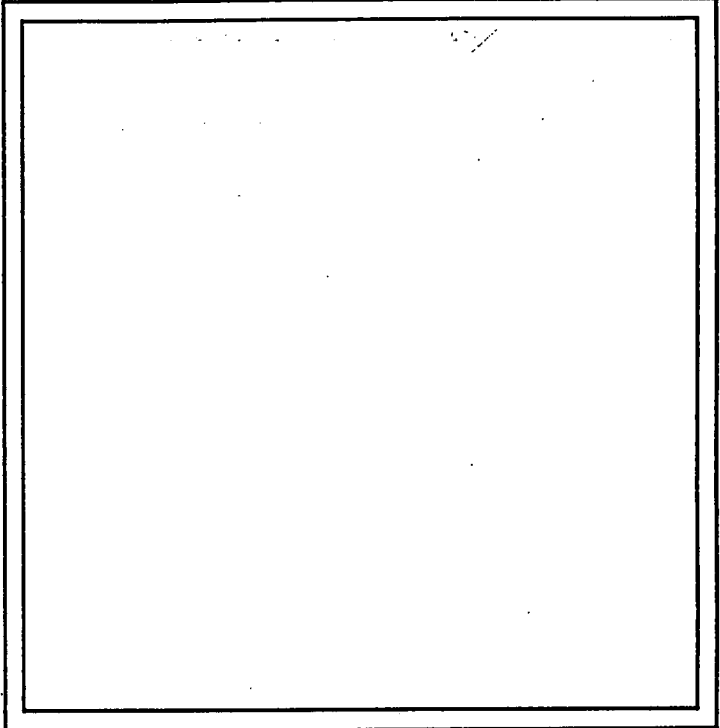
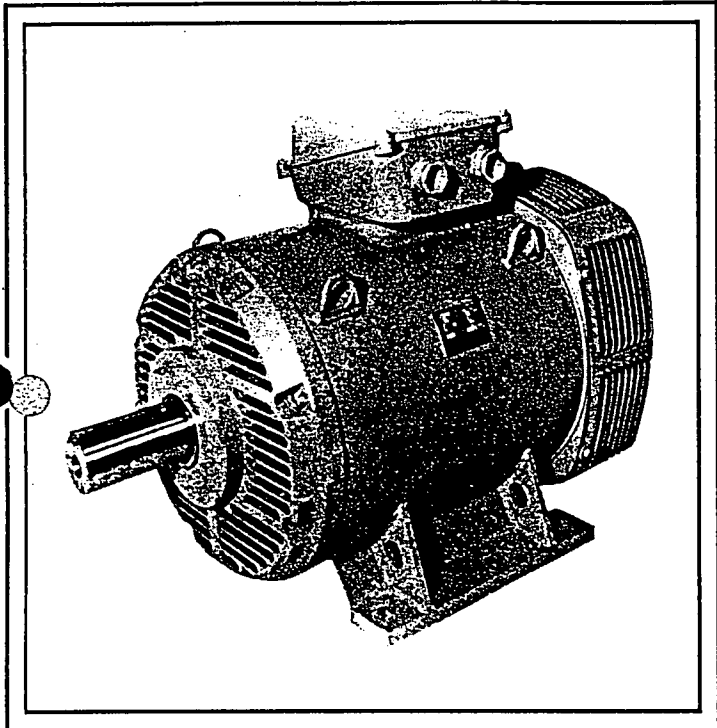
OPERATING INSTRUCTIONS
FIL : 3809M

Tegnet	PKF/57	S. nr.	202
Dato	26.06.1995	Total	

Endring	Dato	Sign.

IPSWICH
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Tegn. nr.
937.323.069.0.0



● **PRESTIBLOC O.D.P. (IP 23 S)**
squirrel cage motors

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STARTUP*Positioning*

The engine should be installed in a properly ventilated location (cf. B1-207/3 «Choosing an engine»). A check should also be made to ensure that no hot air is recycled.
In the case of roller bearings, release the shaft.

Electrical checks

For startup after a period in storage, or following an extended stoppage (of several weeks) in a damp atmosphere, the engine should be dried out for 24 hours at 100 to 110°C, or supplied with approximately 20% of the rated voltage. In either case, before use, check that insulation, under 500 volts DC for 60 seconds, is not less than 10 megohms.

Drive connection

Turn over the engine before connecting it up, in order to detect any damage suffered in transit.

a) Direct drive

Machines must be carefully aligned, checking that differences in the concentricity and parallelism of the two half-couplings do not exceed 1/10 th mm.

b) Pulley drive

The engine is usually mounted on slides, for the most convenient adjustment of belt tension and pulley alignment.

For any details concerning pulleys and belts, see document B 101-203/2 «Pulleys and belts for short-circuit rotor protected engines». Remember that the SMALLER THE PULLEY, THE GREATER WILL BE THE STRAIN ON THE SHAFT END, AND THE SHORTER THE LIFESPAN OF THE BEARING.

c) Gear drive

Driving pinion-wheel details must be stated when ordering : number of teeth, moduli, type of cutting (straight or helicoidal), and our design office's approval must be obtained.

Geared couplings require careful assembly of the pinion.

d) For engines with two shaft ends, the end coming out on the ventilation side is kept for direct-drive connections.

GENERAL RECOMMENDATIONS

Parts fitted to engine shafts should always be balanced carefully.

They should be fitted on tightly :

- cold by tapered tightening sleeve ;
- hot, for single-piece parts.

The overhang should be kept as small as possible, and where in doubt please consult us.

Electrical connection

See the maker's plate, and the layout glued inside the terminal box. Any thermal protection devices should be led back to the terminal box. Mains connection to the engine should be done by eyelet-to-eyelet connections. Before switching on, check that the nuts on the terminal plate have been tightened.

STEVE
FOOTE

0403 059 268

3281-1700

3281, 2299

TYPE	Driving side bearing	Max. rotor weight kg (4 poles)	8 hours/day duration of bearings 20 à 30 000 hrs				24 hours/day duration of bearings 40 à 60 000 hrs				24 hours/day with high security 100 000 hrs			
			3000 min ⁻¹	1500 min ⁻¹	1000 min ⁻¹	750 min ⁻¹	3000 min ⁻¹	1500 min ⁻¹	1000 min ⁻¹	750 min ⁻¹	3000 min ⁻¹	1500 min ⁻¹	1000 min ⁻¹	750 min ⁻¹
P 160 M	6210	20	145	205	235	260	115	145	165	180	90	115	140	145
P 160 LMG	6310	25	260	360	415	450	200	260	290	320	160	200	230	260
P 180 ML	6212	30	205	245	320	350	155	200	225	240	110	155	180	200
P 180 G	6312	40	340	425	550	610	270	340	390	430	190	270	310	340
P 200 M	6313	50	385	490	620	680	300	390	435	485	215	300	350	385
P 200 LMG	6314	60	435	540	695	770	340	435	490	550	245	340	360	435
P 225	6314	75	435	540	695	770	340	435	490	550	245	340	360	435
P 250	6317	110	555	690	890	985	390	555	630	700	310	390	450	600
P 250 G	6318	150		740	960	1030		585	675	755		420	485	600
P 280 2 P	6315	120	475				330				260			
P 280	6318	150		740	960	1030		585	675	755		420	485	600
P 280 G	6320	150		900	1035	1145		655	820	915		510	590	655
P 315 2 P	6316	240	520				365				290			
P 315	6320	280		900	1035	1145		655	820	915		510	590	655
P 315 G 2 P	6317	320	555				390				310			
P 315 G	6322	460		1050	1210	1360		760	960	1050		600	690	750

SERVICING

Bearing – Lubrication

Permitted axial stresses for continuous operation in a horizontal position.

The permitted axial stress in a vertical position is obtained by adding or subtracting the weight of the rotor from the values shown above, depending on the direction of the force applied to the shaft.

NB : In all cases, radial stresses act on the bearing on the coupling side, and axial stresses are borne by this same bearing.

Engines are normally lubricated, when they leave the factory, with a soap and lithium-based grease : Stabilube No. 2 - Sophos. For regular lubrications, however, we recommend J.M.F.R.-type greases, complying with AFNOR E 60 200.

Lubrication is recommended with the engine in service.

The lubrication frequency shown below applies to a maximum bearing temperature of 85°C. This frequency should be divided by two for every additional 15°C.

TYPE	Front bearing	Rear bearing	Quantity of grease	Frequency of lubrication			
				2 POLES	4 POLES	6 POLES	8 POLES
P 160 (1)	6210 2 RS C3	6208 2 RS C3			20000 H ⁽¹⁾	30000 H ⁽¹⁾	40000 H ⁽¹⁾
P 160 LMG (1)	6310 2 RS C3	6210 2 RS C3			20000 H ⁽¹⁾	30000 H ⁽¹⁾	40000 H ⁽¹⁾
P 180 ML (1)	6212 2 RS C3	6210 2 RS C3			20000 H ⁽¹⁾	30000 H ⁽¹⁾	40000 H ⁽¹⁾
P 160 M (2)	6210 ZC 3	6208 ZC3	15 g	2200 H	5000 H ⁽²⁾	7500 H ⁽²⁾	8000 H ⁽¹⁾
P 160 LMG (2)	6310 ZC3	6210 ZC3	15 g	2200 H	5000 H ⁽²⁾	7500 H ⁽²⁾	8000 H ⁽²⁾
P 180 ML (2)	6212 ZC3	6210 ZC3	20 g	1700 H	4500 H ⁽²⁾	7200 H ²	8000 H ⁽²⁾
P 180 G	6312 C3	6212 C3	20 g	1700 H	4500 H	7200 H	8000 H
P 200 M	6313 C3	6212 C3	25 g	1400 H	4200 H	6800 H	8000 H
P 200 LMG	6314 C3	6214 C3	30 g	1200 H	3800 H	6500 H	8000 H
P 225	6314 C3	6214 C3	30 g	1200 H	3800 H	6500 H	8000 H
P 250	6317 C3	6314 C3	40 g	800 H	3000 H	5200 H	8000 H
P 250 G	6318 C3	6315 C3	45 g		2800 H	5100 H	7600 H
P 280 2 P	6315 C3	6315 C3	30 g	1100 H			
P 280	6318 C3	6315 C3	45 g		2800 H	5100 H	7600 H
P 280 G	6320 C3	6316 C3	50 g		2600 H	5000 H	7300 H
P 315 2 P	6316 C3	6316 C3	35 g	1000 H			
P 315	6320 C3	6316 C3	50 g		2600 H	5000 H	7300 H
P 315 G 2 P	6317 C3	6317 C3	40 g	800 H			
P 315 (G)	6322 C3	6317 C3	60 g		2200 H	4400 H	6600 H

- (1) Standards : sealed bearing (For 2 poles, regreasable bearing)
(2) Regreasable bearings (on request for the 4 - 6 - 8 poles)

Recommendation

The interval elapsing between two lubrications should never exceed one year. After extended storage, for more than this period, it is advisable for perform several successive lubrications, to ensure that the lubricant has been entirely replaced.

Ventilation

Care should be taken that circulation of air is not reduced as a result of partial blocking of protective grids. Air enters the engine on the drive side, and leaves it on the ventilation side.

Unusual noises

Noises and unusual vibrations are often caused by damage to bearings, or worn bearings, and it is advisable to replace them, to avoid the risk of any blocking, which could seriously affect the engine and auxiliaries.

DISASSEMBLY

Motors P 160 - 180 - 200 and **225**

Fig. 1

The engine is bare, without any transmission components :

- Remove the cover (13) after removing the 4 screws (307).
- Remove the fan (7), using a hub-extractor, or, failing this, two levers resting on the support.
- Remove assembly rods (14)
- Using a bronze rod, remove the supports (5 and 6), by tapping the assembly keepers.
- Remove the bearings (30) and (50), using a hub extractor.
- Note the presence of a Borelly preload washer (59).

Motors P 250, 280, 315 and 315 G

Fig. 2

The engine is bare, without any transmission components :

- Unscrew the lubricator (64) and its extension (65)
- Remove the cover (13) after removing the 4 screws (307)
- Unscrew the nut or screw (9) locking the fan (7)
- Remove the fan, using the apertures round the hub to place a hub extractor in position.
- Unscrew the screws (270) and (273) fastening the supports (5) and (6) (P. 315 and 315 G).
- Remove the screws (40) and (62) fastening the covers from each bearing, being careful to replace each one of them in turn with extraction rods.
- Remove the outer covers (32) and (52) from the bearings.
- Loosen the moving part (35) of the lubrication valve, acting as the retaining nut for the drive side bearing.
- Fit a central screw extractor on the extractor rods, being careful to protect the shaft end with a thick washer ; remove the support (5), bearing (30) and inside cover (33) as an assembly.
- Proceed in the same way for the other side, after removing the needle screw (57) from the moving valve (56) (P. 315 - 315 G)
- Check the presence of bearing preload springs (59) and struts (390).
- Remove bearings from supports, using a bronze rod.
- Remove the rotor (3), from the stator being careful not to damage the windings.

PRIOR TO REASSEMBLY**Stator**

Must be dusted and dried, so as to obtain insulation of at least 10 megohms. Clean fittings carefully, and remove any traces of disassembly operations from supporting surfaces.

If the winding is being degreased, ensure that the right solvent is used, with no harmful effect on the insulators ; it must be dielectric.

Rotor :

Clean bearing surfaces

Check that threadings, keys or lugs and their matching recesses are in good condition.

Bearing supports :

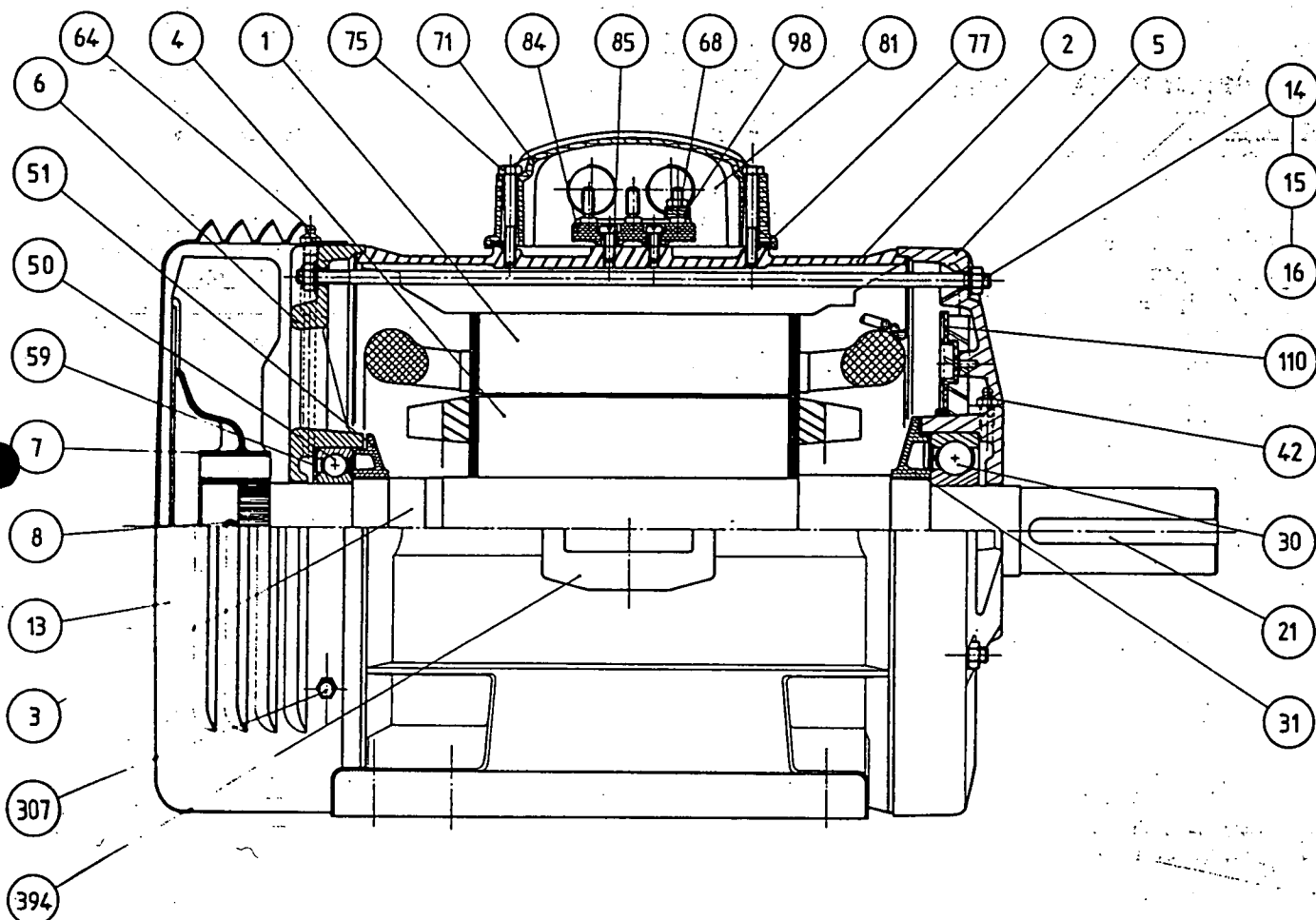
Must be free of any dirt, and coated inside with anti-flash varnish, and outside with good-quality heat-resistant paint. Grease valves and caps should be cleaned.

REASSEMBLY

Fig. 1 and 2.

- Fit the inner covers (33) and (53) on to the rotor, together with the preload springs (P. 250 to 315 G) and struts (390).
- Place bearings on rotor, after heating them to about 80° C, preferably in an oil bath.
- Insert the rotor into the stator, being very careful not to damage the windings.
- Screw a pin into one of the threaded holes in the inner covers, to hold them in position while the supports are being fitted. Check that lube passages are correctly positioned (P. 250 to 315 G).
- Heat the ventilation side support hub , add the preload washer (P. 160 to 225) fit it on.
- Carry out the same procedure for the drive side support.
- Fit the assembly rods (14) and their nuts (15) (P. 160 to 280), or support assembly screws (P. 315 and 315 G).
- Complete assembly of drive side bearings by fitting the moving valve (35).
- Block the needle screw (36), fit the outer cover, and tighten the screws (40) (P. 250 to 315).
- Carry out the same procedure for the ventilation side bearing (P 315 and 315 G).
- After refitting and locking the fan (P 250 to 315 G), fit the fan cover (13) and tighten screws (307).
- Screw on lubricator (64) and its extension (65).
- Check that assembly has been satisfactorily completed by turning the engine over by hand, to ensure that there is no axial play.
- If necessary, repaint the engine.

Figure 1
P 160 - 180 - 200 - 225



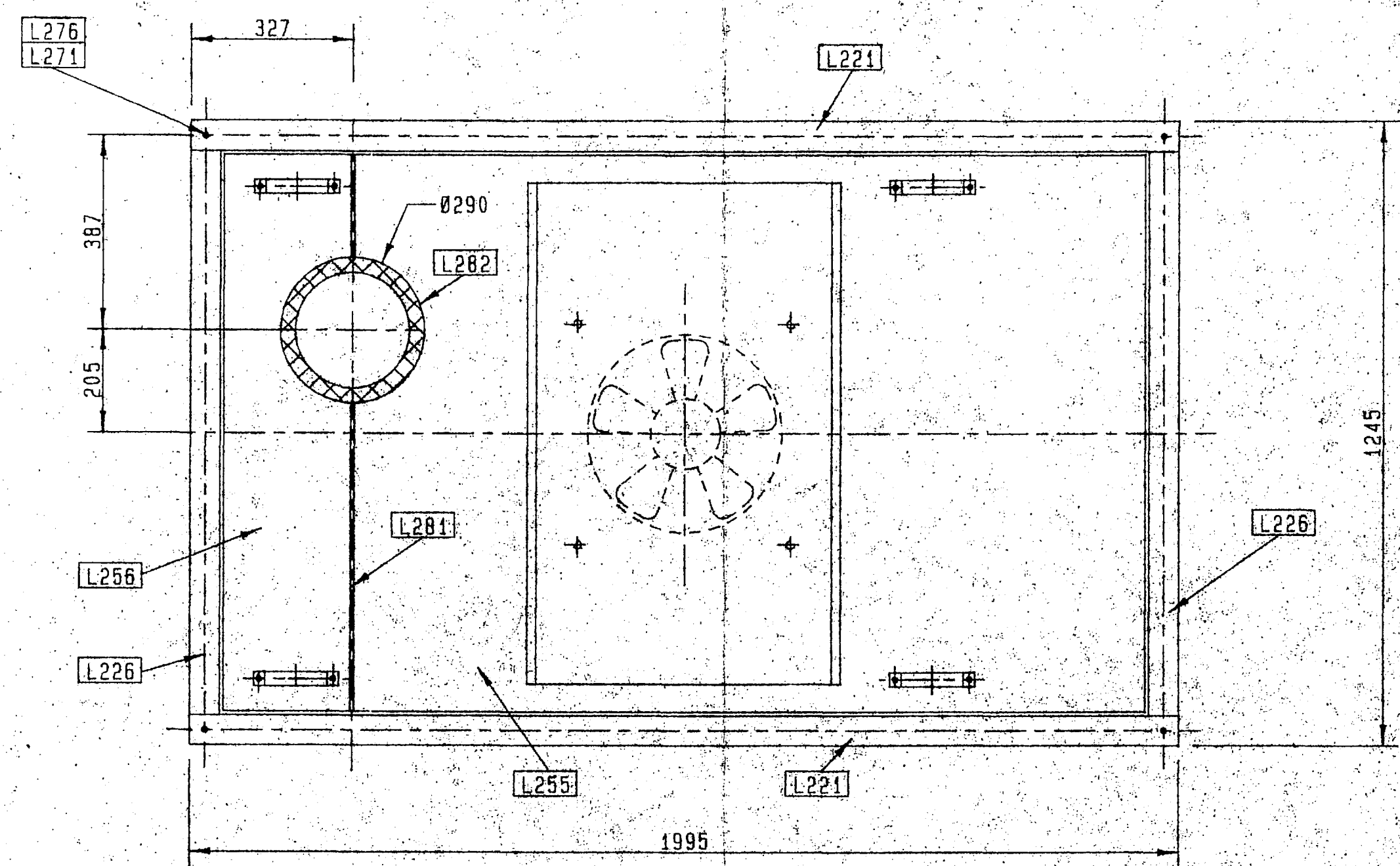
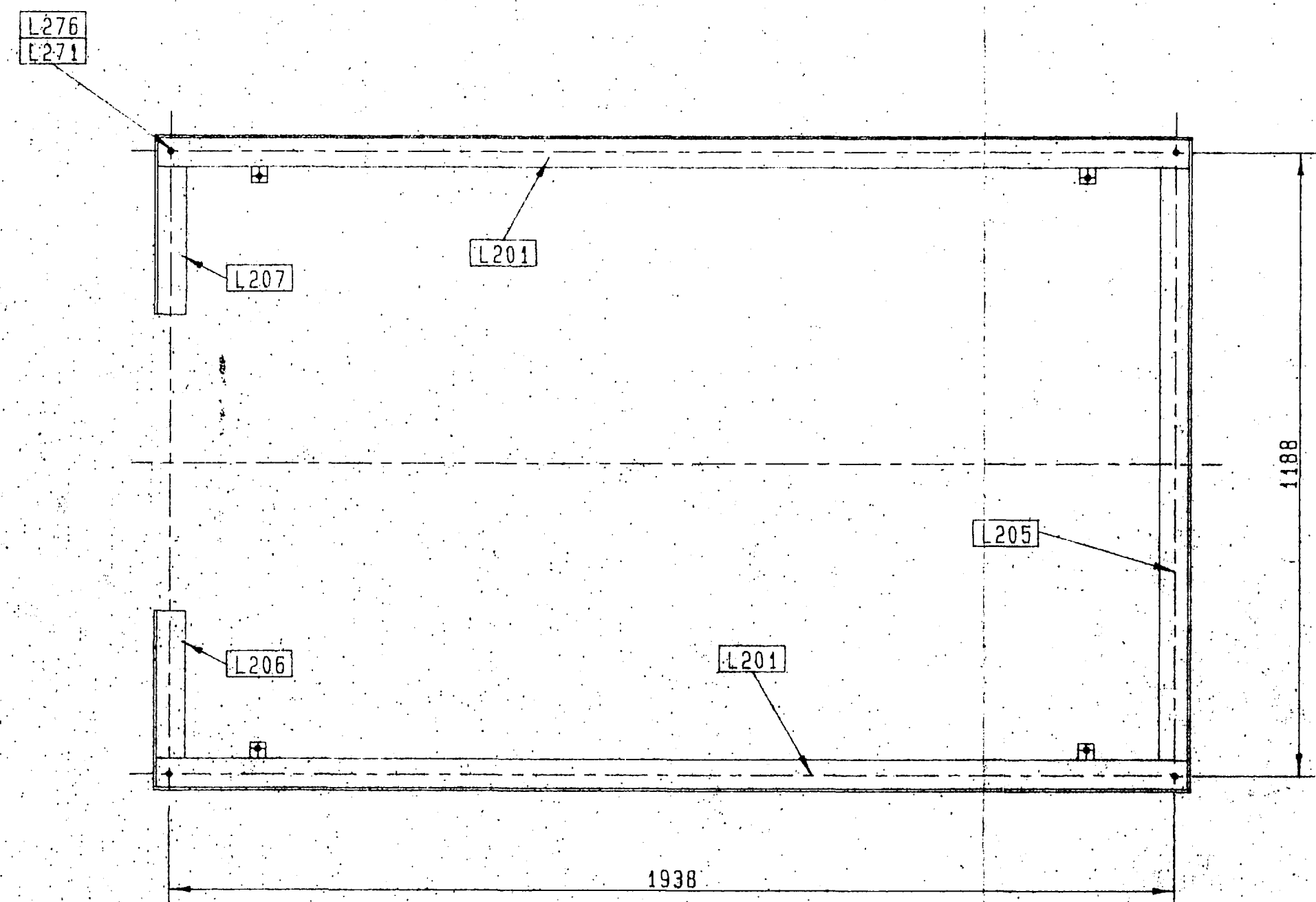
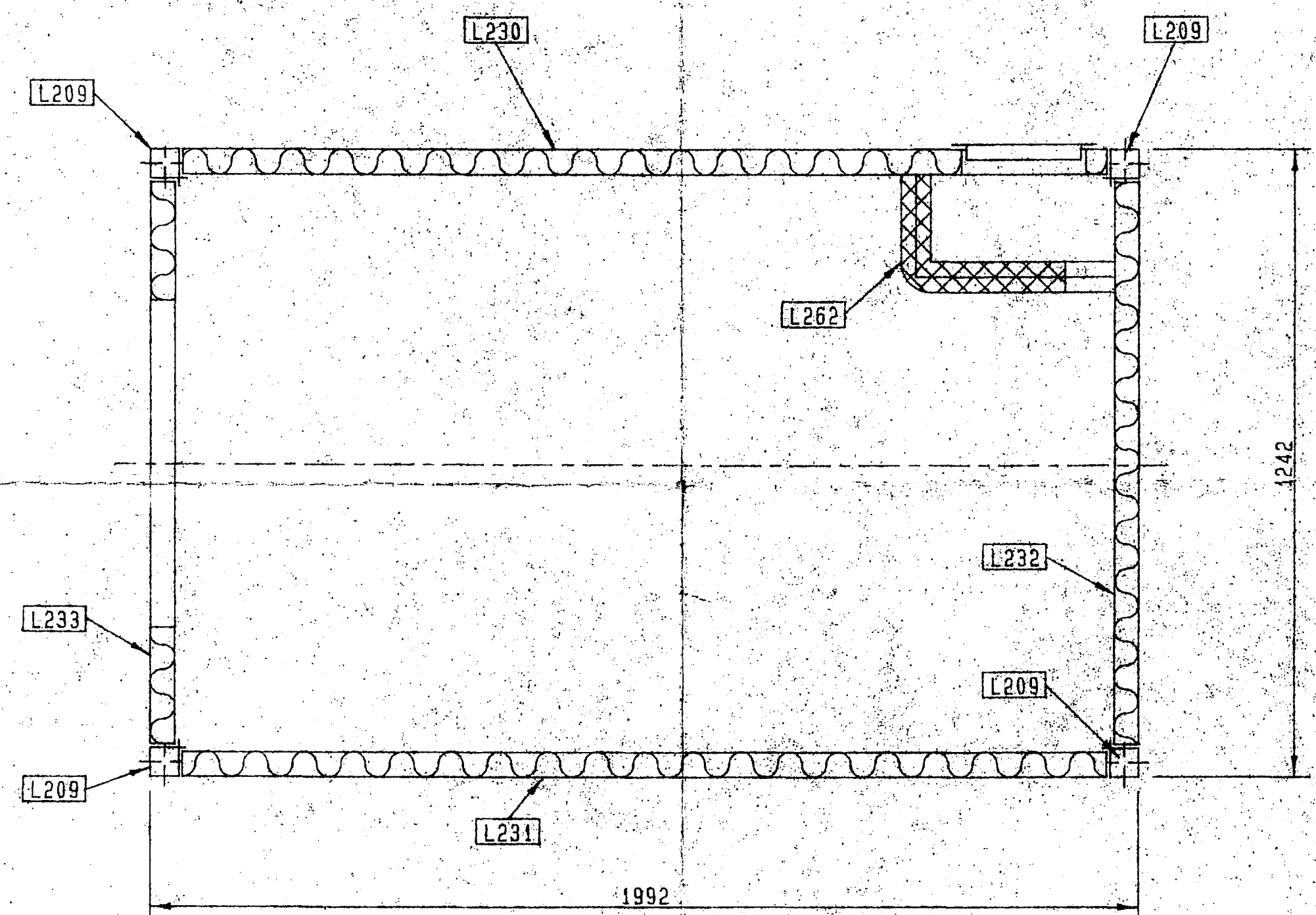
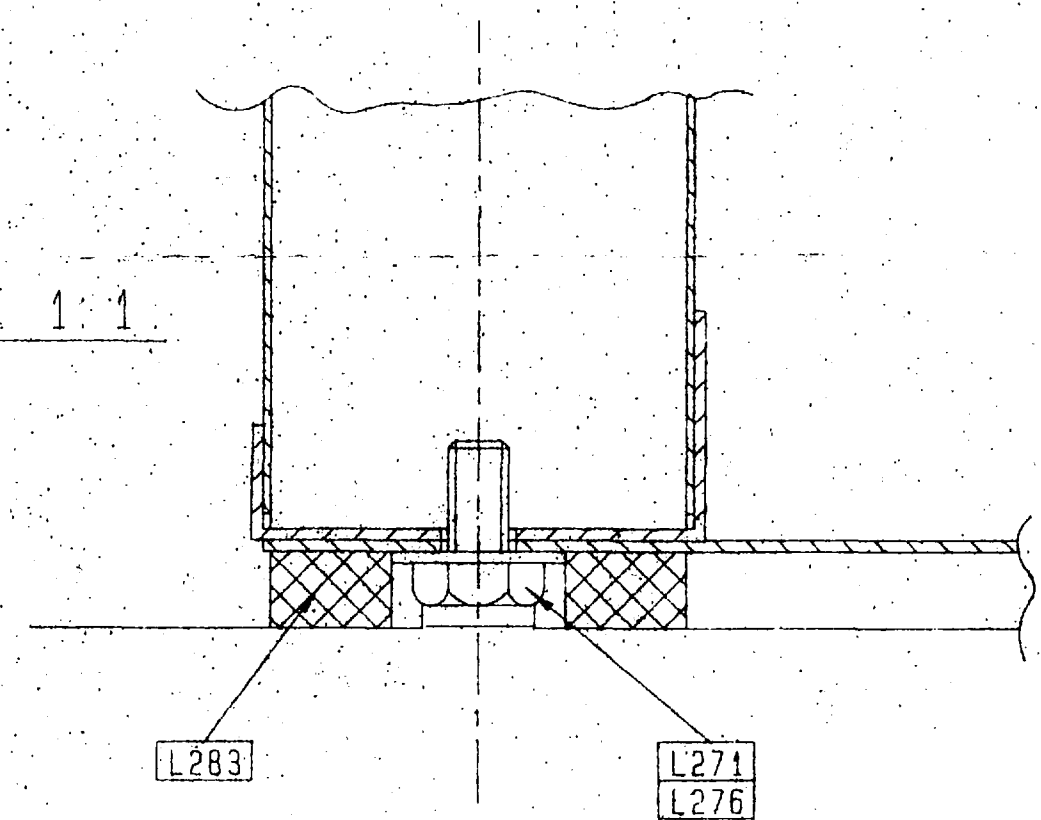
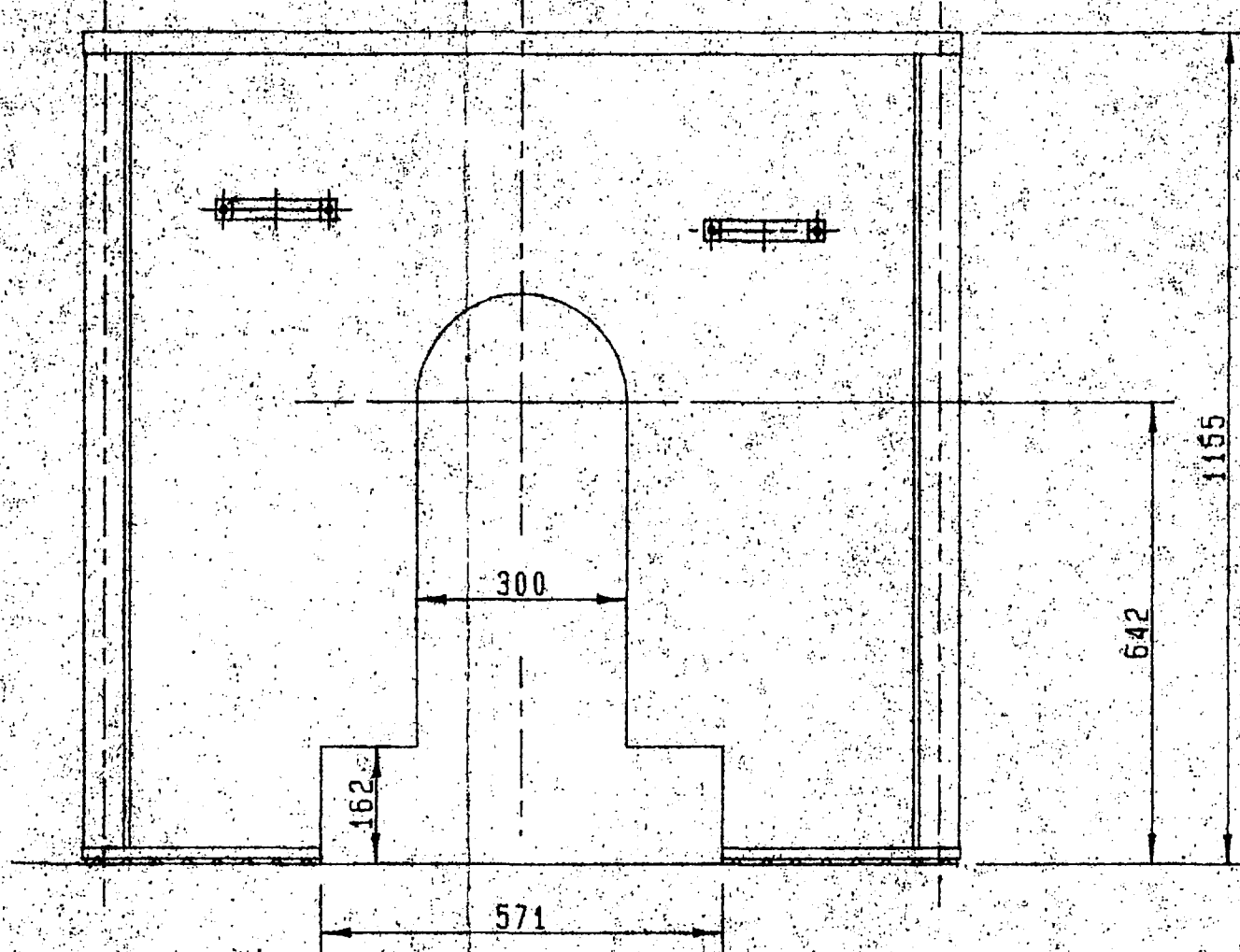
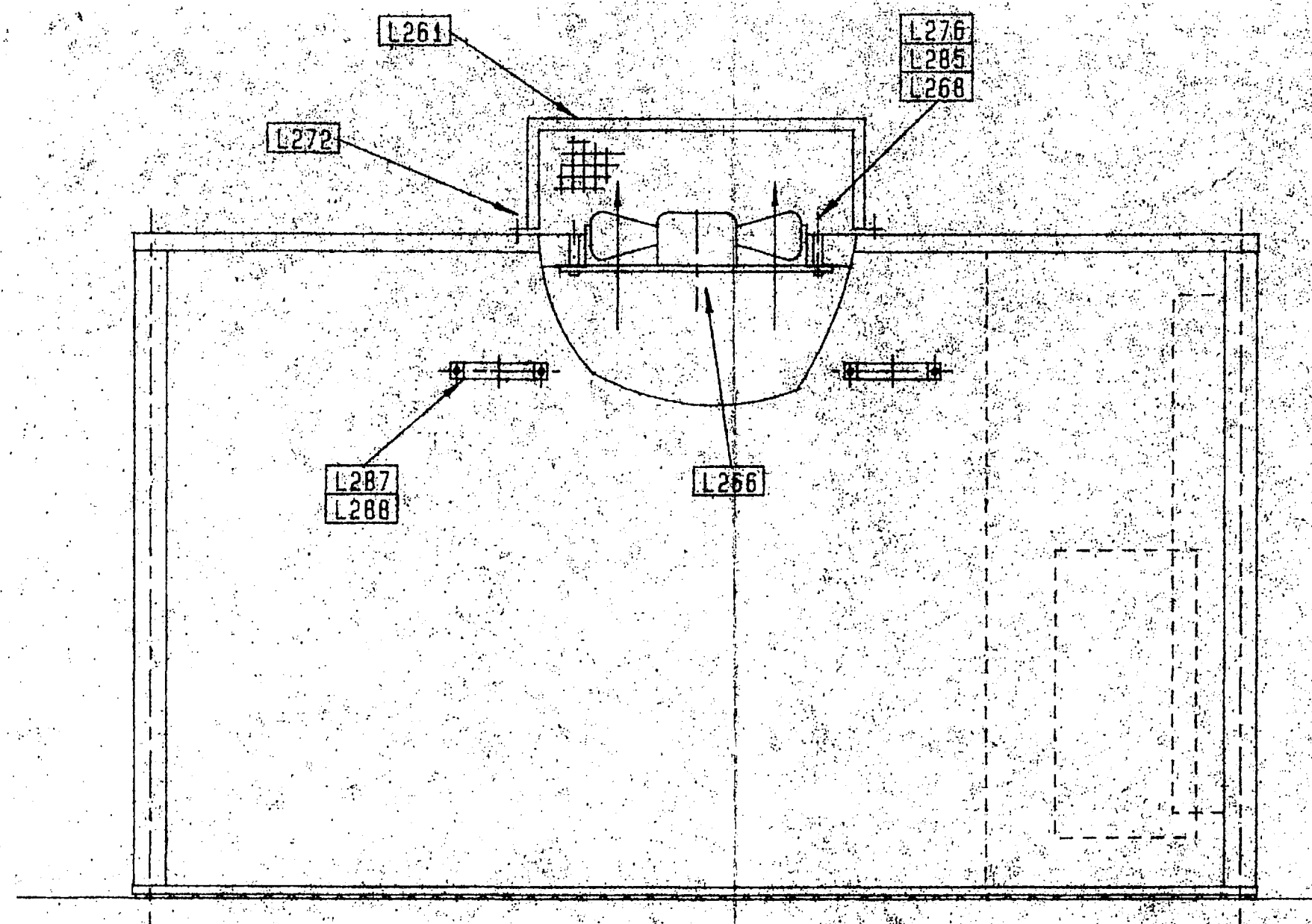
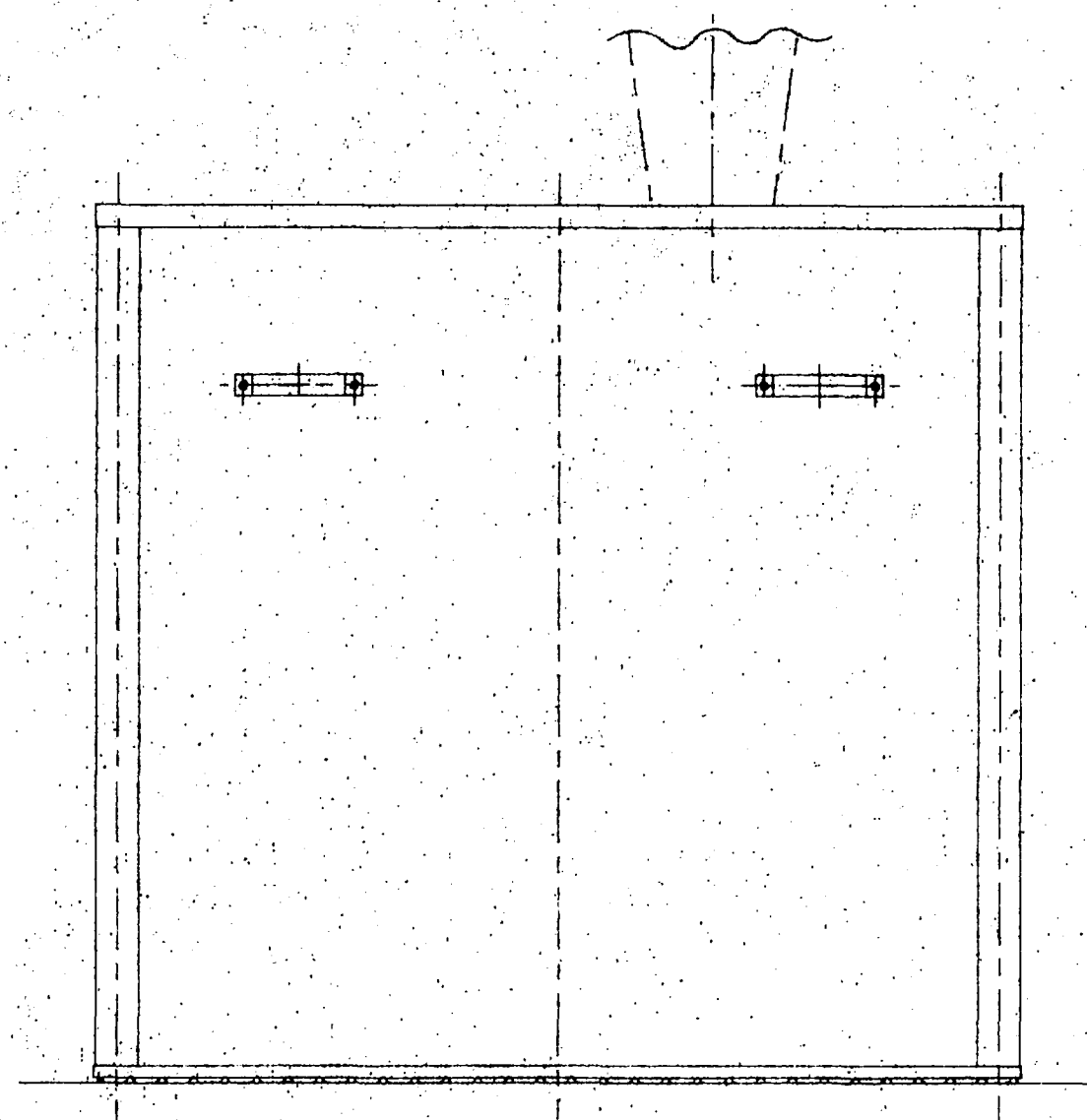
P 160, 180, 200 and **225**

- | | |
|-------------------------------|------------------------------------|
| 1 Wound stator | 50 Preload bearing |
| 2 Carcass | 51 Back lube chamber |
| 3 Rotor | 59 Borelly washer |
| 4 Rotor weight | 64 Lubricator |
| 5 Support on drive side | 68 Terminal lut (LS motor) |
| 6 Support opposite drive side | 71 Terminal box (LS motor) |
| 7 Fan or turbine | 75 Terminal box lid fastener screw |
| 8 Fan pin | 77 Lid seal |
| 13 Cover | 81 Gland support plate |
| 14 Assembly rods | 84 Terminal plate |
| 15 Assembly nut | 85 Terminal plate fastener screw |
| 16 AZ lock washer | 98 Connection strip |
| 21 Shaft-end key | 110 Protective grid |
| 30 Fixed bearing | 307 Cover fastener screw |
| 31 Front lube chamber | 394 Maker's plate base |
| 42 Lubricator | |

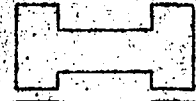
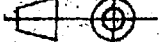


10.00 REFERENCE DRAWINGS & MINOR MANUALS

- 933 080 038 0.0, Acoustic Enclosure
- Bernard Actuator Manual (for blow-off valve)
- Wouter Witzel Eurovalve (blow-off valve)
- YQ.148-20, Blower Building, General Arrangement

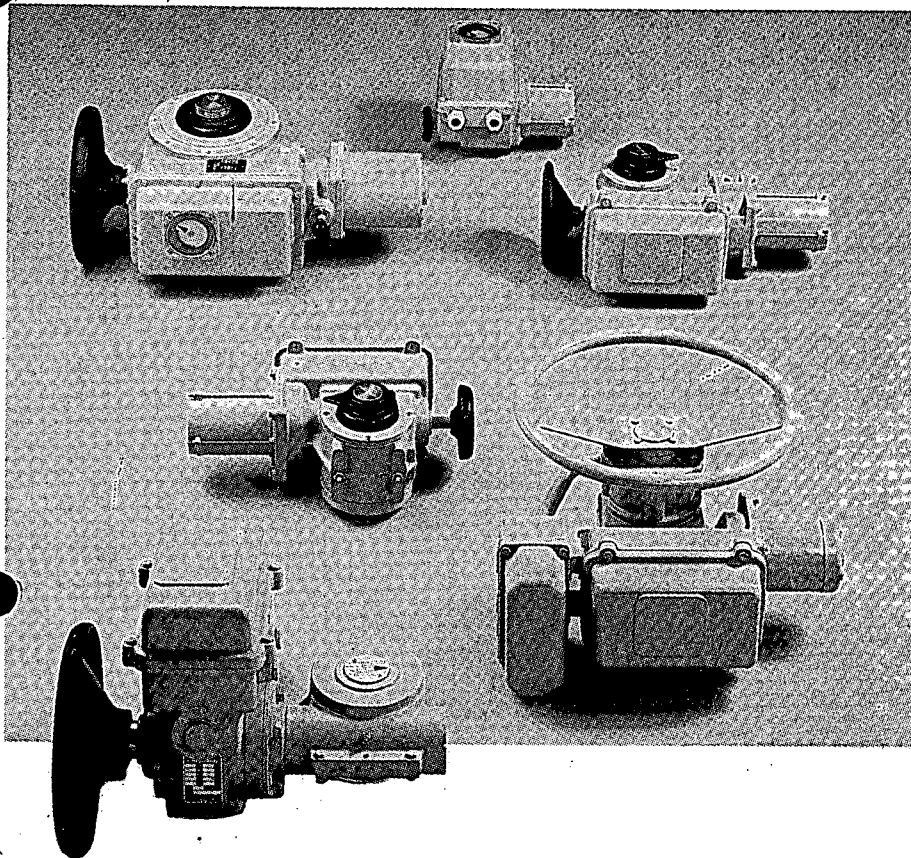


L288	24	UNBRACO SCREW M6 x 20 mm	N61TR06020
L287	12	HANDLE	9330790529
L286	4	NUT M8	N91608
L284	30M	SEALING STRIP	9330890640
L283	13M	SEALING STRIP, 20 x 10 mm	89413066
L282	2M	SEALING STRIP, 50 x 30 x 2000 mm	9330790420
L281	2M	SEALING STRIP 30 X 5 mm	89413074
L276	12	WASHER ø8.4	N64G08_4
L275	4	EXPANSION BOLT M8X50	N68B08050
L272	4	SELVSELDORILLINGSCREW B14 x 20 mm	89411755
L271	6	SCREW M8 x 16	N61G08016
L268	4	SCREW M8X80	N61G608080
L266	1	VENTILATOR ebn/W4D 350-DA06-02	9330791920
L262	1	BAFFLEPLATE	9330890820
L261	1	VENTILATION CANAL	9330792950
L256	1	TOP PANEL	9330870380
L255	1	TOP PANEL	9330870370
L233	1	WALL PANEL	9330860420
L232	1	WALL PANEL	9330860350
L231	1	WALL PANEL	9330850210
L230	1	WALL PANEL	9330850330
L226	2	TOP PROFILE	9330830340
L221	2	TOP PROFILE	9330830330
L209	4	CORNER POST	9330820170
L207	1	FLOOR PROFILE	9330810520
L206	1	FLOOR PROFILE	9330810510
L205	1	FLOOR PROFILE	9330810500
L201	2	FLOOR PROFILE	9330810490

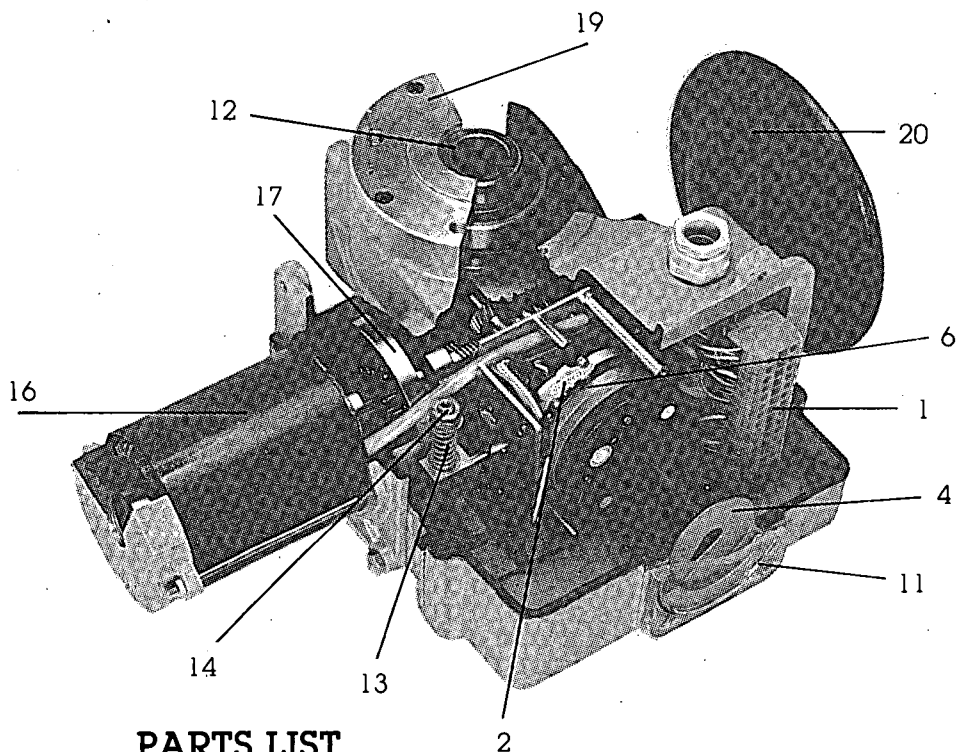
POS.	ARTAL	BETEGNELSE	KATR.	MRK. NR.	TEGN. NR.
 TURBO			SKALA	Tegnet. LR	933 080 038 0
			1:10	Dato 14/6-95	
			A1	Kontrol 14/6-95	
				Godkendt LR	
ACOUSTICAL ENCLOSURE				CAD	
IPSWICH			TEGN. NR.		
ASSEMBLY DRAWING			933 080 038 0 0		
623809					



COMMISSIONING INSTRUCTIONS



T-MS-302-SD-(GB)



PARTS LIST

- 1 Terminal strip
- 2 Travel limit switches
- 3 Extra travel limit switches (optional)
- 4 Mechanical position indicator (optional)
- 5 Drive slot
- 6 Cam block assembly
- 7 Limit switch adjusting screw (4 N°s)
- 8 Potentiometer drive needle (optional)
- 9 Potentiometer (optional)
- 10 Travel limit gear
- 11 Position indicator window
- 12 Output drive shaft
- 13 Torque limiter spring
- 14 Adjustment nut of torque spring
- 15 Torque limit switch
- 16 Motor
- 17 Planetary gear stage
- 18 Worm + wheel gear stage : type AO to B1
(spur gear for type C to E1)
- 19 Mounting flange
- 20 Handwheel

1 Assembly

Normally the valve or gearbox is supplied with a mounting flange and drive shaft/stem to suit the valve so that actuator only needs to be mounted and secured with bolts. See examples of assembly page 15.

After assembly the actuator can operate horizontally, vertically, or at any intermediate inclined position.

2 Electrical Connections

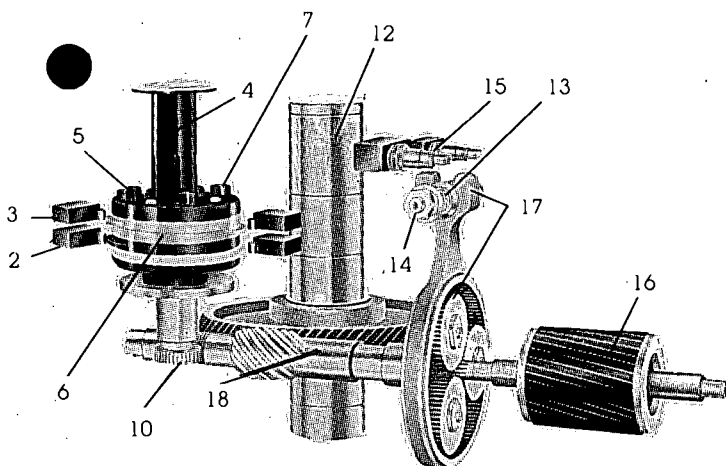
All control elements of the actuator are wired to a terminal strip (1) in the switching compartment. Remove the cover and insert the cables through the cable glands in order to reach the terminal strip.

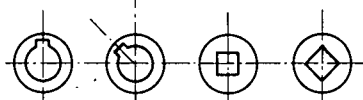
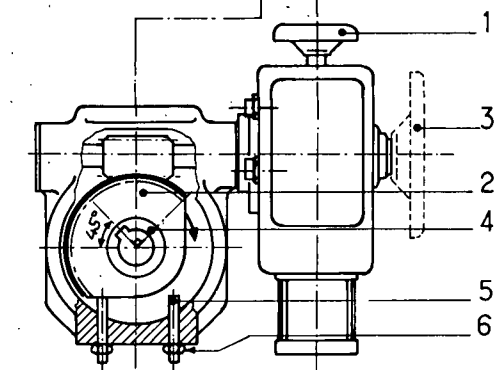
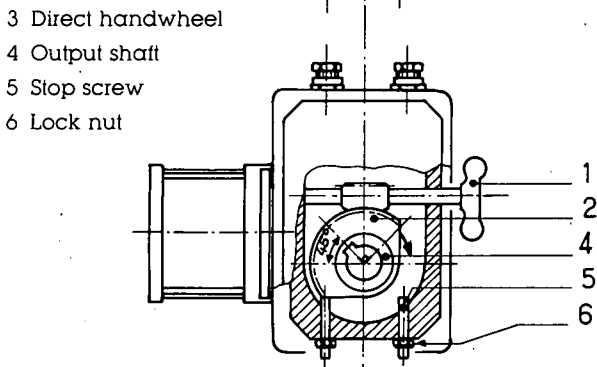
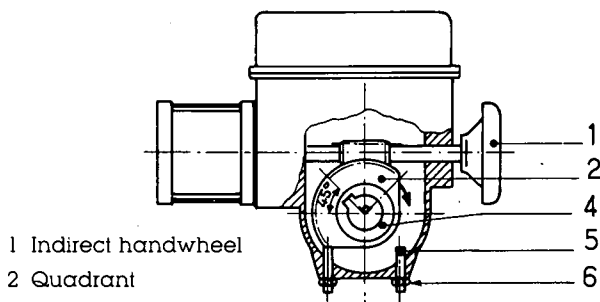
The connections are made in accordance with the wiring diagram as are the wiring details for ancillary equipment. Before beginning this procedure, check if actuator wiring is standard or specialized (see pages 12 and 13) and make sure that power supply voltage is in accordance with the actuator nameplate.

After the terminal connections have been made, move the valve manually to half-open position and make a preliminary check of wiring.

The following items must be checked :

- A) Direction of motor rotation is in accordance with electrical order.
- B) Function of torque and travel limit switches corresponds to the correct rotational direction of motor.
- C) Operate the switches by hand. If the motor rotates in the wrong direction, change the terminal connections detailed on page 14.





(for the mounting flange position, see our catalogue 1/4 turn - Range SD)

3 Adjustment of 90° actuators and gears with mechanical stops

All quarter-turn actuators are provided with a mechanical stop device at each end of the travel. The advantage of this arrangement serves to avoid over-travel with the handwheel going beyond the 1/4-turn rotation and to preserve the adjustment of the travel limit switches. As the indirect handwheel is fitted to the gearworm the operation effort is relatively low for the valve drive.

The illustrations show the position of the various output shafts (4) in the open position (clockwise movement closes the valve).

The illustrations are plan views, with the mounting flange on the opposite side.

When mounting the actuator, the position of the output shaft (4) should be considered.

Actuators and gears are supplied, and tested for 90° operation.

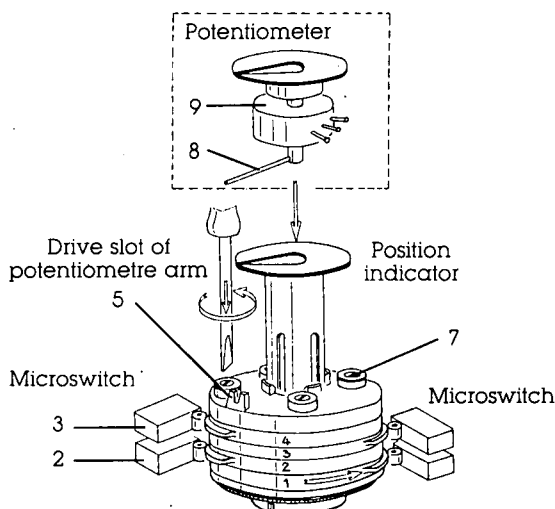
Fine adjustment is available, utilising the stop screws (5) (max. $\pm 2^\circ$ which corresponds to 1.5 revolutions of the stop screws).

The stop screws (5) must be secured with the lock nut (6) after any adjustment :

The 90° travel must always be limited by the travel limit switches so they must be set to trip just before mechanical stop contact. To achieve this, loosen stop screws (5) by 2 1/2 turns. Then, after travel limit switch setting is terminated, (see paragraph 4), operate the actuator electrically to closed position. Now rotate stop screws to mechanical contact, loosen 1 turn, and secure by lock nut. Proceed in the same way in open position.

It is emphasized that the mechanical stops are only a safety design feature to prevent overtravel in the event of travel limit switch failure or when the actuator is being operated manually.

4 Setting of travel limit switching



After checking the direction of rotation electrically, we recommend that you switch off power supply especially if actuator provides more than 300Nm output torque. This permits safe working conditions.

The cams operating the limit switches are in a cylindrical block which does not require any disassembly. Each cam can be set independently of the others. There are 4 cams included in the camblock, each marked with a different color :

- A) 1 = white and 2 = black for end of travel limits
- B) 3 = beige and 4 = grey are additional limit switches and are optional.

How to set the cams :

- 1 Put a screwdriver in the slot of the button (7) encircled by the same color as the cam to be set.
- 2 Press lightly to disengage the cam of locked position.
- 3 By turning the screwdriver rotate the cam to the position in which it can trip the limit switch.
- 4 Remove screwdriver and ensure that the button has come back to its original position, thus locking the cam in the chosen place.

5 Setting of potentiometer or current transmitter and mechanical position indicator (optional)

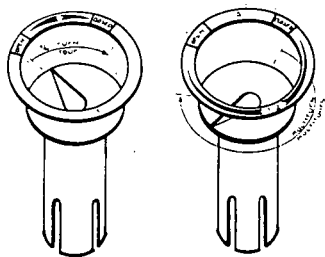
When an actuator is fitted with a potentiometer (9), its shaft holds a needle (8) which is designed to fit in the slot (5) on top of the cam block.

- To set the Ohm value of the potentiometer loosen (not remove) the 3 screws which fix the potentiometer to its plate.
- Next, rotate the potentiometer until the signal shows zero Ohms at closed valve and make sure the signal increases when opening.
- Now retighten the potentiometer fixing screws.

- Setting of position indicator :

The indicator plate with arrow can be rotated by hand without removal until it is set in front of its proper marking inside the window.

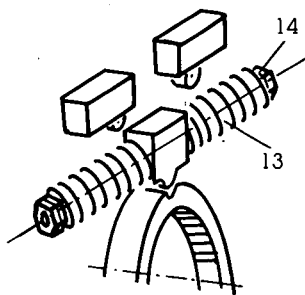
Actuators with potentiometer have indicator plate held in place by a screw. After loosening this screw, setting will be possible.



Position indicators

Setting of torque limit switches

IMPORTANT : The torque limit switch design of Bernard SD-Range actuators gives a short duration contact only. On request, actuators can be equipped with relays holding this contact maintained.



Actuators are set and tested in accordance with the torques stated on orders. If no torque is specified, we will supply the actuator with torque springs capable of the maximum output. If necessary, this torque setting can be readjusted by rotating the nuts (14) which compress the torque springs (13). So the torque can be increased or decreased by tightening or loosening the nuts (14). Also upon request, we can provide charts which will help to ensure accurate torque adjustment.

The maximum output torque of the actuator is published with the performance summary of the catalogue.

It is recommended that both torque switches are always connected to prevent damage to the actuator or valve.

Our torque limiter design measures continuously and reliably the output torque without the possibility of alteration by external influences.

7 Maintenance

If actuator is correctly mounted and sealed, no special maintenance is required. Check once a year function of motor and make sure that switch compartment is condensation free. If environment is humid, we recommend installation of an anti-condensation heater resistance and/or breathers, thus protecting the electric parts from alteration.

LUBRICATION

Actuators are lubricated for about 100,000 operations with grease. If it becomes necessary to renew the grease, use a product which is at least equivalent (refer to list hereafter).

NOTE : When changing the grease, first remove the old one.

General characteristics of lubricant (for normal conditions) :

- Duty temperature (grease : -30°C to $+135^{\circ}\text{C}$)
- Penetration ASTM at $+25^{\circ}\text{C}$: 265/295
- Drop point : $+180^{\circ}\text{C}$

Equivalence Table

(normal conditions = -20°C to $+70^{\circ}\text{C}$)

ELF	TOTAL	SHELL	MOBIL	ESSO
EPEXA 2	MULTIS EP2	ALVANIA EP2	MOBILUX EP2 OR MOBILPLEX 47	BEACON EP2

8 Instruction for storage of actuators

The actuator includes electric equipment as well as grease lubricated gear stages. In spite of the weatherproof enclosure, oxydation, jamming and other alterations are possible if actuator is not correctly stored.

STORAGE

The actuators should be stored under a shelter in a clean, dry place and protected from constant changes in temperature.
Avoid placing the actuators directly on the floor.

For the actuators equipped with heat resistance, it is recommended that you connect and give supply to it especially if the place of storage is humid (standard voltage 220 Volts, unless otherwise specified).

Check that the temporary sealing plugs of the cable entries are well in place.

Make sure that the covers and the boxes are well closed to ensure weatherproof sealing.

CONTROL AFTER STORAGE

- Maintain a visual check of electric equipment.
- Operate manually the microswitches, buttons, selectors, etc. to insure the correct mechanical function.
- Operate apparatus manually.
- Verify the correct grease consistency.
- For actuators equipped with grease nipple, remember to add some new grease.
- Follow instructions included in the commissioning instructions heregiven.

STORAGE EXCEDING ONE YEAR :

Sometimes the actuators with valves are installed on site but the electric wiring cannot yet be installed.

During this period :

- Be sure that the cable gland and the electrical boxes are weather-proof.
- Cover the actuator with a plastic tarp.

In the case of a valve with rising stem having a long stroke, verify that the protection tube is well mounted on the actuator. If it is not, fix it with joint glue.

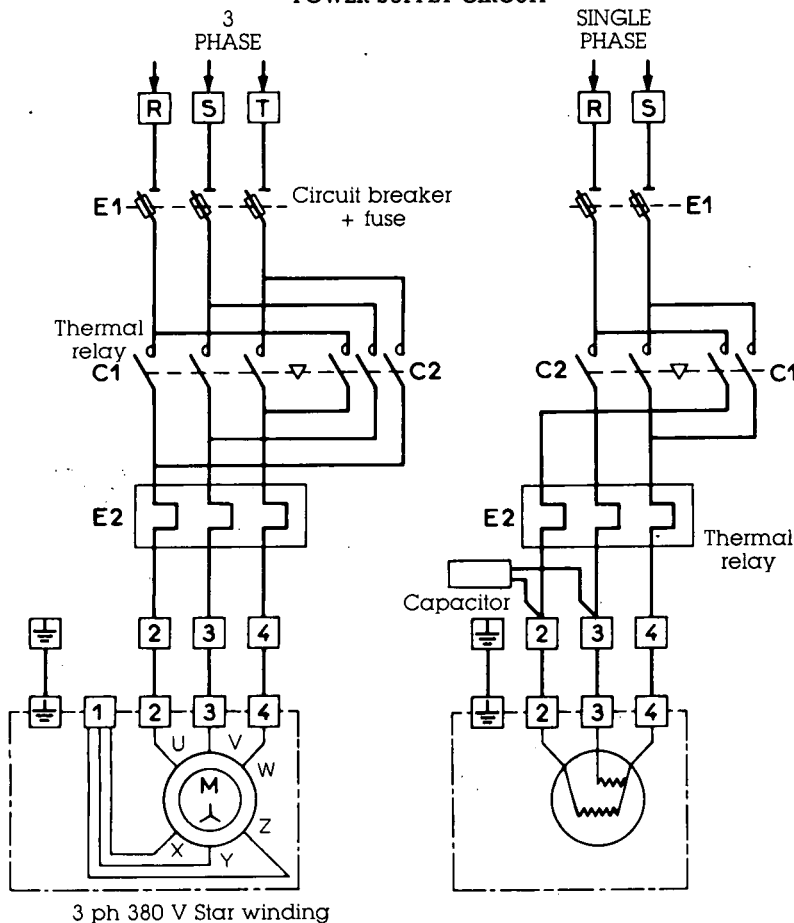
We advise to give supply to the heating elements while the actuator is out of service, even if it is only temporarily awaiting final wiring hook up.

STORAGE OF ACTUATORS EQUIPPED WITH ELECTRONIC COMPONENTS

Long term storage of electronic components which are not in service risk malfunctioning.

This practice is therefore highly unadvisable.

If a long term storage is absolutely necessary, we strongly recommend a revision of the electronic cards in our factory before actuator usage.

EXAMPLE OF WIRING DIAGRAM**POWER SUPPLY CIRCUIT****LEGENDE**

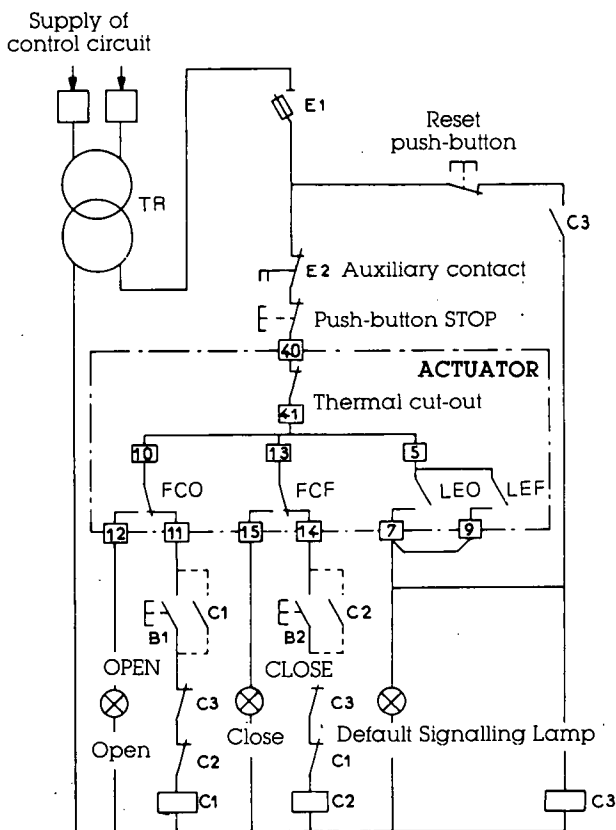
- E1 : circuit breaker with fuse
- E2 : thermal relay
- C1 : contactor OPEN
- C2 : contactor CLOSE
- C3 : relay of torque limit device
- FCO : travel limit switch OPEN
- PCF : travel limit switch CLOSE
- LEO : torque limit switch OPEN
- LEF : torque limit switch CLOSE
- Limitherm : thermal cut-out in motor (optional)
- TR : transformer

These are part of actuator

FOR STANDARD ACTUATOR

EXAMPLE OF CONTROL BOX

CONTROL CIRCUIT



For actuators without torque limit device
the circuit or relay C3 is not existing.

Dotted line : for short duration type signal
(not maintained).

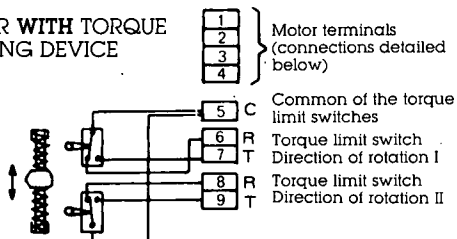
Function

- Stop in open and close positions on travel limit switch.
- Torque limit in safety action, with manual reset.

NOTE : We can supply other types for any function on request.

STANDARD INTERNAL

ACTUATOR WITH TORQUE LIMITING DEVICE

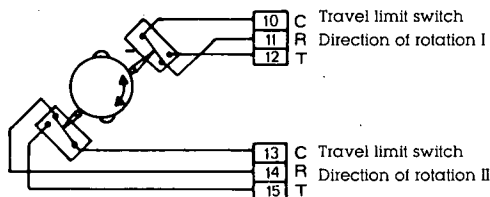


FUNCTION OF SWITCHES

Direction of rotation*
I - anti clockwise
(normally opening)
Direction of rotation
II - clockwise
(normally closing)

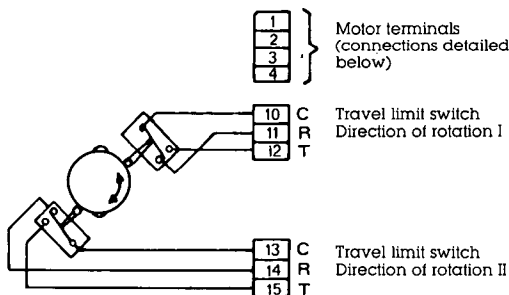
TORQUE SWITCHES give
SHORT DURATION
contacts only

TRAVEL LIMIT SWITCHES
give maintained contact



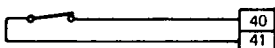
* Direction of rotation seen on opposite side of fixing flange of actuator.

ACTUATOR WITHOUT TORQUE LIMITING DEVICE (types OA)



FUNCTION OF SWITCHES

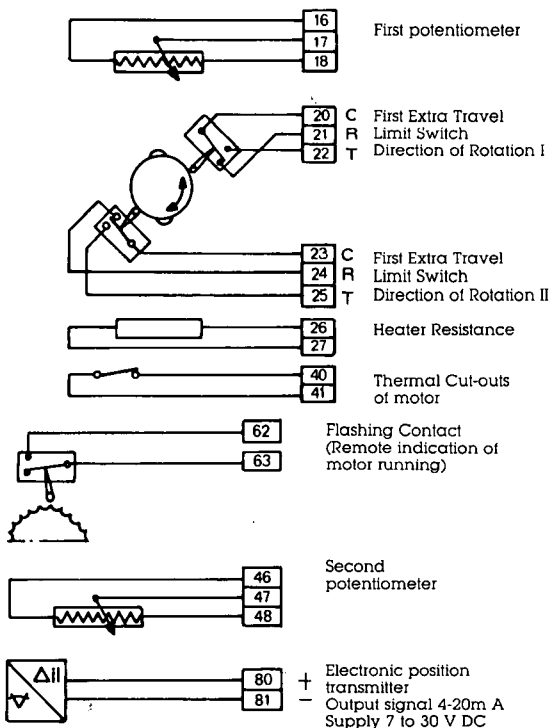
Direction of rotation*
I - anti-clockwise
(normally opening)
Direction of rotation
II - clockwise
(normally closing)



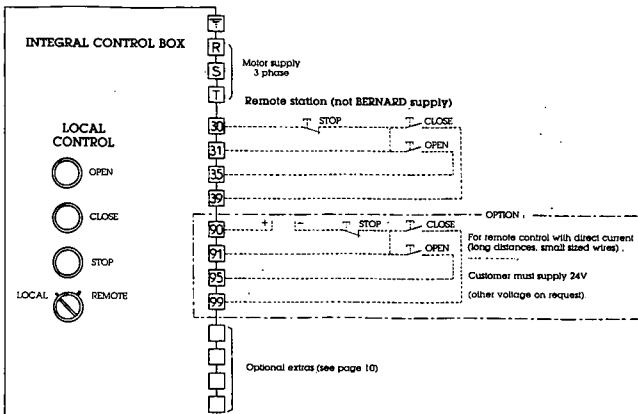
* Direction of rotation seen on opposite side of fixing flange of actuator.

WIRING DIAGRAM

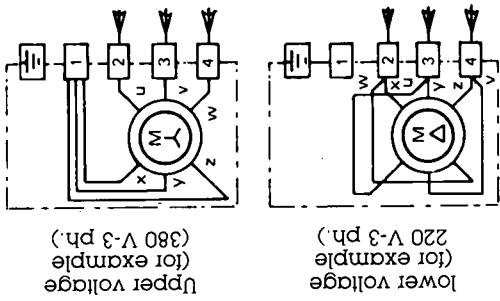
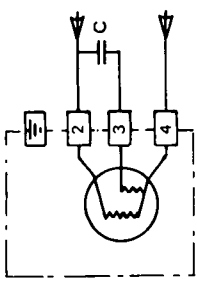
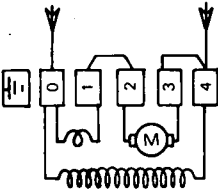
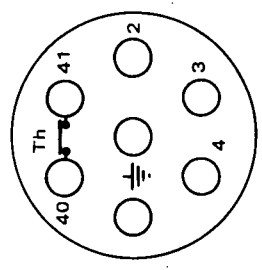
OPTIONAL ACCESSORIES



WIRING DIAGRAM FOR CONNECTION OF MODEL INTEGRAL



Connection to motor terminals

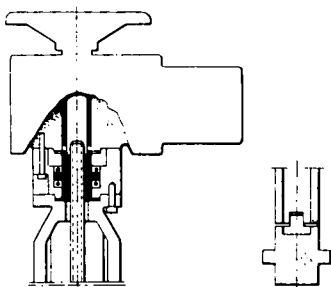
<p>MOTOR</p> <p>THREE PHASE</p>  <p>Upper voltage (for example 380 V-3 ph.)</p> <p>Lower voltage (for example 220 V-3 ph.)</p>	<p>SINGLE PHASE</p>  <p>Note : The capacitor is enclosed in the types OA and supplied separately for the other types of actuators.</p>	<p>DIRECT</p> 	<p>EXPLOSIONPROOF</p> <p>Th : Thermal cut-out</p>  <p>Independant terminal box of motor</p>
<p>To change direction</p>	<p>Interchange terminals 2 and 3</p>	<p>Supply either terminal 2 or terminal 3</p>	<p>Connect terminal 1 with 3 and supply terminals 2 and 4</p>

CAUTION : Check systematically the rotational direction during commissioning.

Output shafts and examples of assembly

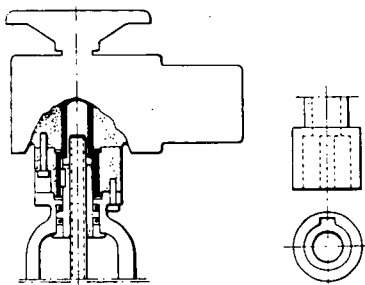
INCORPORATED DRIVE BUSH (Form A)

For valves with rising stems and without drive bush. It is easy to remove the bush to machine it to suit the valve stem thread. The bush is then driven by the hollow shaft of actuator permitting the inner passage of the stem to rise.



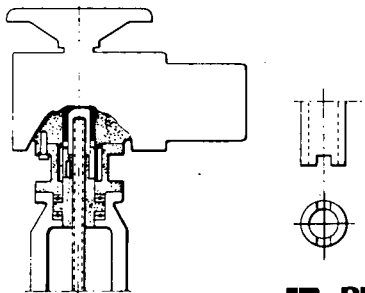
ENLARGED SLEEVE (Form B)

For valves with rising stems and incorporated bushes. The sleeve can drive directly - the valve nut having the same dimensions as the actuator sleeve. The valve stem can rise within the actuator hollow shaft.



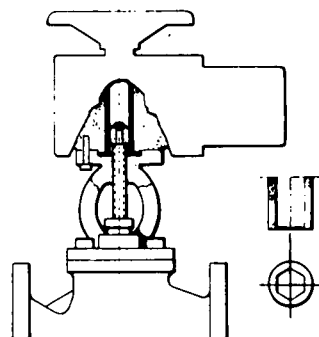
CLAW COUPLING END (Form C)

For valves with rising stems only a coupling piece fitted to the valve nut, is driven by the actuator shaft with claw coupling end.



HEXAGONAL HOLLOW SHAFT

For valve with rising and turning stems. A driven sleeve is secured to the valve stem and driven through the actuator shaft. The stem slides axially within the hollow actuator shaft for the full valve travel.



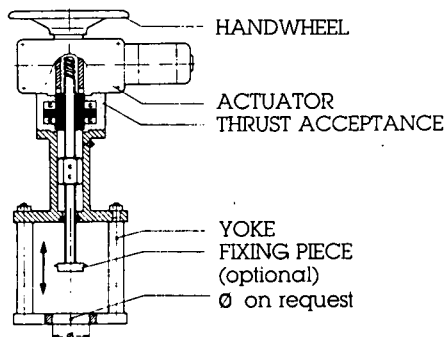
LINEAR ACTUATOR

As previously stated, multitem actuators can be adapted to provide linear actuation offering high output thrusts and strokes up to one meter.

The mounting flange and coupling adaptor can be supplied to customer requirements.

The actuators can be supplied with single phase motors which are normally required for control systems.

Due to the low inertia of the output shaft, almost instant stopping is assured, but if specified, electric short circuit brakes can be supplied.





AUSTRALIA	CONTROL AUTOMATION PTY LTD P.O. Box 351 GRANVILLE NSW 2142	Fax : (02) 6827196 Tel. : (02) 6821422
AUSTRIA	IPU ING. PAUL UNGER Hardtmuthgasse 53 1100 WIEN	Telex : 136643 Tel. : (0222) 6024549
BELGIUM	BERNARD BENELUX SA Rue des Alliés 302 1190 BRUXELLES	Fax : (02) 3472843 Tel. : (02) 3434122
DENMARK	JORGEN A. NIELSEN A/S Mollevøj 15 2990 NIVA	Telex : 41208 Tel. : (02) 249500
FINLAND	OY SOFFCO AB Karapellontie 11 02610 ESPOO	Fax : (0) 596726 Tel. : (0) 596033
FRANCE	ETS L. BERNARD 60, avenue du Président-Wilson 93211 LA PLAINE SAINT DENIS	Telex : 236743 Tel. : (1) 48092912
GERMANY	DEUFRA GMBH Bonner Strasse 60 6200 SIEGBURG	Telex : 889543 Tel. : (02241) 60030 65048
HOLLAND	BERNARD BENELUX NV Sophialaan 5 3542 AR UTRECHT	Tel. : (30) 414700 Fax : (30) 413949
HUNGARY	WARIMPEX Váci utca 81 1056 BUDAPEST	Tel. : (1) 1181 873 Fax : (1) 1177 477
INDIA	INSTRUMENTATION LTD Kanjikode West 678623 PALGHAT — KERALA	Telex : 0852205 Tel. : (0491) 24452
ITALY	PECHINEY ITALIA S.P.A. Viale F. Restelli 5 20124 MILAN	Telex : 316577 Tel. : (02) 668931
KOREA	SEWON INTERNATIONAL CO. Young Dong P.O. Box 1049 SEOUL	Fax : (02) 553.9678 Tel. : (02) 567.7186
NORWAY	G. FAGERBERG NORGE Postboks 536 1501 MOSS	Fax : (9) 267333 Tel. : (9) 265044
SINGAPORE	MATCO ASIA (S) PTE LTD Jalan Buroh Warehouse Complex 30 Jurong Port Road Unit TWA-6 SINGAPORE 2262	Telex : 38136 Tel. : (65) 2610359
SPAIN	MAIN S.L. San Romualdo, 26 28037 MADRID	Tel. : (91) 7544947 Telex : 42952
SOUTH AFRICA	ACTUATOR TECHNICAL SERVICES P.O. Box 2439 KEMPTON PARK 1620	Tel. : 823-2762 Fax : 823-2766
SWEDEN	G. FAGERBERG AB Postbox 12105 40241 GOETEBORG	Telex : 20661 Tel. : (031) 693700
SWITZERLAND	MAT KEMI AG Erlenstrasse 27 4106 THERWIL	Telex : 962440 Tel. : (061) 7214822
UNITED KINGDOM	MAGA CONTROLS LTD 4 Riverside Park Ind. Estate FARNHAM, SURREY GU9 7UG	Tel. : (0252) 722452 Fax : (0252) 711151
USA	BERNARD CONTROLS Inc. 10649 Haddington DR. HOUSTON, TEXAS 77043	Fax : 713.461.0007 Tel. : 713.461.1666

ETABLISSEMENTS L. BERNARD

60, avenue du Président Wilson

B.P. 32 — 93211 LA PLAINE SAINT-DENIS (FRANCE)

Telex : 236743 F Elberna — Fax : (1) 48.09.25.29 — Tel. : (1) 48.09.29.12

BUTTERFLY VALVE - RANGE EVBS - SEMI LUG TYPE - DN 50-300 (2"-12")

Working pressure : - DN 50 - 200 (2" - 8") 16 bar
- DN 250 - 300 (10"-12") 10 bar
- 16 bar on request

Flange connections : - DN 50 - 150 (2" - 6")
ISO 7005/DIN 2501 PN16
- DN 200 - 300 (8"-12")
ISO 7005/DIN 2501 PN10,
PN16 on request

Face to face dim. : acc. to ISO 5752 short, basic series 20, equal to BS 5155 wafer short, DIN 3202-K1, API 609

Top flange / PCD : acc. to ISO 5211

Marking : acc. to ISO 5209 (API 609, MSS SP25 on request).

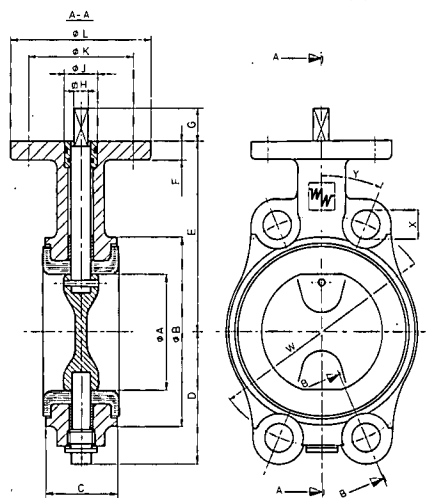
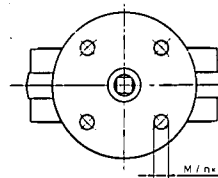
Centring between pipe flanges : with centring holes

Remarks : - max. pressure allowed as end of line valve service : 10 bar
- type of washers acc. to DIN 125 and ISO R887
- Torque to tighten the flange bolts M16 / 45 Nm and M20 / 90 Nm

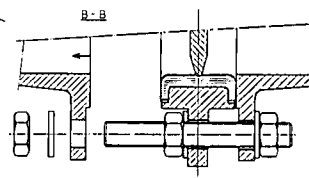
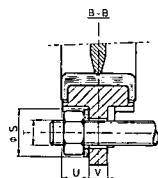
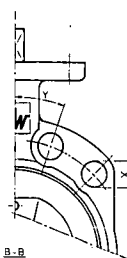
Actuation : - Lever page 33 + 41/42
- Wormgear page 33 + 43-48
- Pneumatic page 35-38, 49-57
- Hydraulic page 40
- Electric page 39

Material specification : see page 7-8

Coating systems : see page 65-66



DN 250 - 300

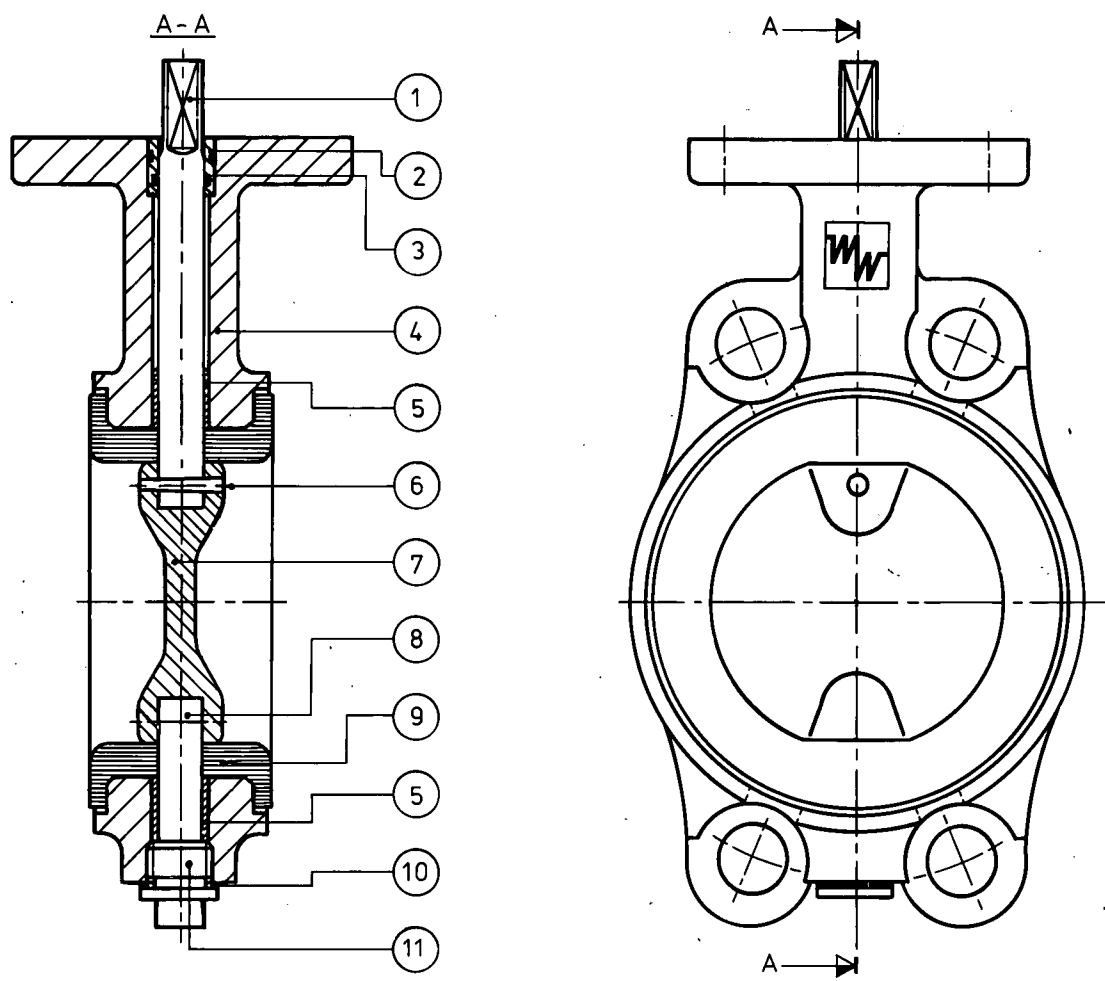


DN		A	B	C	D	E	F	G	H	J	K	L	M
50	2"	50	100	43	63	118	12	34	10	18	70	90	9
65	2½"	65	115	46	71	126	12	34	10	18	70	90	9
80	3"	80	130	46	78	133	12	34	10	18	70	90	
100	4"	100	150	52	96	147	12	34	12	22	70	90	9
125	5"	125	182	56	109	160	12	34	12	22	70	90	9
150	6"	150	210	56	133	180	14	34	16	30	70	90	9
200	8"	200	262	60	158	204	14	34	16	30	70	90	9
250	10"	250	315	68	194	245	15	45	24	38	102	125	11
300	12"	300	371	78	219	270	15	45	24	38	102	125	11

DN	n	ISO 5211	S	T	U	V	W	X	Y	± KG	
50	2''	4	F07	30	M16	17	9	125	19	45°	2,8
65	2½''	4	F07	30	M16	17,5	11	145	19	45°	3,6
80	3''	4	F07	30	M16	17,5	11	160	19	22,5°	3,9
100	4''	4	F07	30	M16	17	18	180	19	22,5°	5,1
125	5''	4	F07	30	M16	17	22	210	19	22,5°	7,0
150	6''	4	F07	37	M20	20	16	240	23	22,5°	9,5
200	8''	4	F07	37	M20	20	20	295	23	22,5°/15°	14
250	10''	4	F10	37	M20	20	26	350	25	15°	24
300	12''	4	F10	37	M20	20	28	400	25	15°	36

Bigger sizes on request. Due to the use of a lever there is a hole through the uppershaft of DN 50-300. For actuator dimensions please refer to appropriate data sheets. It is the companies policy to improve and update the products and therefore we reserve the right to change the specification accordingly. This document supersedes the previous issues.

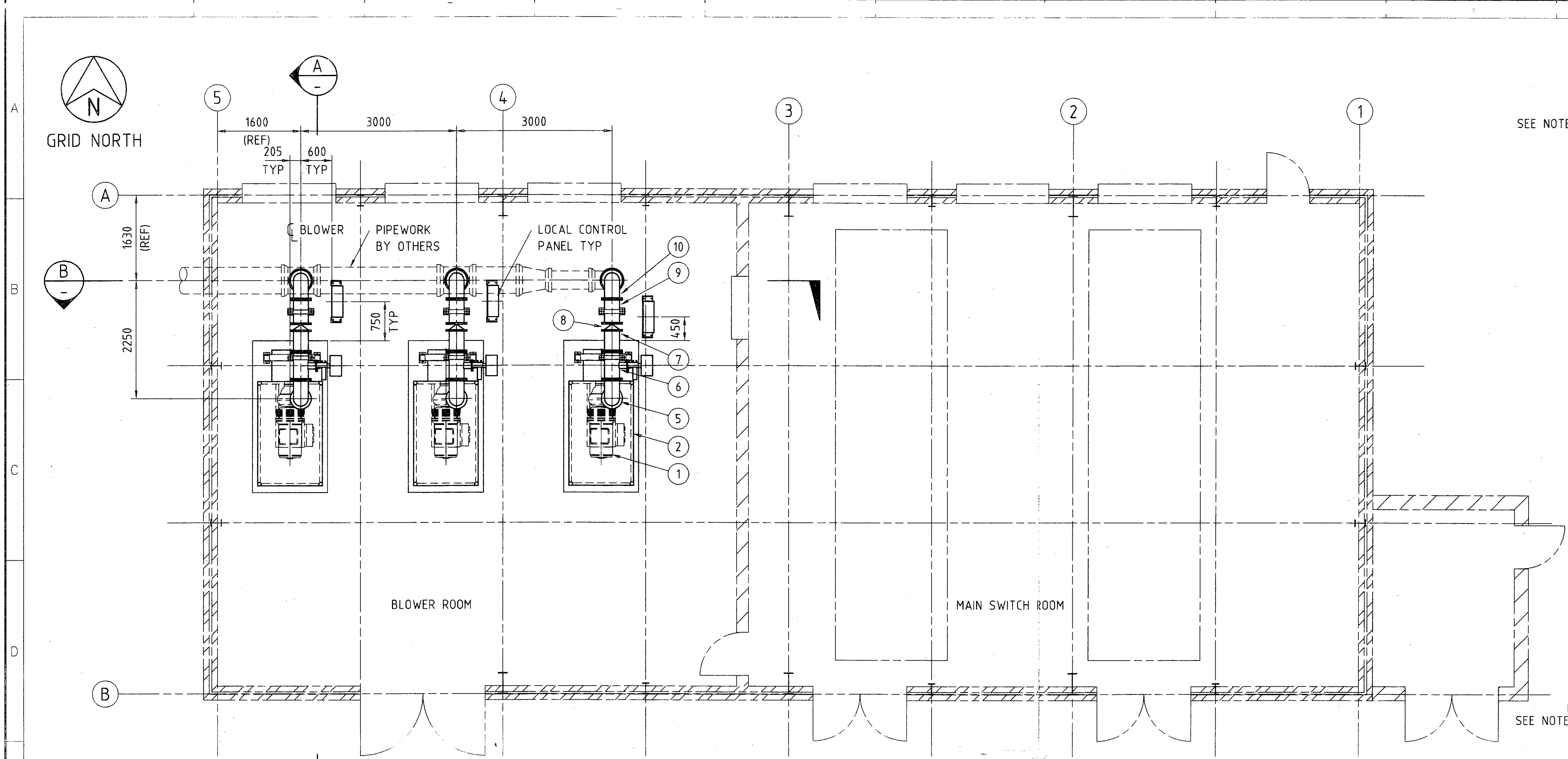
Range EVBS



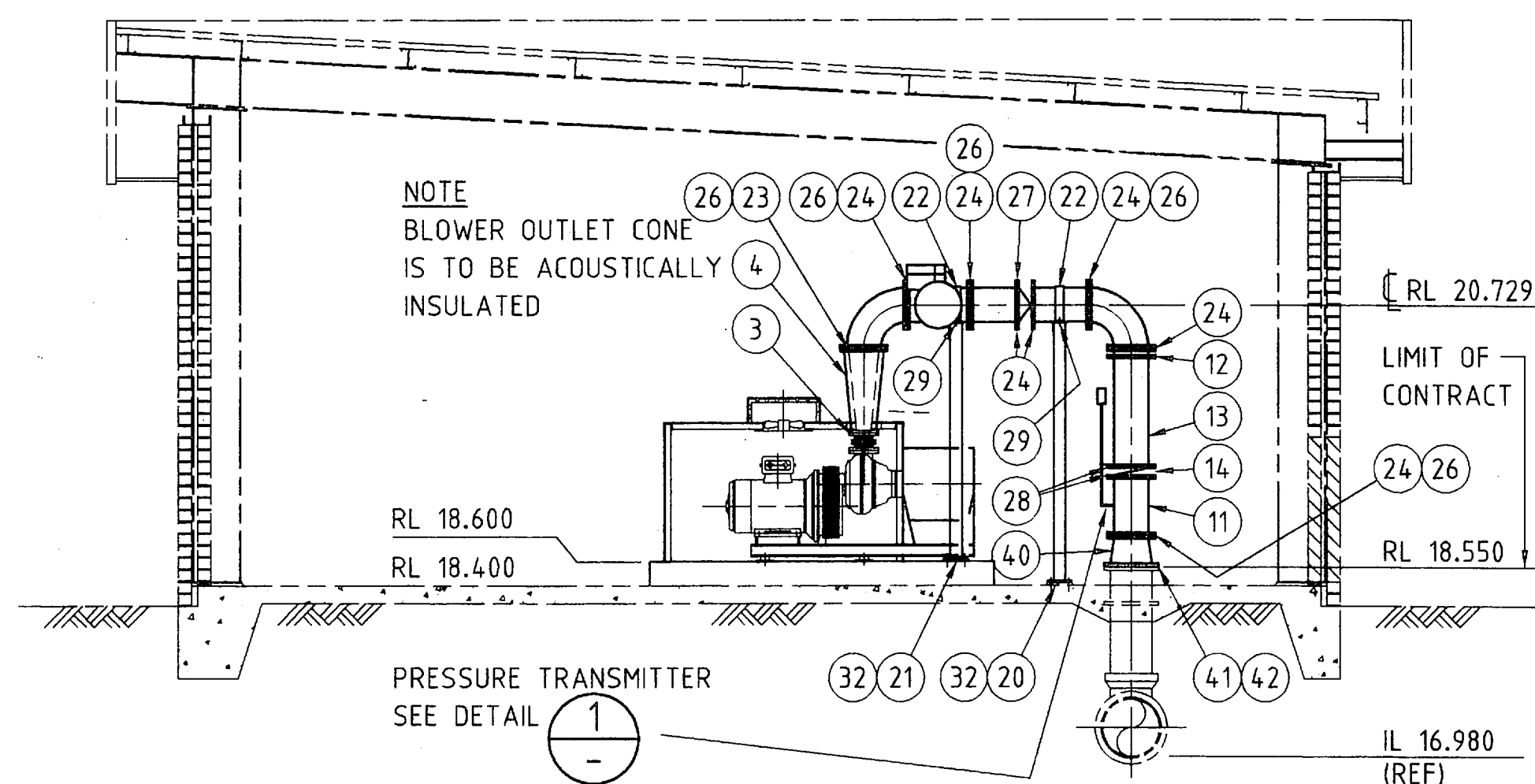
Pos nr.	Aantal Pieces Stück Nombre	Omschrijving	Description	Benennung	Description
1	1	as	shaft	Welle	axe
2	1-2	bus	bush	Buchse	garniture d'étanchéité
3	2-4	o-ring	o-ring	O-ring	o-ring
4	1	huis	body	Gehäuse	corps
5	2-4	lager	bearing	Lagerbuchse	palier
6	1-2-3-4	conische pen	conical pin	Kegelstifte	goupille conique
7	1	klep	disc	Klappe	papillon
8	1	as	shaft	Welle	axe
9	1	voering	lining	Futter	bague souple
10	1	afdichting	sealing ring	Dichtungsring	joint
11	1	kraagplug	plug	Verschlussschraube	bouchon

It is the companies policy to improve and update the products and therefore we reserve the right to change the specification accordingly. This document superseeds the previous issues.

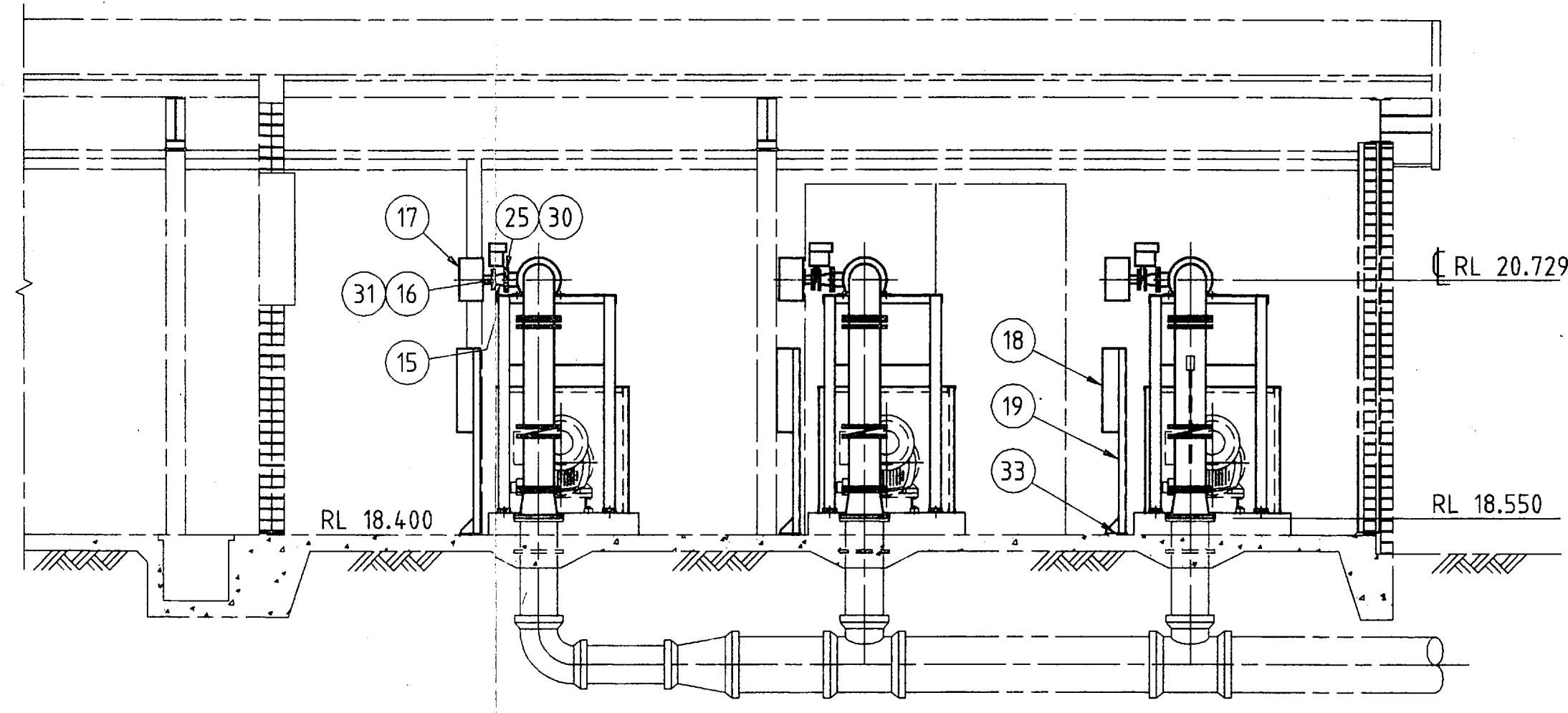
Pos nr./Material	
1	7
2	8
3	9
4	10
5	11
6	



PLAN
1:50



SECTION A
1:50

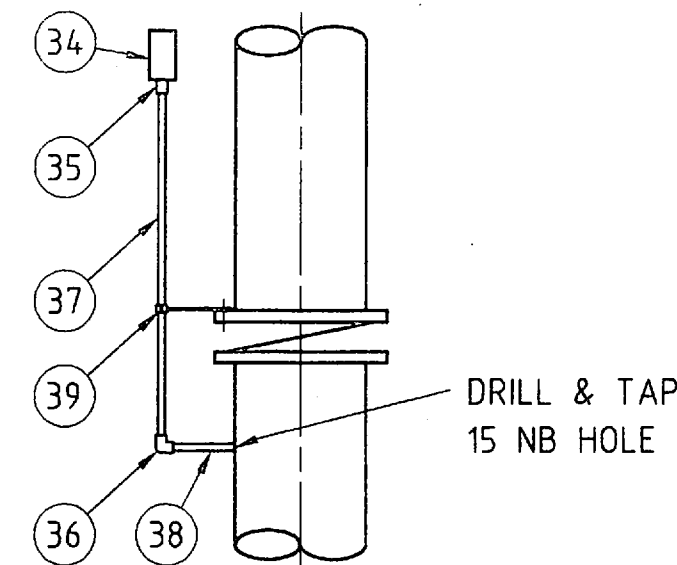


SECTION B
1:50

SEE NOTE 3

SEE NOTE 7

ITEM No.	QTY.	DESCRIPTION	MATERIAL OR MARK No.	NOTES
1	3	BLOWER	KA2SV-GK2	HV TURBO
2	3	ACOUSTIC ENCLOSURE		HV TURBO
3	3	125 NB COMPENSATOR	930.830.043	HV TURBO
4	3	125x250 NB OUTLET DIFFUSER CONE	930.830.041	HV TURBO
5	3	250 NB FL & FL 90° BEND	DIEL	TUBEMAKERS
6	3	250x100 NB ALL FL TEE	DIEL	TUBEMAKERS
7	3	250 NB FL & FL PIPE 410 LONG	DIEL	TUBEMAKERS
8	3	250 NB NON RETURN CHECK VALVE	930.830.038	HV TURBO
9	3	250 NB FL & FL PIPE 476 LONG	DIEL	TUBEMAKERS
10	3	250 NB FL & FL 90° BEND	DIEL	TUBEMAKERS
11	3	250 NB FL & FL PIPE 500 LONG	DIEL	TUBEMAKERS
12	3	250 NB NON THRUST DISTANT. JOINT	DI	TUBEMAKERS
13	3	250 NB FL & SP PIPE 983 LONG	DIEL	TUBEMAKERS
14	3	250 NB BUTTERFLY VALVE AS TABLE C	TYPE F2	KEystone
15	3	PIPE SPOOL	A-YQ.148-24	
16	3	65 NB MOTORISED BUTTERFLY VALVE	930.830.033	HV TURBO
17	3	65 NB SILENCER	930.910.016	HV TURBO
18	3	LOCAL CONTROLLER PANEL		HV TURBO
19	3	LOCAL CONTROL PANEL STAND		HV TURBO
20	3	PIPE SUPPORT	A-YQ.148-22	
21	3	PIPE SUPPORT	A.YQ-148-23	
22	6	250 NB SADDLE CLAMP	PP109-250	PROPLANT
23	3	250 NB INSERTION NEOPRENE GASKET	3 THICK	DIN 2501 PN10
24	21	250 NB INSERTION NEOPRENE GASKET	3 THICK	AS TABLE C
25	3	100 NB INSERTION NEOPRENE GASKET	3 THICK	AS TABLE C
26	132	M20x80 LG HEX HD BOLT	316 SS	C/W NUT AND FLAT WASHER
27	24	M20x230 LG THREADED ROD	316 SS	C/W 2 NUTS AND 2 FLAT WASHERS
28	48	M20x55 LG HEX HD SET SCREW	316 SS	C/W FLAT WASHER
29	12	M24x70 LG HEX HD BOLT	316 SS	C/W NUT AND FLAT WASHER
30	12	M16x55 LG HEX HD BOLT	316 SS	C/W NUT AND FLAT WASHER
31	12	M16x90 LG HEX HD BOLT	316 SS	C/W NUT AND FLAT WASHER
32	24	M12 CHEMICAL ANCHOR HVA-R	316 SS	HILTI
33	12	M10 CHEMICAL ANCHOR HVA-R	316 SS	HILTI
34	1	PRESSURE TRANSMITTER		
35	1	15 NB SOCKET	GAL MAL IRON	TUBEMAKERS
36	1	15 NB F & F ELBOW	GAL MAL IRON	TUBEMAKERS
37	1	15 NB THREADED PIPE - 1000 LONG	GALV-STEEL	TUBEMAKERS
38	1	15 NB THREADED PIPE - 400 LONG	GALV-STEEL	TUBEMAKERS
39	1	STAND OFF BRACKET	UN9-21	UNISTRUT
40	3	250x300 NB FL & FL CONCENTRIC TAPER	DIEL	TUBEMAKERS
41	3	250 NB INSERTION NEOPRENE GASKET	3 THICK	AS TABLE C
42	36	M20x100 LG HEX HD BOLT	316 SS	C/W NUT AND FLAT WASHER



DETAIL 1
1:20

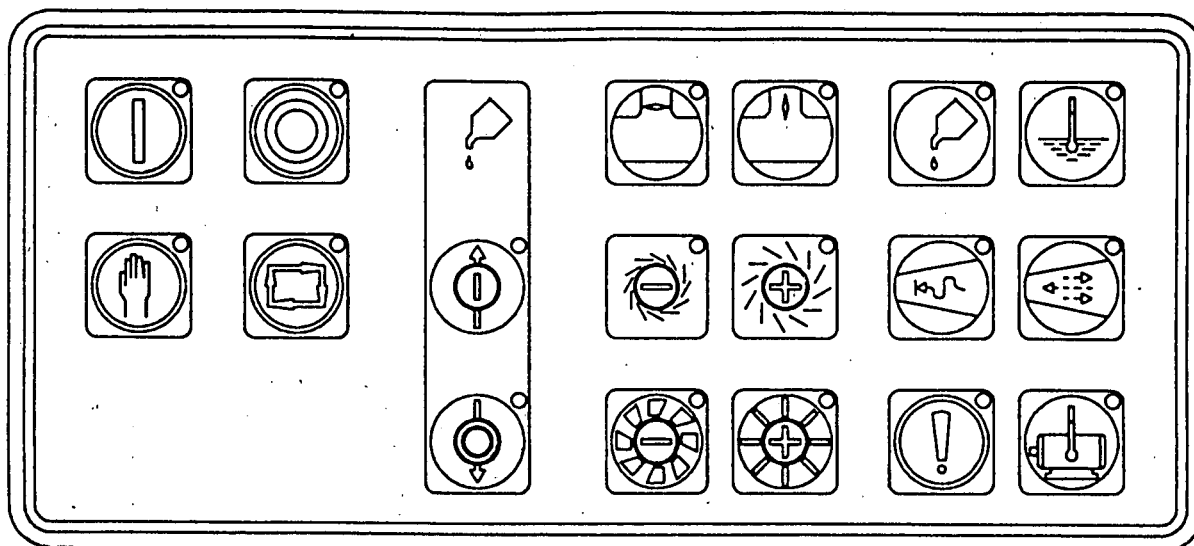
NOTES

- DUCTILE IRON PIPEWORK AND FITTING (TO AS2280) DIMENSIONS BASED ON TUBEMAKERS SPECIFICATIONS. ANY ALTERNATIVE TYPE OF DUCTILE IRON USED TO BE DIMENSIONALLY IDENTICAL.
- ALL DIEL PIPEWORK TO HAVE TABLE C FLANGES UNLESS NOTED OTHERWISE.
- 250 NB FL & FL 90° BEND (3 OFF ITEM 5 ONLY) TO HAVE ONE FLANGE TO AS 2129 TABLE C THE OTHER TO DIN 2501 PN10.
- MODIFY STAND OFF BRACKET TO SUIT FLANGE BOLT.
- COAT THREADS OF BOLTS WITH AN APPROVED ANTIGALLING GREASE PRIOR TO ASSEMBLY.

REFERENCE DRAWINGS

- YQ.148-21 BLOWER BUILDING - PLINTH LAYOUT
- YQ.148-22 BLOWER BUILDING - PIPE SUPPORT DETAIL
- YQ.148-23 BLOWER BUILDING - PIPE SUPPORT DETAIL
- YQ.148-24 BLOWER BUILDING - PIPEWORK DETAIL

REVISION A ISSUED FOR APPROVAL 31/5/95 B. ACOUSTIC INSULATION SHOWN ON BLOWER OUTLET CONE 4-8-95	COPYRIGHT This drawing and the information contained thereon is the property of Aquatec - Maxcon Pty Ltd and shall not be shown to third parties nor be copied, duplicated or reproduced in any form whatsoever nor used for manufacturing purposes on behalf of third parties without the written agreement of Aquatec - Maxcon Pty Ltd.		DESIGNED JEM DATE 22/5/95	AQUATEC-MAXCON PTY. LTD. A.C.N. 002 250 482 WATER TREATMENT TECHNOLOGY AND EQUIPMENT 16/390 EASTERN VALLEY WAY ROSEVILLE N.S.W. 2069 PH (02) 417-4855 FAX (02) 417-6904	CLIENT IPSWICH CITY COUNCIL			
	"A" INITIALS REPLACE SIGNATURES FROM PREVIOUS REVISIONS	CHECKED JC DATE 30/5/95	PROJECT EASTERN WASTEWATER CENTRE ST. 3 AUGMENTATION					
		APPROVED D.W. DATE 31-5-95	TITLE BLOWER BUILDING GENERAL ARRANGEMENT					
		CAD FILE NAME YQ148-20	CAD DISK No. 84		SCALE 1:50 1:20			
3RD ANGLE PROJECTION DIMENSIONS IN MILLIMETRES U.N.O. DO NOT SCALE				CLIENT REFERENCE 367/94	AQUATEC-MAXCON REF. YQ.148	DRAWING No. YQ.148-20	REV B	A1



	L1: COMPRESSOR IS STARTED T1: START COMPRESSOR		L10: DIFFUSER IN MIN. T10: CLOSE DIFFUSER		L8: SURGING T8: RESET
	L2: COMPRESSOR IS STOPPED T2: STOP COMPRESSOR		L9: DIFFUSER IN MAX. T9: OPEN DIFFUSER		L7: RECIRCULATION T7: RESET
	L13: LOCAL/MANUAL T13: IN LOCAL/MANUAL		L17: IGV IN MIN. T17: CLOSE IGV		L15: GENERAL ALARM T15: RESET
	L12: REMOTE/AUTO T12: IN REMOTE/AUTO		L16: IGV IN MAX. T16: OPEN IGV		L14: MOTOR TEMP. TOO HIGH T14: RESET
	L3: BLOW-OFF VALVE CLOSED T3: CLOSE BLOW-OFF VALVE		L5: OIL PRESS. TOO LOW T5: RESET		L11: NOT USED T11: NOT USED
	L4: BLOW-OFF VALVE OPEN T4: OPEN BLOW-OFF VALVE		L6: OIL TEMP. TOO HIGH T6: RESET		L18: NOT USED T18: NOT USED



MEMBRANE SWITCH
FIL : 3809L

Tegnet	PKF/57	S. nr.	204
Date	09.05.1995	Total	
Tegn. nr.	937.123.111.0.0		

IPSWICH
ORDER NO. 62.3809

2. REMOTE/AUTOMATIC

REMOTE/AUTOMATIC operation is selected by activating T12 (f-t). LED L12 "REMOTE/AUTO" will then be on while LED L13 "LOCAL/MAN" simultaneously is off.

Start conditions are the same as for LOCAL/MANUAL.

When the start conditions are fulfilled, the compressor can be started by a PERMANENT signal from the master control panel "MCP" on terminal X3:2 (potential-free contact or MCP). Resetting of this signal will bring the compressor to stop.

The diffuser is controlled by signals on terminal X3:3 and X3:4 respectively (Potential-free contact or MCP).

Prerotation: See LOCAL/MANUAL.

3. SERVICE

By repair or the like, the control panel can be adjusted for service by activating T13 (f-t) "LOCAL/MAN" during more than 5 seconds. LEDs L12 "REMOTE/AUTO" and L13 "LOCAL/MAN" will then flash as a sign that the control panel is in service. This makes it possible to operate the blow-off valve, the diffuser and the prerotation independently, by using the T-Ts on the panel front.

TEST

By setting switch 13S10, placed inside the panel, on position 2, a start-up sequence can be run through to test all functions without starting the main motor. This applies to all 3 service functions.

NOTE!!!

Before renewed start-up of the compressor, the control panel must be brought out of service operation by activating once more T13 (f-t), while 13S10 must be reset on position 1.

See "F-T symbols" for identification of finger-touches and diodes.

Switch "Test - 13S10" is shown on the Arrangement drawing.

ALARM

An error in the operating procedure will bring the compressor to stop. In the yellow section - which symbolizes the error - the LED will go on, indicating the error in question. When the stop sequence is completed, the alarm is reset by activating the F-T corresponding to the LED. Unless the error has NOT been corrected, the LED will go off.

In case of an alarm signal, the blow-off valve at once begins to open, and 8 seconds later the compressor will stop.

In case of an emergency stop, the compressor will stop immediately without waiting for the blow-off valve to open.

Five special alarms are symbolized on the panel, and they will be alight when the corresponding error occurs. In addition, there is a general alarm signalling whenever an error occurs.



OPERATING INSTRUCTIONS
FIL : 3809L

Tegnet	PKF/57	S. nr.	201
Date	09.05.1995	Total	
Tegn. nr.	937.123.111.0.0		

IPSWICH
ORDER NO. 62.3809

BASIC SPECIFICATION

- HV-Turbo KA2SV-GK2 single stage centrifugal compressor.
- 75kW, 2 pole Schorch motor
- Rated - 3,524 m³/hr to 1,586 m³/hr
(100% to 45% capacity)
 - 52 kPa differential pressure
 - to 45° ambient air temperature
 - 59.1 kW maximum
- Capacity control by adjustable outlet diffusers
- Efficiency control by adjustable inlet guide vanes (PRC)
- Inlet filter Class EU3
- Inlet silencer
- 5.5 litres synthetic oil
- Gas carburised and ground gears
- Special high speed precision ball bearings on rotor shaft
- Aluminium alloy impeller
- Operating speed 23,124 rpm

(41 in Australia & New Zealand since 1987)

Merrimac (3), Wacol (3), Loganholme (4), Coombabah (1),
Toowoomba (2), Banora Point (3), Eastern (3).

930910041.US

TYPICAL COMPRESSOR



Revision : 3

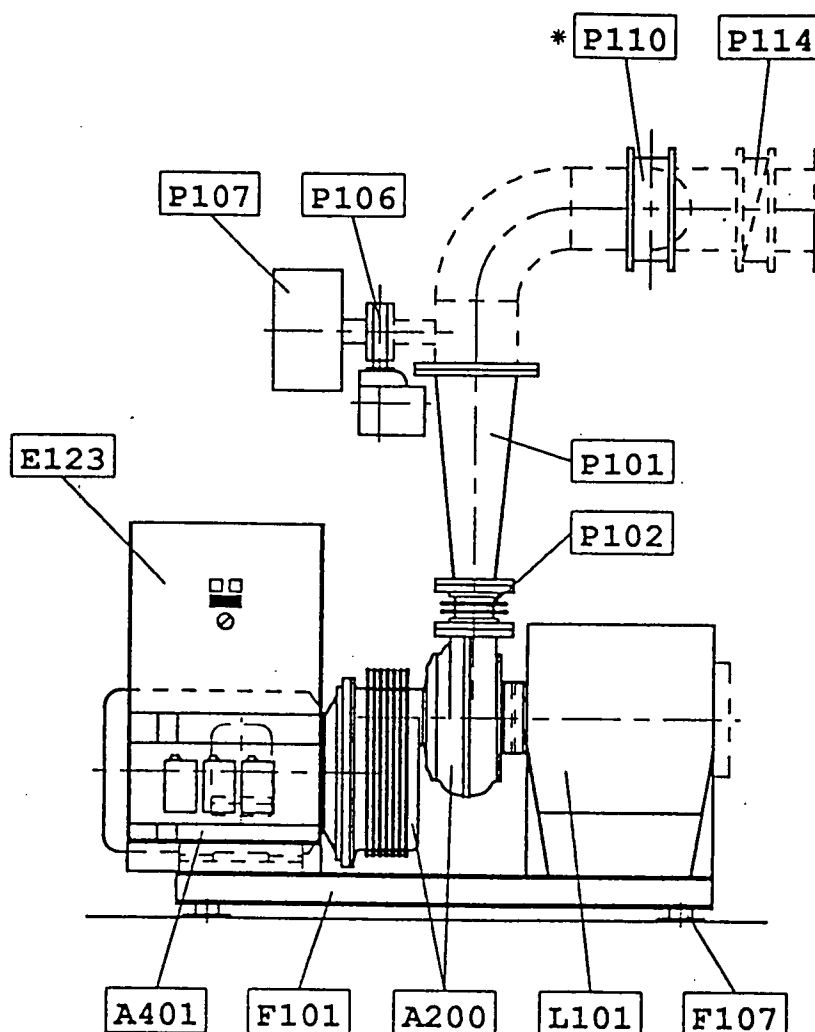
INSTALLATION

Page : 1 of 1

KA2

Prepared by : Dept.
 Latest revision : PKH Dept. 53

Date : 1991
 Date : December 1, 1992



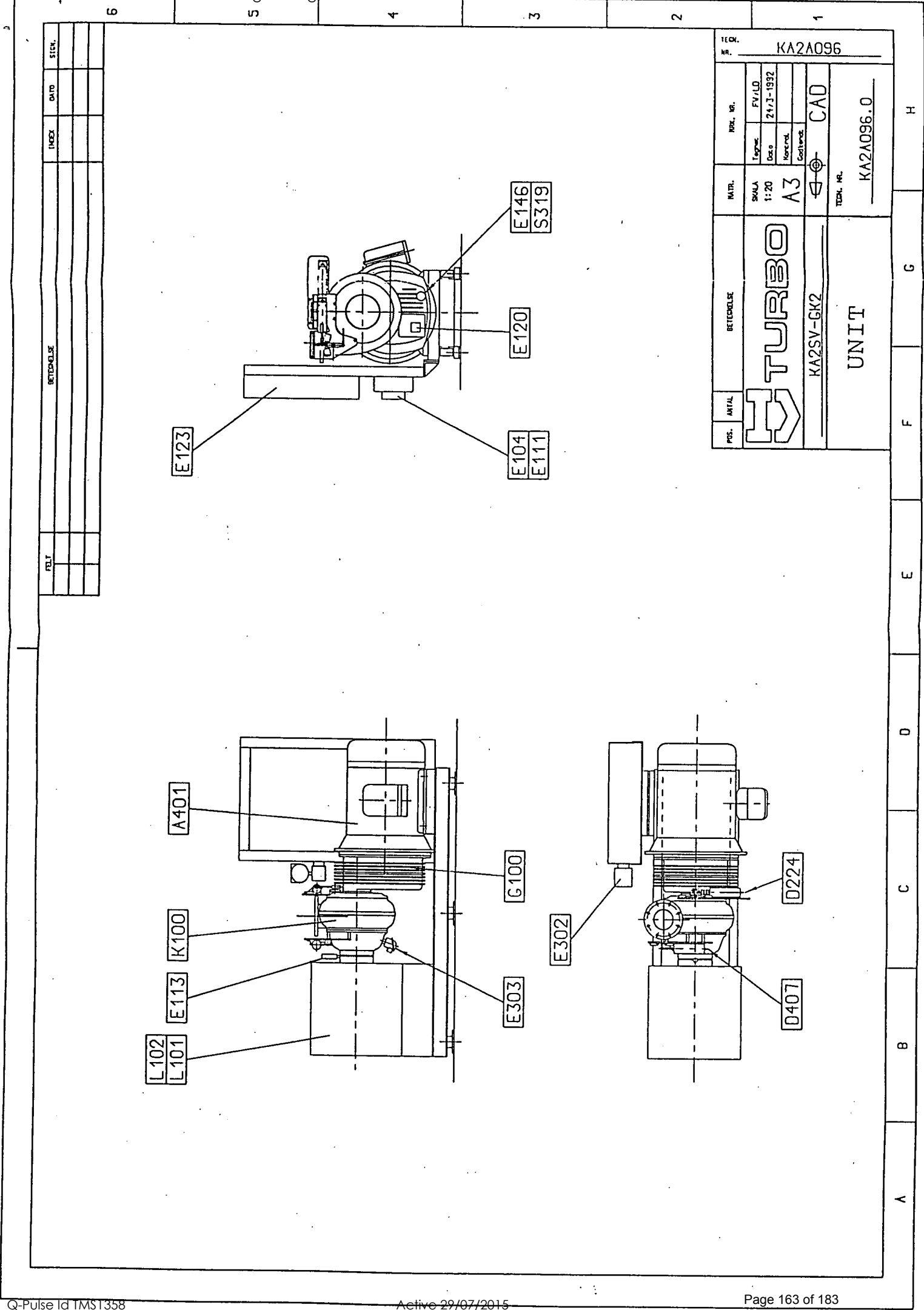
COMPRESSOR UNIT WITH:

A200 - COMPRESSOR/GEARBOX
 A401 - ELECTRIC MOTOR
 F101 - BASEPLATE
 L101 - INLET SILENCER
 WITH FILTER

ACCESSORIES:

P102 - COMPENSATOR
 P101 - CONE DIFFUSER
 P106 - BLOW-OFF VALVE
 P107 - SILENCER FOR BLOW-OFF VALVE
 P110 - NON-RETURN CHECK VALVE
 P114 - SHUT-OFF VALVE
 E123 - LOCAL CONTROL PANEL
 F107 - MACHINE MOUNTS

* P110 - MOUNTED WITH VERTICAL SHAFT



HV-TURBO

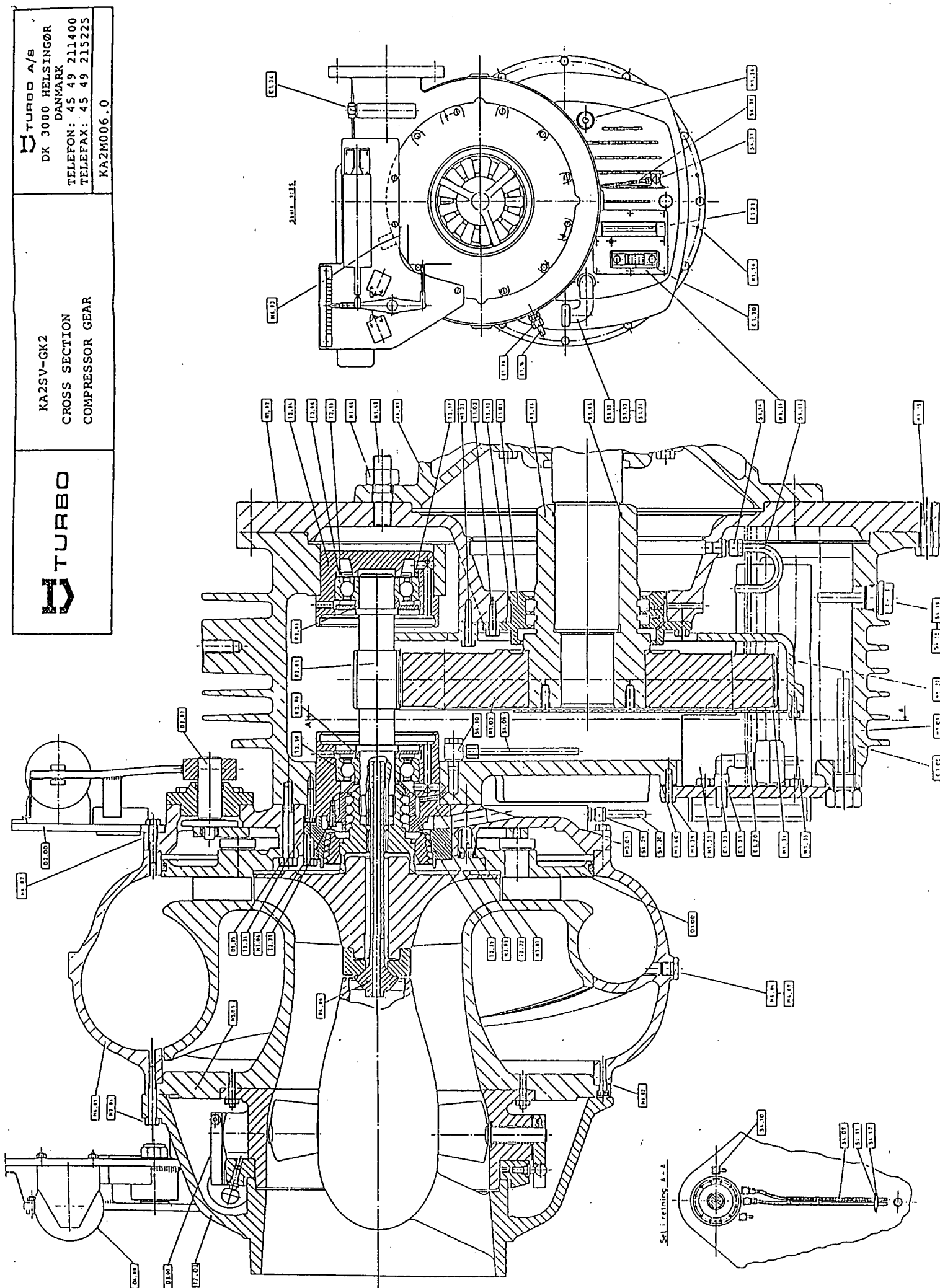
UNIT. KA2SV-GK2

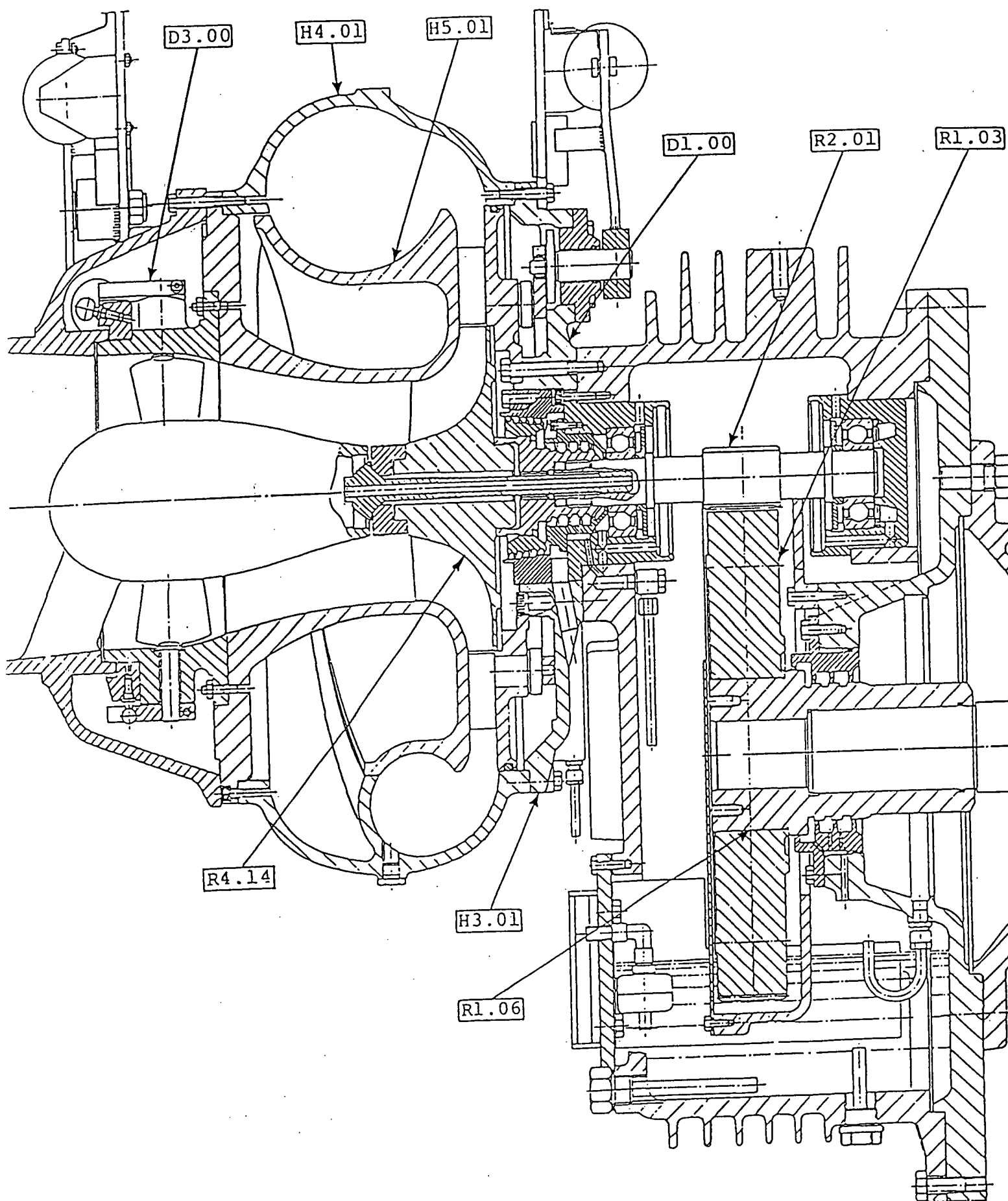
Rev. 0

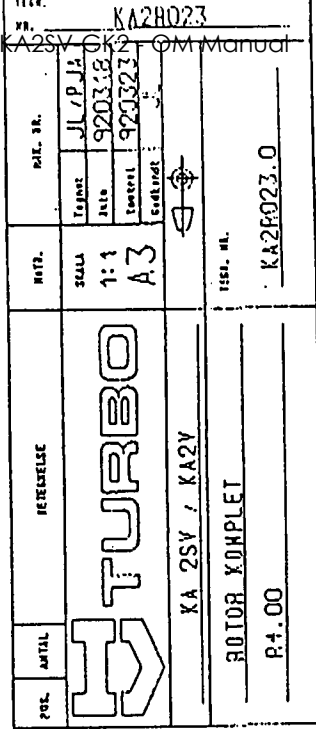
page 1

DRAWING NO. KA2A096.0 UNIT DRAWING

<u>Pos. No.</u>	<u>Description</u>
A401	Drive motor
D224	Linear motor/Diffuser
E104	Thermostat
E111	Thermostat
E113	Pressure switch
E120	Oil level switch
E123	Local control panel
E146	Thermostat - heating element
E302	Differential pressure transmitter
E303	Temperature transmitter
G100	Gear complete
K100	Compressor
L101	Silencer
L102	Filter box
S319	Heater for oil tank







ASSEMBLY DRAWING NO. KA2M006.0

<u>Pos. No.</u>	<u>Description</u>
A4.01	Electric motor
D1.00	Inner diffuser drive
D1.15	Screw for D1.01/H3.01/H1.01
D2.00	Outer diffuser drive
D2.07	Excenter shaft
D3.00	Inner prerotation drive
D4.00	Outer prerotation drive
E1.05	Sensor pocket (oil temperature)
E1.14	Fitting
E1.16	Pipe
E1.20	Oil level switch
E1.22	Thermometer (oil temperature)
E1.30	Sight glass (oil level)
E1.31	Angle fitting
E1.32	Fitting
E1.34	Sensor pocket
H1.01	Gear housing (part A)
H1.02	Gear housing (part B)
H1.15	Screw for H1.01/H1.02
H1.16	Dowel for H1.01/H1.02
H1.24	Plug
H1.30	Cover
H1.31	Shield
H1.32	Oil shield
H1.33	Screw for H1.32/H1.02
H1.34	Cover plate for oil shield
H1.35	Screw for H1.34/H1.32
H1.39	Screw for H1.30/H1.01
H1.40	Gasket for H1.30/H1.01
H1.43	Plug
H1.44	Nut
H3.01	Rear plate
H3.03	Labyrinth sealing
H3.06	Screw for H3.03/T2.22/H1.01
H3.07	Screw for H3.01/H1.01
H4.01	Outer volute casing
H4.02	Screw for H4.01/H3.01
H4.03	Screw for spiral casing positions
H4.04	Plug for H4.01
H4.09	Gasket for H4.04/H4.01
H5.01	Inner volute casing
H6.02	Screw for H5.01/H4.01
H7.01	Inlet housing
H7.04	Screw for H7.01/H4.01

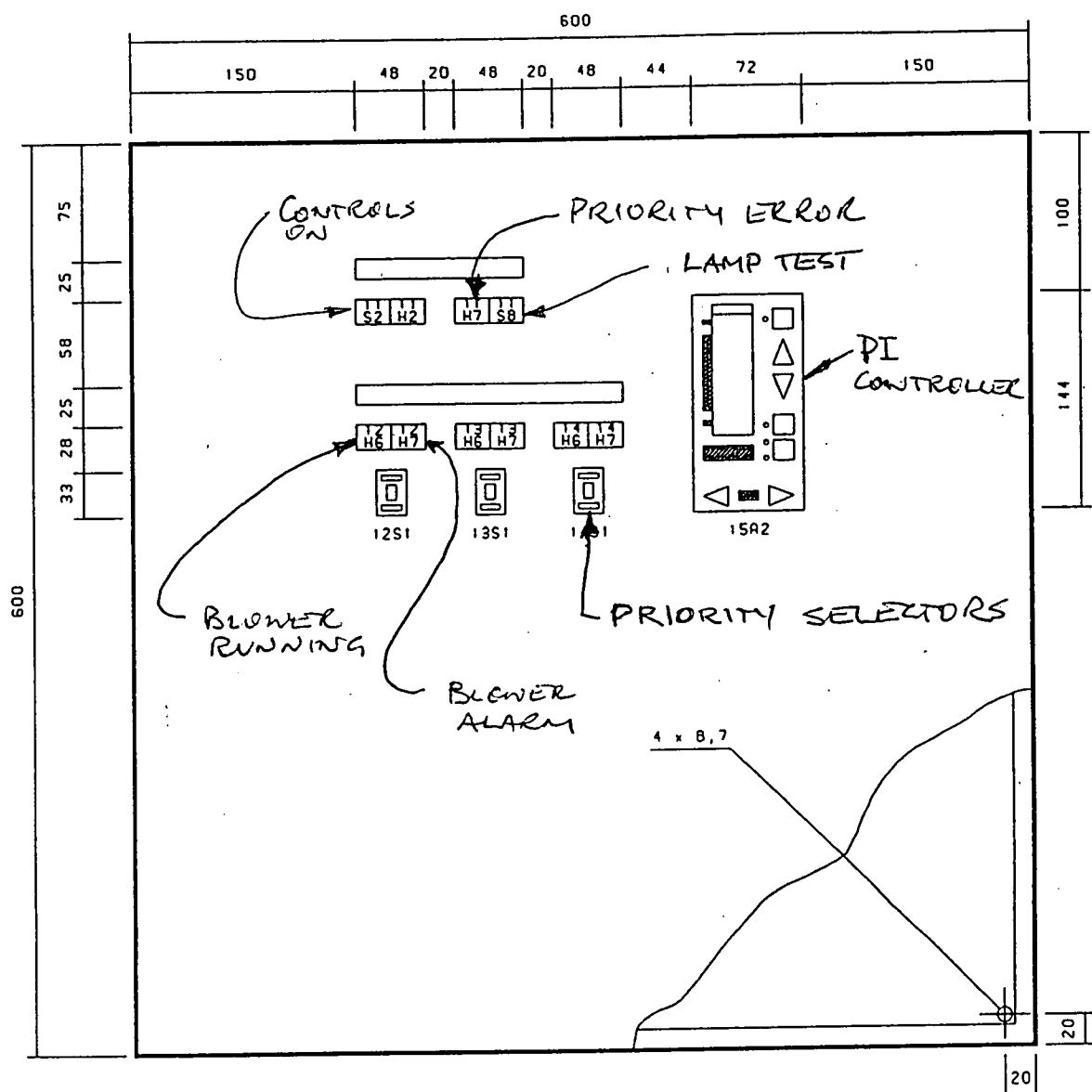
HV-TURBO

POSNR.KA2SV-GK2

Rev. 0

page 2

R1.03	Gear-wheel
R1.05	O-ring
R1.06	Hub
R2.01	Pinion shaft
R2.06	Pump disc
R4.00	Rotor complete
S1.12	Filler stud
S1.13	Cover for S1.12
S1.24	Angle fitting
S4.09	Drain pipe for T2.20
S4.10	Fitting
S4.11	Pipe strap for S4.09
S4.12	Screw for S4.11
S4.13	Pipe
S4.14	Fitting, straight
S4.15	Magnet plug
S4.16	Gasket for S4.15
S4.29	Fitting, straight
S4.30	Pipe
D4.31	Angle fitting
T1.01	Sealing ring
T1.02	Screw for T1.01
T1.12	O-ring for T1.01
T2.04	Bearing housing, motor end
T2.08	Journal bearing, motor end
T2.10	Journal bearing, compressor end
T2.18	Shims for T2.08
T2.19	Plate springs for T2.08
T2.20	Sealing ring
T2.21	Screw for T2.20/T2.22
T2.22	bearing housing, compressor end
T2.34	Screw for T2.22/H1.01



DEGREE OF PROTECTION: IP 54
COLOUR : RAL 7032



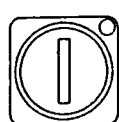
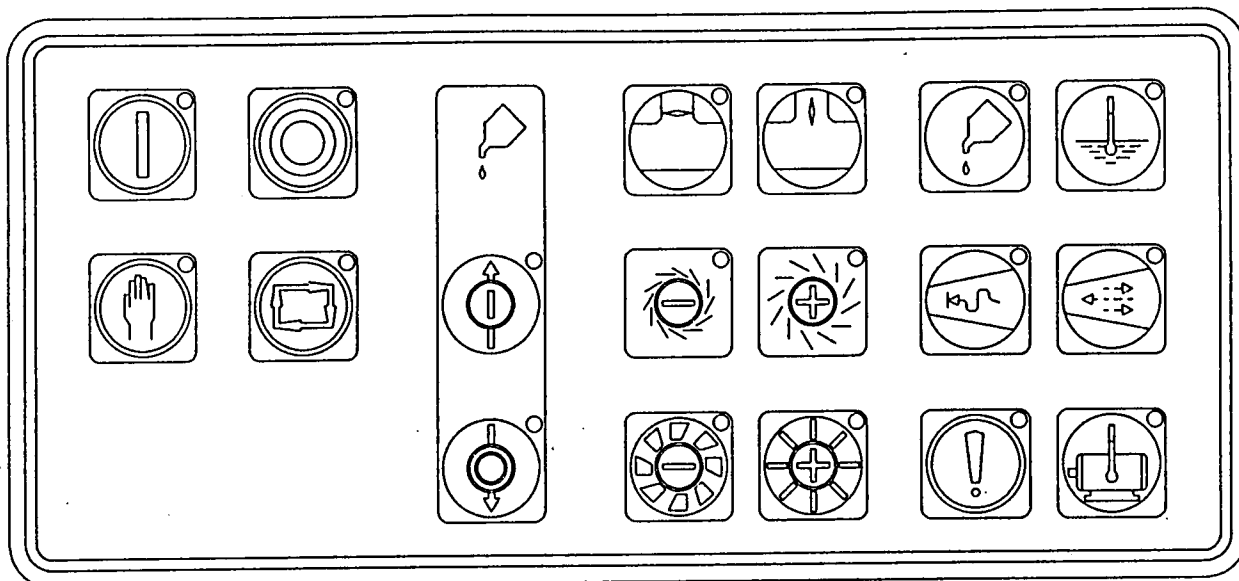
PANEL LAY-OUT FOR MCP-3
FIL : 3415M

Tegnet	SKC/SH	S. nr	003
Dato	18.11.1993	Total	

ndring	Dato	Sign.
Q-Pulse Id TMS1358		

STW. MERRIMAC
ORD. nr. 19/07/2025 3415

Tegn. nr. 93728 of 189 0 0



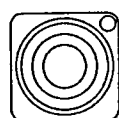
L1: COMPRESSOR
IS STARTED
T1: START
COMPRESSOR



L10: DIFFUSER
IN MIN.
T10: CLOSE
DIFFUSER



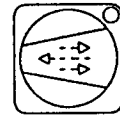
L8: SURGING
T8: RESET



L2: COMPRESSOR
IS STOPPED
T2: STOP
COMPRESSOR



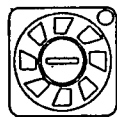
L9: DIFFUSER
IN MAX.
T9: OPEN
DIFFUSER



L7: RECIRCULATION
T7: RESET



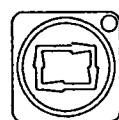
L13: LOCAL/MANUAL
T13: IN
LOCAL/MANUAL



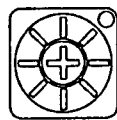
L17: IGV
IN MIN.
T17: CLOSE
IGV



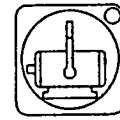
L15: GENERAL ALARM
T15: RESET



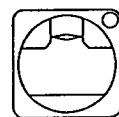
L12: REMOTE/AUTO
T12: IN
REMOTE/AUTO



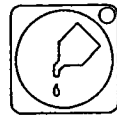
L16: IGV
IN MAX.
T16: OPEN
IGV



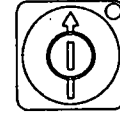
L14: MOTOR TEMP.
TOO HIGH
T14: RESET



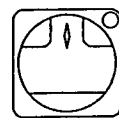
L3: BLOW-OFF VALVE
CLOSED
T3: CLOSE
BLOW-OFF VALVE



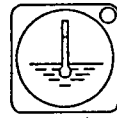
L5: OIL PRESS.
TOO LOW
T5: RESET



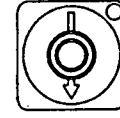
L11: NOT USED
T11: NOT USED



L4: BLOW-OFF VALVE
OPEN
T4: OPEN
BLOW-OFF VALVE



L6: OIL TEMP.
TOO HIGH
T6: RESET



L18: NOT USED
T18: NOT USED



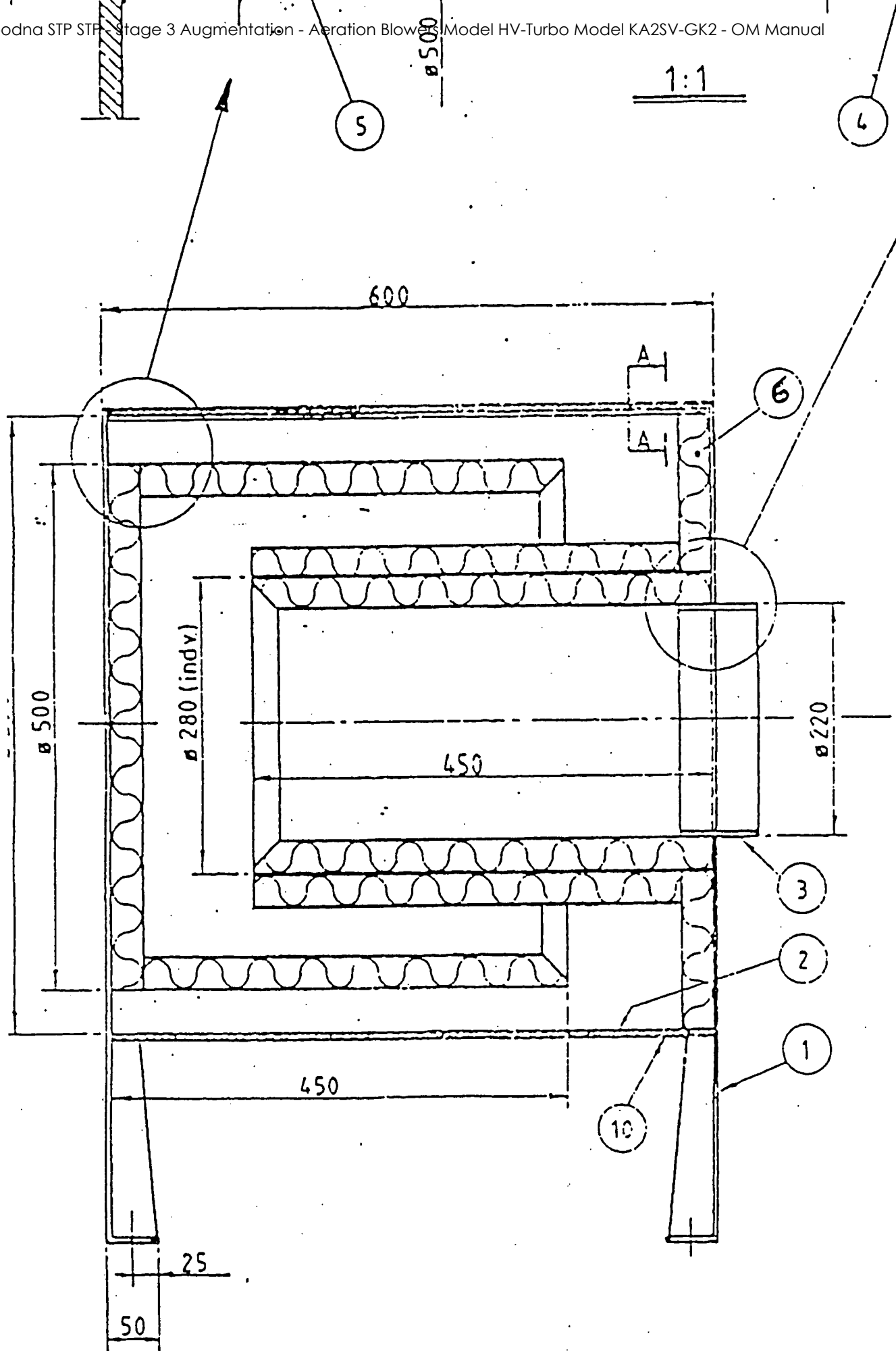
MEMBRANE SWITCH
FIL 3415L

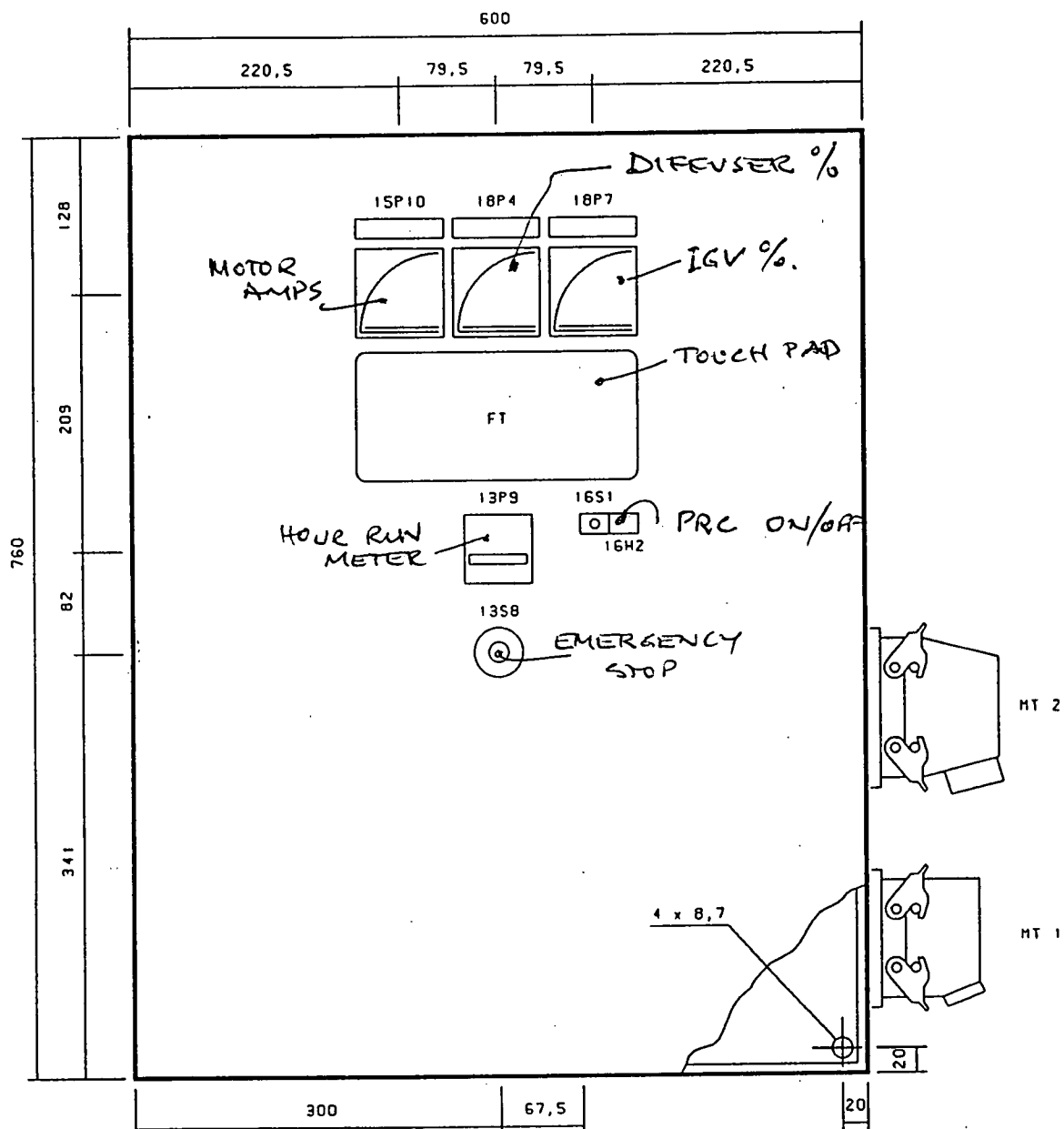
Tegnet	SKC/SH	S. nr	204
Dato	17.11.1993	Total	

ndring	Dato	Sign.
Q-Pulse Id TMS1358		

STW. MERRIMAC
ORD. nr. 17/07/2015 3415

Tegn. nr. 9371301039 0 0





DEGREE OF PROTECTION: IP 54
COLOUR : RAL 7032



PANEL LAY-OUT FOR LC-1D
FIL : 3415L

Tegnat	SKC/SH	S. nr	003
Date	17.11.1993	Total	

ndring	Dato	Sign.

STW MERRIMAC
ORDRE NR 62 3415
Active 29/07/2015

Tegn. nr. 937 123 089 0 0
Page 143 of 168

930930035.UK

Revision : 0

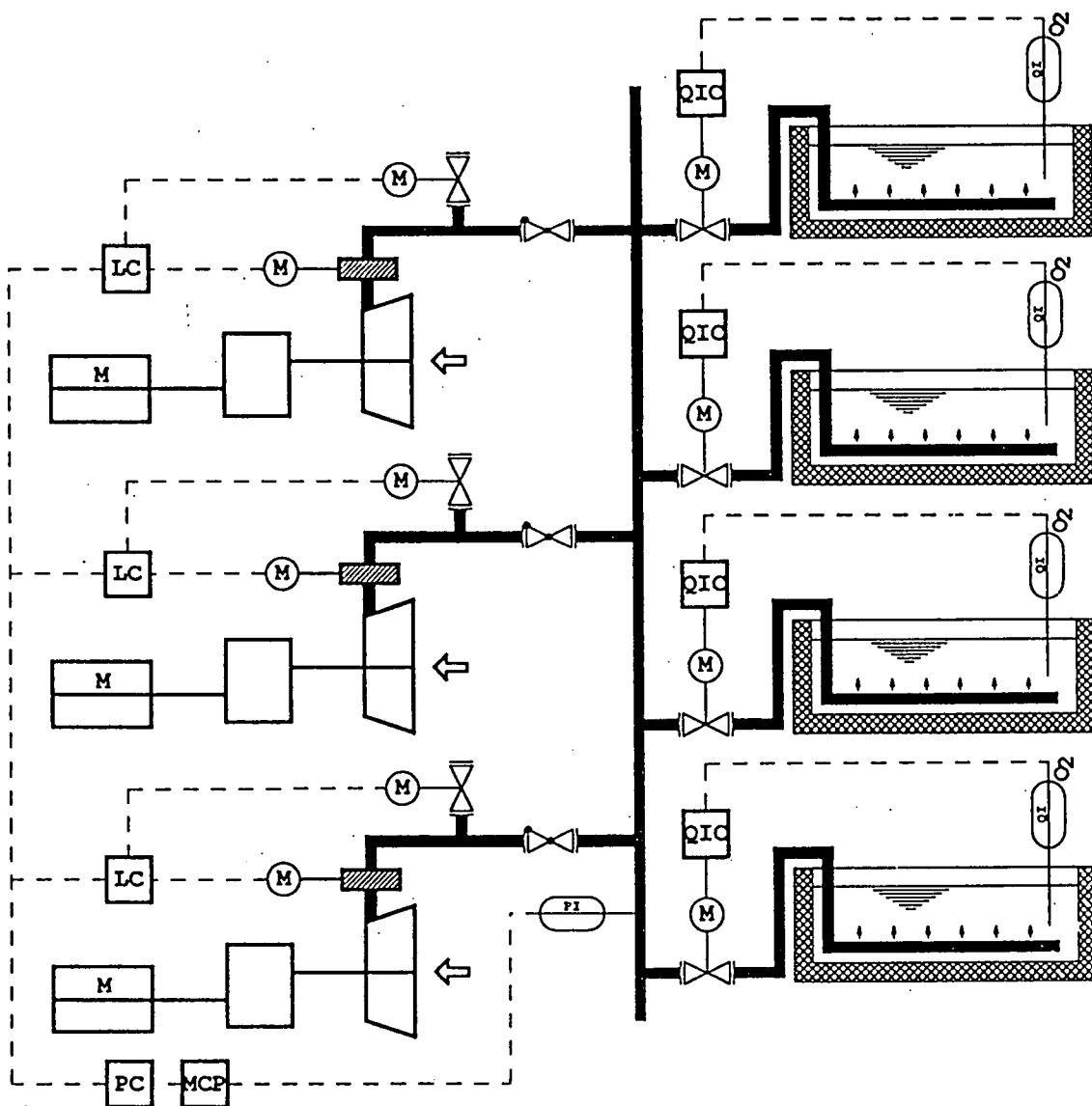
Page : 1 of 1

AERATION SYSTEM PRESSURE - CONTROLLED



Prepared by : FW/HH
Latest revision :

Date : 20/4-1993
Date :



CONTROL SYSTEM FOR MULTIPLE HV-TURBO CENTRIFUGAL BLOWERS WITH LOCAL CONTROL PANELS

The following describes the method of control applied to a series of two or more HV-Turbo centrifugal blowers, installed in parallel to service a single process, under the control of a single master controller. Each blower shall have its own Local Control Panel (LCP) and each will be connected to the common master control panel (MCP), motor control centre (MCC) and power supply as shown in the accompanying Figure No.1.

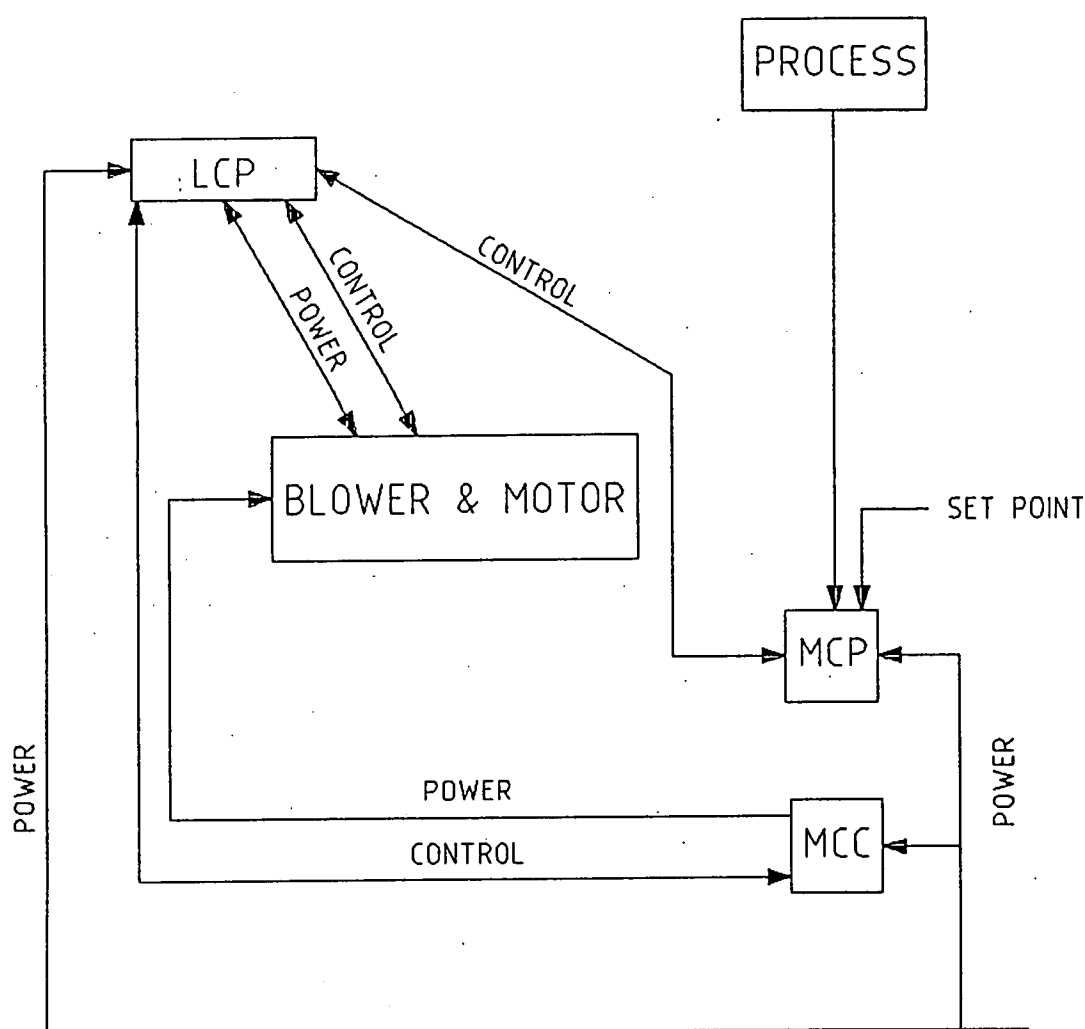


FIGURE 1

C58HIL05

LOCAL CONTROL PANEL (LCP) - KA2SV-GK2 BLOWER

Each LCP controls and/or monitors the blower ancillary drives and safety devices including:

- Diffuser drive
- Diffuser position
- Inlet guide vane drive
- Inlet guide vane position
- High Lube oil temperature
- Low Lube oil level
- Blow-off valve drive
- Blow-off valve end travel limits
- Acoustic hood vent fan drive
- Inlet air temperature (recirculation)
- Surge detector
- Drive motor temperature
- Drive motor amps

The signals which pass between the LCP and the MCP are as follows:

LCP to MCP

1. Blower ready to start
2. Blower general fault condition
3. Blower under local control
4. Blower running
5. Diffuser fully open
6. Diffuser fully closed

MCP to LCP

7. Open diffuser
8. Close diffuser
9. Start blower
10. Stop blower

START UP PRE-CONDITIONS

Diffuser in minimum

I.G.V in minimum

Blow-off valve fully open

No active alarm conditions

Blower not in "manual" or "service" control

FAULT CONDITIONS

Motor temperature too high

Oil level too low

Oil temperature too high

Inlet air temperature too high (recirculation)

Blower surge (differential pressure too high)

General (common) alarm - B.O.V. not closed in time

Emergency stop engaged

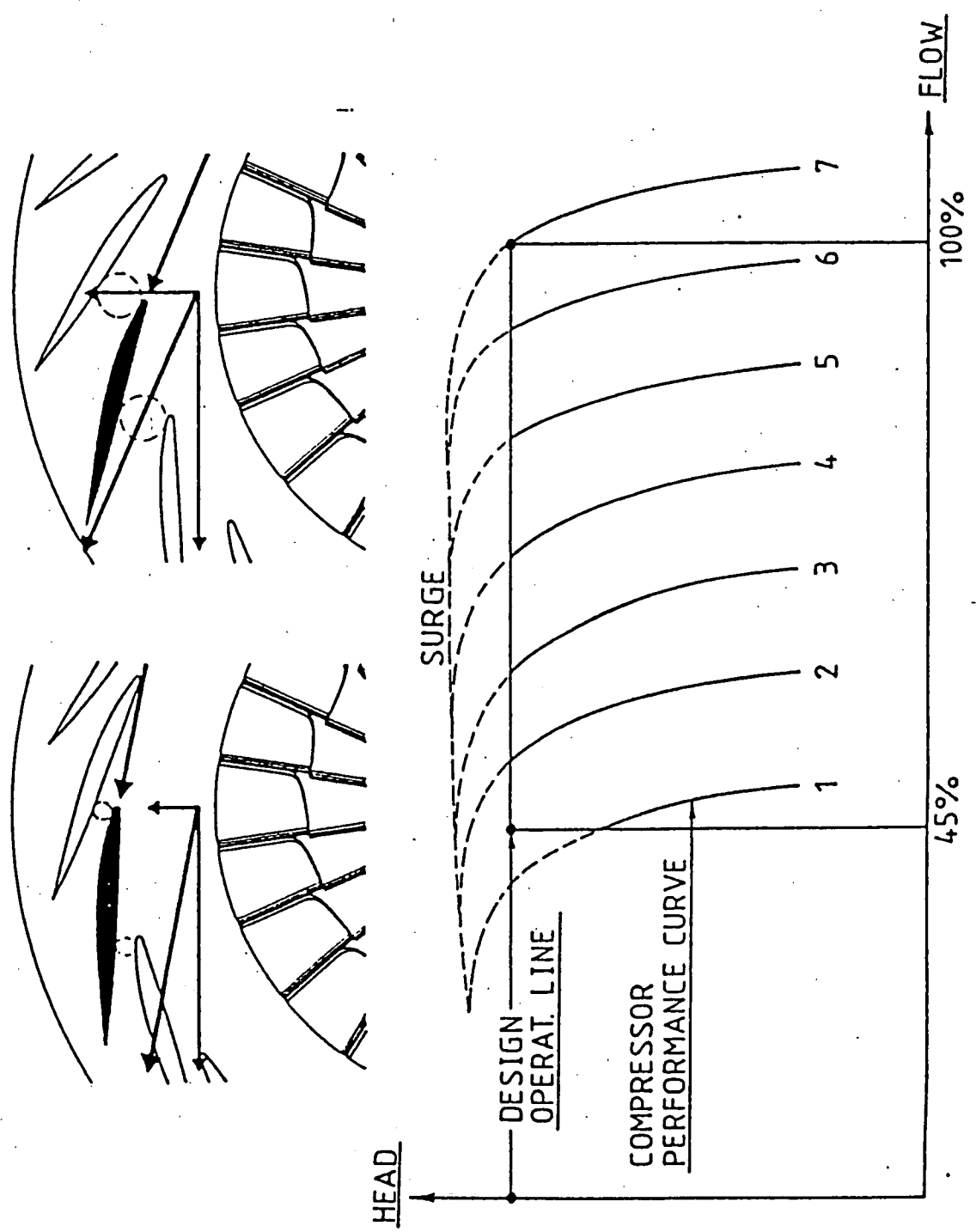
Motor doesn't start

INSPECTION

1. Listen for foreign noises
2. Check filter losses < 60mm W.C.
3. Check oil level
4. Check oil temperature
5. Check motor amps

MAINTENANCE

- Change filter cloth at 60mm WC (max)
- Change gearbox oil 500 hrs then 6000 hrs
- Change bearings 18,000 hours
- Clean impeller etc 18,000 hours



Various diffuser vane settings will provide various operational curves.

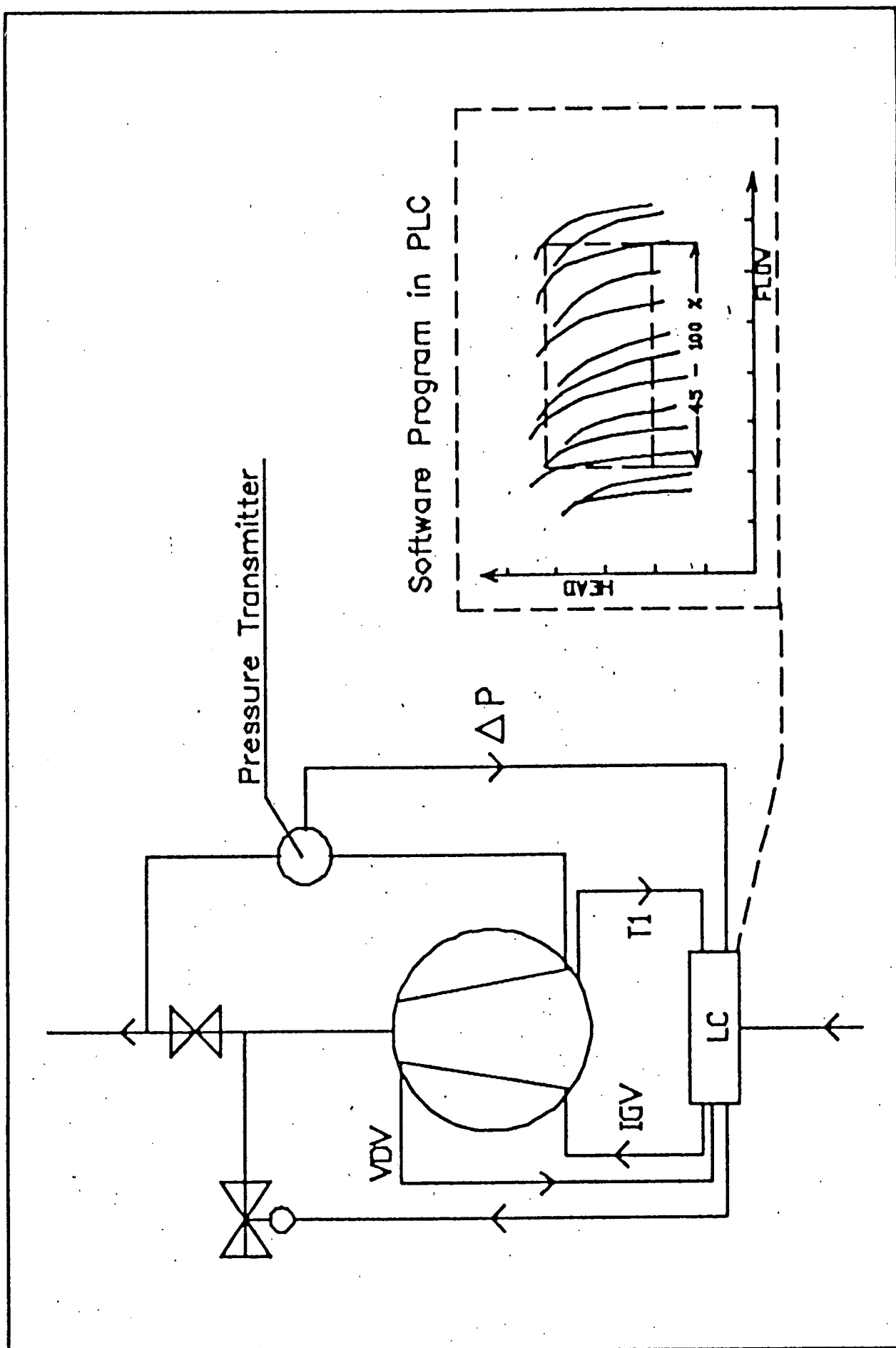


Figure 11. The local control LC calculates the IGV position based on the process variables, which are air demand, pressure and temperature

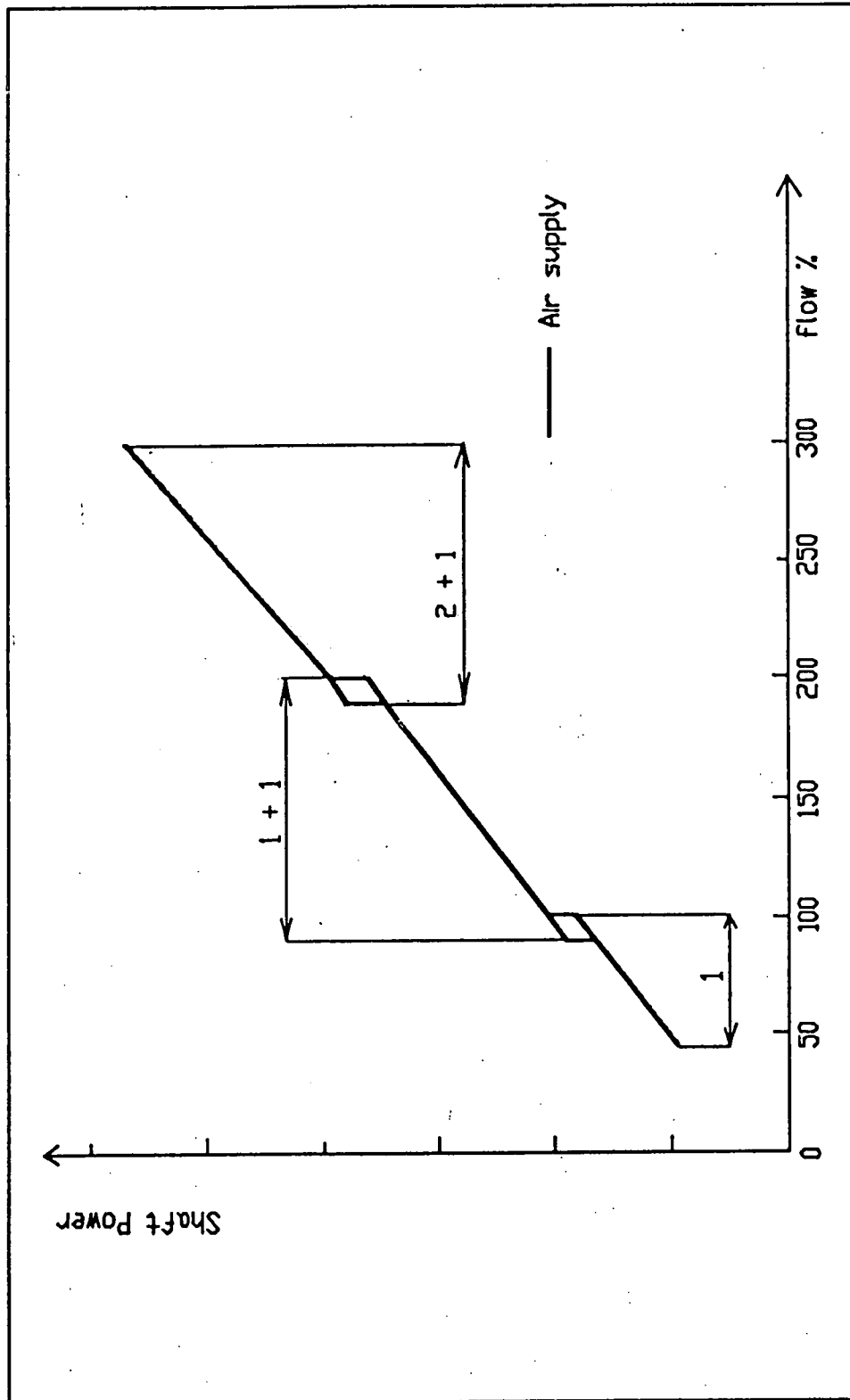


Figure 13. A regulating range of 45 -100 percent of the design flow creates capacity overlapping and thus provides a continuous air supply with cascade regulation.

DATE: 10/10/2015

DATA SHEET



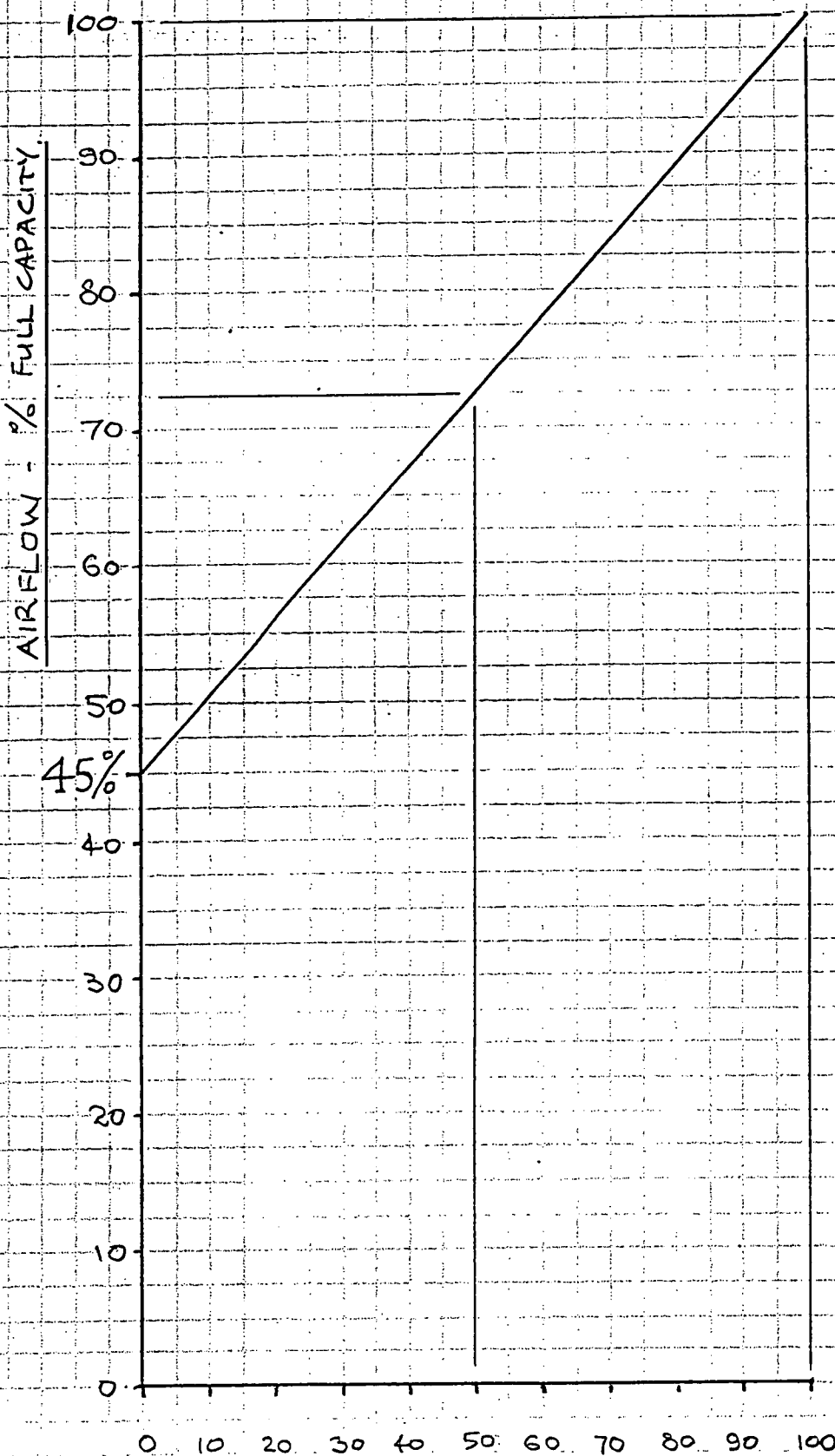
Project		Equipment		Manufacturer	
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4		5		6	
7		8		9	
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769		770		771	
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781		782		783	
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847					



DATA SHEET

AQUATEC-MAXCON PTY LTD

Project	Job N ^o	Date	
Equipment HV-TURBO "KA" CENTRIFUGAL	By	Checked	Sheet
Component DIFFUSER SETTINGS.	Revisions	Of	


DIFFUSER - % OPEN.