COMPRESSOR
KA2S-GK190
ST 41
1HOUR MFTFR
AT
COMISSIONING
42325

OPERATION OF COMPRESSOR

MAINTENANCE OF COMPRESSOR

DIMENSION DRAWING

JB-1D

ACOUSTIC ENCLOSURE

CERTIFICATES

ACCESSORIES

REF. KF01897

CONNECT

5 705831 018976

HANDBOOK

FOR

OPERATION AND MAINTENANCE

OF

COMPRESSOR KA2S-GK190

HV-TURBO A/S
ALLEGADE 2, DK-3000 HELSINGØR, DENMARK
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TURBO

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Revision: 7
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EC DECLARATION OF CONFORMITY

TURBO

Prepared by	MC	Date:	94.10.25
Latest revision:	FP	Date:	05.09.12

Performed according to EN 45014 model

We **HV-TURBO A/S, ALLEGADE 2, 3000 HELSINGØR, DENMARK**
(supplier's name and address)

declare under our sole responsibility that the following product range:

COMPRESSORS FOR AIR

Type KA2, KA5, KA10, KA22, KA44, KA66, KA80 and KA100
(name, type or model, lot, batch or serial number, possibly sources and numbers of items)

to which this declaration relates is in conformity with the following standards or other normative documents:

EN 1012-1:1996	Compressors and vacuum pumps - Safety requirements
EN 60 204-1:1998	Safety of machinery: Electrical equipment of machines
EN ISO 12100-1:2003	Safety of machinery: Basic terminology
EN ISO 12100-2:2003	Safety of machinery: Technical principles
EN 294:1994	Safety of machinery: Safety distances to prevent danger zones being reached by the upper limbs
EN 418:1994	Safety of machinery: Emergency stop
EN 563:1994	Safety of machinery: Temperatures of touchable surfaces
EN 953:2003	Safety of machinery: Guard of machinery
EN 61000-6-4:2002	Electromagnetic compatibility, emission
EN 61000-6-2:2001	Electromagnetic compatibility, immunity
EN 60439-1:2001	Low voltage switchgear and control gear assemblies - Part 1: Type-tested and partially type-tested assemblies

(title and/or number and date of issue of the standard(s) or other normative document(s)

(if applicable) following the provisions of directives:

73/23/EEC	Low tension
98/37	Machinery
89/336/EEC	EMC requirements
92/31/EEC	1. Amendment of 89/336/EEC

and that the technical documentation is filed for a period of minimum 10 years from delivery.

Helsingør 14-2005
(place and date of issue)

(name and signature)

TURBO
Allegade 2 . 3000 Helsingør
Danmark

IMPORTANT (TECH.DOC. 930940077UK)

This compressor unit is a high-capacity machine. If not operated correctly it will be damaged and also expose the personnel in the immediate vicinity of the machine or the electric wiring to hazards.

The Instruction Handbook shall be studied entirely prior to final installation, electric connection, and start-up. Especially, note the following sections.

Safety of Machinery:	See the handbook, § 0
Installation:	(See the handbook)
Direction of Rotation:	Note that even a minor period of operation in the wrong direction of rotation will damage the bearings in gear and compressor. (See the handbook)
Coupling:	Check of alignment before start. (See the handbook)
Re-tightening:	After about 10 operating hours the coupling bolts shall be re-tightened. (See the handbook)
Oil Check:	HV-TURBO recommends having the oil analyzed after approx. 500 operating hours, and then to decide the intervals of oil change on the basis of regular oil analyses. (See the handbook)
Electric motors	Grease lubricated bearings in electric motors must be lubricated immediately after start-up of the unit. Correct type and quantity of grease as well as frequency are stated on the motor nameplate and/or in motor supplier's instruction. In case of oil lubricated bearings in electric motor, oil quality and oil level should be checked before start-up. The customer is obliged to and responsible for compliance with the lubrication instructions.

In case of defects, damage, or faulty delivery, the supplier shall be notified immediately.

0. MACHINERY SAFETY REQUIREMENTS

PUTTING INTO SERVICE

The compressor unit shall only be operated in compliance with the operating conditions agreed upon, as indicated on the nameplate and described in Technical Data.

LIFT

The weight of the compressor unit is stamped on the consignment. Lifting is carried out according to Instruction Concerning Straps.

START BY MANUAL CONTROL

The compressor can be started by pressing IEC417-5007 symbol ***T1*** on the membrane keyboard of the local control panel. When ***T1*** is activated, the main motor starts. See the chapter on LC-Panel.

STOP BY MANUAL CONTROL

The compressor can be stopped by pressing IEC417-5008 symbol ***T2*** on the membrane keyboard of the local control panel. When ***T2*** is activated the compressor stops and is blocked for restart for one minute. See the chapter on LC-Panel.

EMERGENCY STOP

An emergency stop (EN418) is positioned on the front of the local control panel. The emergency stop is ***not*** to be activated unless hazardous situations threaten or ***have already*** occurred. The safety monitor activates the emergency stop function when a control device is activated by a malfunction. All functions will stop immediately. Under these circumstances the compressor will emit a lot of noise. The emergency stop shall *not* be used as an ordinary stop function, as repeated emergency stops may damage the compressor.

AUTOMATIC START/STOP

Compressor units may be set in remote control mode by pressing ***T13***. In this mode the compressor can start and stop ***without forewarning***. An ISO 7000-0017 symbol warns of remote control start/-stop. In this mode all guards ***must*** be correctly mounted and no persons allowed in the immediate vicinity of the rotating machine parts.

MECHANICAL HAZARD

Fixed guards acc. to EN294 & EN953 shall protect all rotating parts. The guards are not to be removed unless the machine is safeguarded against unintentional start. Loose clothing is to be avoided and it is advisable to keep a safe distance as long as the machine is in the remote control mode.
Do not mount the compressor; the surface may be greasy and slippery.

INLET SYSTEM

The inlet system shall be correctly mounted before start of the compressor. Avoid blocking the inlet and staying near connected inlet channels when the machine is ready to start.

HOT SURFACES

A sign warning of hot surfaces has been placed directly on the machine. It is indicated by symbol EN1012-annex 3. Avoid touching the hottest surfaces, which are normally more than 70°C.

NOISE HAZARD

Noise emission from the compressor unit is measured acc. to ISO3744, normally without silencer hood. The measurements are recorded in the noise certificate. See certificates.
At the entrance to the compressor room and/or silencer hoods an ISO3864 warning sign is placed which illustrates the use of ear protection.

ELECTRICAL HAZARD

Any contact with electrical high-/low-voltage installations is to be avoided as long as the machine is connected to the power supply. See EN60204-1. Check at regular intervals that all main components of the machine are correctly grounded.

SPECIAL TOOLS

The compressor delivery includes a toolbox with special tools. The tools shall only be used as described in the paragraph on assembly and disassembly of the compressor.

MAINTENANCE & REPAIRS

Repairs and maintenance work is only to be performed when all energy sources to the machine have been properly isolated/insulated. The emergency stop shall be activated, the motor disconnected and the terminals short-circuited. The danger of back flow from the pipe system is safeguarded against by either closing and locking a valve positioned immediately after the check valve or by placing a blind flange upstream by the check valve.

Sign: "Warning: Maintenance work in progress".

NOTIFY!

In case HV-TURBO deliver consignments that are neither assembled nor serviceable machine units, e.g. compressor units without drive motor and/or control systems, the following will apply:

"The compressor unit is comprehended by Machine Directive 89/392/EEC and appurtenant amendment directives, and shall not be put into service until the entire unit, of which it is a part, complies with the said Directive and appurtenant normative standards.

1. SHIPPING - STORAGE - INSTALLATION

1.1 SHIPPING

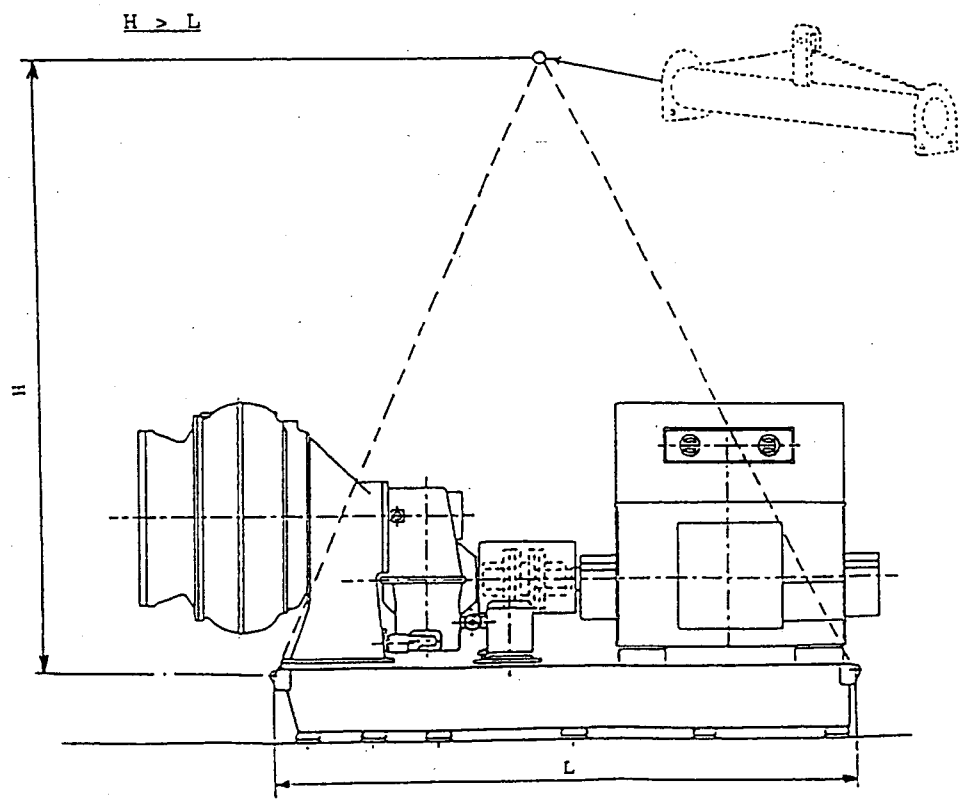
On receipt of the compressor unit, check that the individual parts correspond with those listed on the delivery note.

When unloading, check immediately for possible damage of the compressor unit that may have happened during shipment, such as damaged dents, scratches, corrosion, torn electric cables, bent pipes, or the like. In case of defects or damage, the carrier and supplier shall be informed immediately.

The aggregate shall only be lifted with straps fastened to the 4 lifting hooks mounted on the base. In order to avoid squeezing of instruments, piping, etc., use a lifting yoke.

Weight of compressor aggregate: See section 2.

Use of straps: See fig. below.



1.2 STORAGE

Prior to leaving HV-TURBO, the compressor aggregate has been submitted to a test run. After the test the lubricating oil has been drained off, preservative oil applied and pumped through the lubricating oil system, and all excess preservative oil drained off. All untreated parts of the aggregate, which are likely to corrode, have been treated with a corrosion-preventing agent.

This ensures that the compressor aggregate is protected against corrosion for a minimum of 6 months, provided that it is stored indoors. It is not necessary to remove the corrosion-preventing agent before starting up the aggregate, as the preventive agent does not affect the lubricating oil.

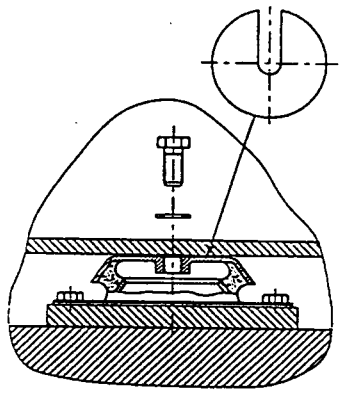
If the compressor is stored for more than 6 months, it shall be treated with a long-term preventive agent. A corrosion-preventing agent used for long-term storage will have to be removed before start-up. This is done by disassembling and cleaning all the compressor parts. In this case only HV-TURBO service engineers shall prepare the compressors for operation. The preparation shall be carried out in a dry and clean environment.

Do not use the compressor unit or parts of it as scaffolding. For further information, require technical information 930920009UK.

1.3 INSTALLATION

It is possible to mount / install the compressor prior to removing a long-term corrosion protection. The compressor can be mounted on any level floor that can carry the weight. A special vibration damping concrete foundation is only used in exceptional cases.

The compressor shall be mounted on vibration damping machine mounts, the underside of which can be glued directly to the concrete floor (see mounting instructions) or the machine mounts can be screwed or welded to its base, depending on the floor construction. In case of uneven floor construction insert shims in order that the machine mounts get in touch with the floor (see fig.).



Important! Before the compressor aggregate is fastened to the floor, check its position to make sure that flanges (and possibly other pipe connections) are placed correctly with a view to the final pipe installation. Do not uncover the flanges until the pipe system is ready for installation. This prevents foreign substance from entering the compressor. All pipe systems shall be cleaned and inspected before they are connected to the aggregate.

If the drive motor shaft has been securely fastened for shipping, this fastening shall be removed and the dismounted coupling remounted.

1.3.1 PIPE CONNECTIONS/PERMISSIBLE LOADS

It is essential that there is a flexible connection in the following places:

- between compressor discharge and cone diffuser
- between compressor inlet and air inlet duct.

Permissible loads: See Technical Information 930910007.UK.

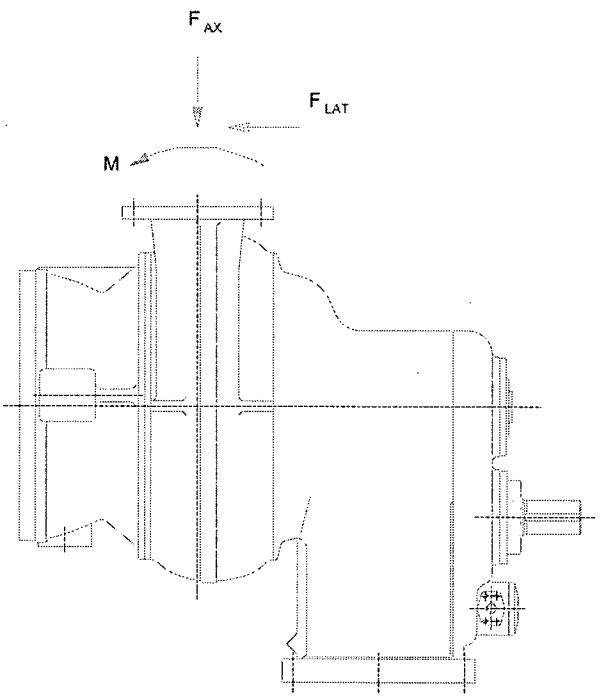
ALLOWABLE LOAD ON COMPRESSOR DISCHARGE FLANGE 930910007UK

Reactions of piping systems connected to turbocompressors, if of sufficient magnitude, will result in misalignment of the compressor sufficient to cause rough operation and in worst case serious mechanical damage.

The external load comes from thermal expansion, pressure loads the weight of the pipe system, and is mainly transmitted to the compressor through the expansion joint, attached on the discharge flange.

If the external loads on the compressor are limited to the figures in the table below, the loads should not influence the compressor operation.

F_{AX} = Forces in the discharge pipe direction
F_{LAT} = Forces perpendicular to F_{AX}
M = Moment in any direction



TYPE	F_{AX}	F_{LAT}	M
	N	N	NM
KA2	1100	330	65
KA5	2700	800	225
KA10	4000	1200	350
KA22	5500	1600	600
KA44	7600	2200	900
KA66	10000	3000	1500
KA80	13500	4000	2000
KA100	17500	5000	3500

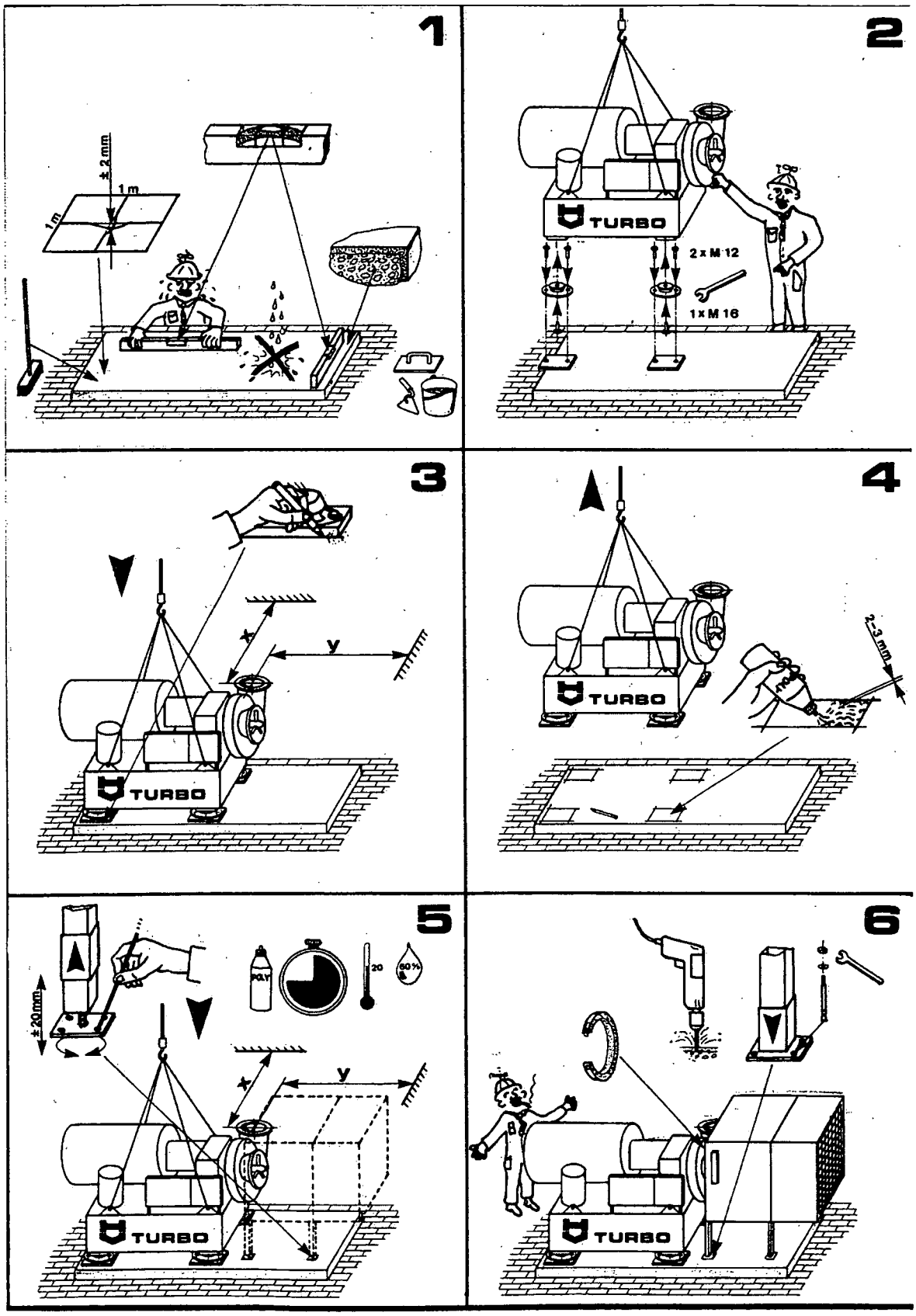
The pipe system must be supported thus minimizing the external loads.

The allowable loads, alignment tolerances etc. of the flexible joint positioned at the discharge flange, must be carefully considered, when designing the pipe system.

The external loads on the compressor are transmitted through the base to the machinery supports and must be included when sizing the supports.

For further information, see the standards NEMA SM23-1985, section 9.4 and API 672, section 2.2.3 and 2.3.4.

INSTALLATION 930840008UK



Instruktionsbøger KA2 GK190: [KA2S_GK190UK.doc]

2. TECHNICAL SPECIFICATIONS

UNIT - Drawing No.

Serial No.	:	7371	
Year	:	2007	
Weight, approx.	:	1500	kg

COMPRESSOR - Pos. No. K100

Make	:	HV-TURBO	
Type	:	KA2S	
Medium flow	:	Air	
Inlet flow, min.	:	1761	m³/h
Inlet flow, max.	:	3913	m³/h
Inlet pressure	:	1,000	bar abs.
Discharge pressure, max.	:	1,530	bar abs.
Inlet temperature, normal	:	20	°C
Inlet temperature, max.	:	45	°C
Revolutions	:	23.734	rpm
Power consumption, min.	:	35,7	kW
Power consumption, max.	:	70,7	kW
The power is indicated at	:	Inlet flow min./max., inlet pressure normal and inlet temperature max	

GEAR - Pos. No. G100

Make	:	HV-TURBO	
Type	:	GK 190	
Gear ratio	:	223/28	
Oil requirement	:	13,0	litres

DRIVE MOTOR - Pos. No. A401

Coupling	:	Rexnord Thomas	
Type	:	SR52N-MSH 225	

LINEAR MOTOR - DIFFUSER - Pos. No. D224, SUPPLIED BY AQUATEC

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	:	IP 54	
Mains frequency	:	60	Hz
Voltage	:	1 x220	V
Position indication built in	:	1000	Ω potentiometer The resistance range <880 Ω can be specified after test run of the compressor.

AIR INLET FILTER (INSERT) - Pos. No. L102

Make	:	VILEDON	
Type	:	Filter Cloth	
EU-class DIN 24185	:	EU4	
Filter clean/replace at max.	:	+ 20	mm WC

MANOMETER Pos. No. E137

LUBRICATING OIL TEMPERATURE

Max.	:	110	°C
Normal operating temperature	:	45 - 85	°C

THERMOMETER - POS. No. E122

LUBRICATING OIL

Normal filling, see enclosure:
OIL SPECIFICATION, HV-TURBO Tech. Info. 930.870.003 (2 pages)

Lubricating oil types, see enclosure
OIL SPECIFICATION, HV-TURBO Tech. Info. 930.870.005 (1 page)

- both inserted after "Technical Specifications".

OIL RESERVOIR IN GEAR - Pos. No. G100

Normal filling	:	13	litres

THERMOSTAT – VENTILATION FAN IN SILENCER HOOD

Make	:	Danfoss A/S
Type	:	RT 103
Sensor	:	Room sensor
Function	:	Starts and stops the ventilation fan for the silencer hood.
Set point	:	30 °C
Difference	:	Minimum

THERMOSTAT - Pos. No. E104

Make	:	Danfoss A/S
Type	:	RT1010
Sensor	:	In reservoir
Function	:	Stops compressor when oil temperature gets too high
Set point	:	110°C
Difference	:	Minimum

THERMOSTAT - Pos. No. E111

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

PRESSOSTAT - Pos. No. E113

Make	:	HV-TURBO
Type	:	SUC-3
Sensor	:	In compressor's inlet
Function	:	Stops compressor at surging

OIL LEVEL CONTACT - Pos. No. E120

Make	:	De Laval
Type	:	LS 1750
Positioning	:	In oil reservoir
Function	:	Gives alarm signal if oil level in the reservoir falls below min.

OIL SPECIFICATIONS (TECH.DOC. 930870003UK)

COMPRESSOR	YEAR OF CONSTRUCTION	OIL TYPE DIN 51502	HV-TURBO REFERENCIES	VISCOSITY INDEX MIN. ISO 2909	VISCOSITY MIN. at 120°C	FZG STAGE MIN. DIN 51354
KA2-GK2	1986	PAO [1]	930870005	137	4.20	10
KA2-GK190	2003	PAO	930870005	137	4.20	10
KA4-GK4	1982	PAO	930870005	137	4.20	10
KA5-GK200	1996	PAO	930870005	137	4.20	10

OIL PUMP CAPACITY AND OIL RESERVOIR

COMPRESSOR	YEAR OF CONSTRUCTION	OIL PUMP CAPACITY STANDARD LITER/MIN.	OIL RESERVOIR LITER +/- 10%
KA2-GK2	1986	--- ---	6
KA2-GK190	2003	--- ---	13
KA4-GK4	1982	--- ---	19
KA5-GK200	1996	14 [2]	35

[1] PAO = Synthetic oil, polyalfaolifine
[2] Oil pump integrated in the gear.

OIL SPECIFICATION (TECH.DOC. 930870005UK)

Specification of lubricating oils applicable for HV-TURBO compressors with anti-friction bearings (ball/roller bearings).

Note: Turbochargers, Journal bearing gearboxes } Please see different specification

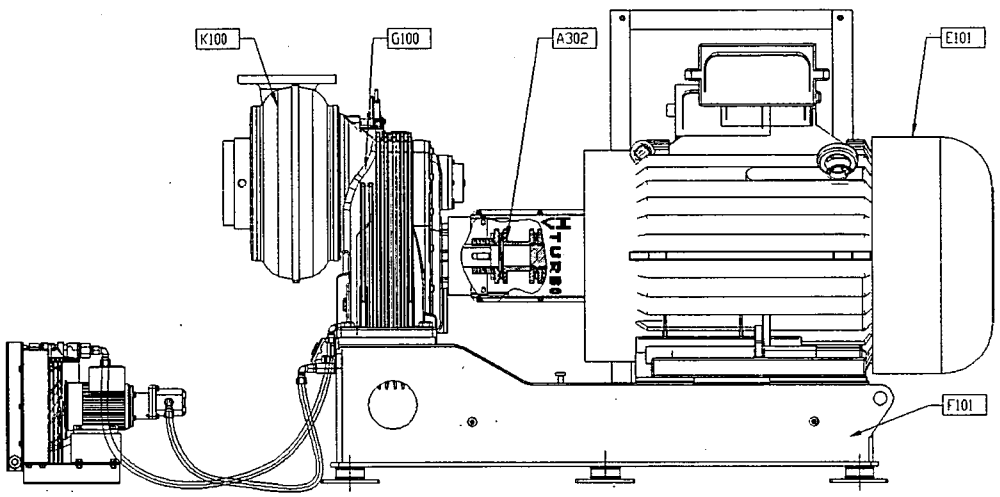
Company	Oil type	Supplier Scandinavia Europe North America
BP	BP ENERGOL RC-S 46	BP BP BP
TOTAL	DACNIS SH 46	Total Fina Elf Total Fina Elf Total Fina Elf
ESSO	ESSO COMPRESSOR OIL RS32	Esso Esso Exxon
MOBIL	MOBIL SHC 624	Mobil Mobil Mobil
Q8	Q8 SCHUMANN 32	Kuwait Petroleum Kuwait Petroleum ----------
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 Lubrication
FUCHS	FUCHS COFRABAR P32	Fuchs Fuchs Fuchs

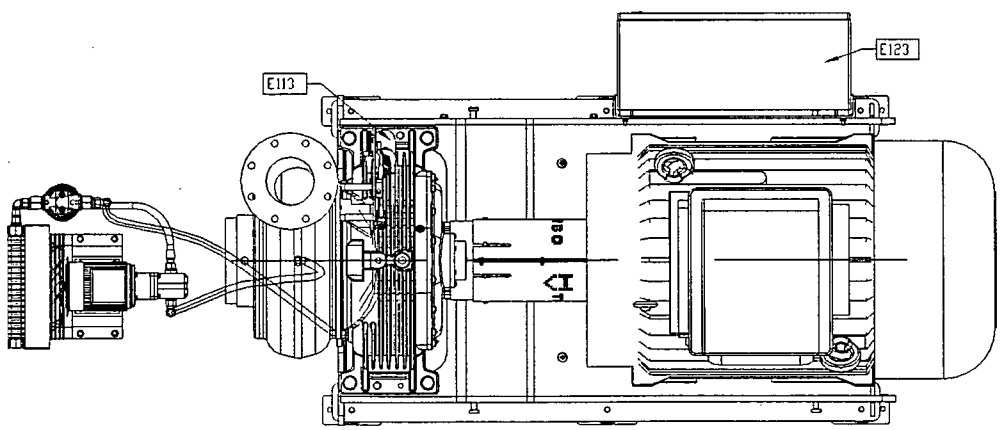
3. UNIT DESIGN

3.1 MAIN CONSTRUCTION

The HV-TURBO compressor consists of the following main parts:

Coupling, motor/gearbox	A300	Base	F101
Drive motor	A401	Gearbox	G100
Local panel	E123	Compressor	K100



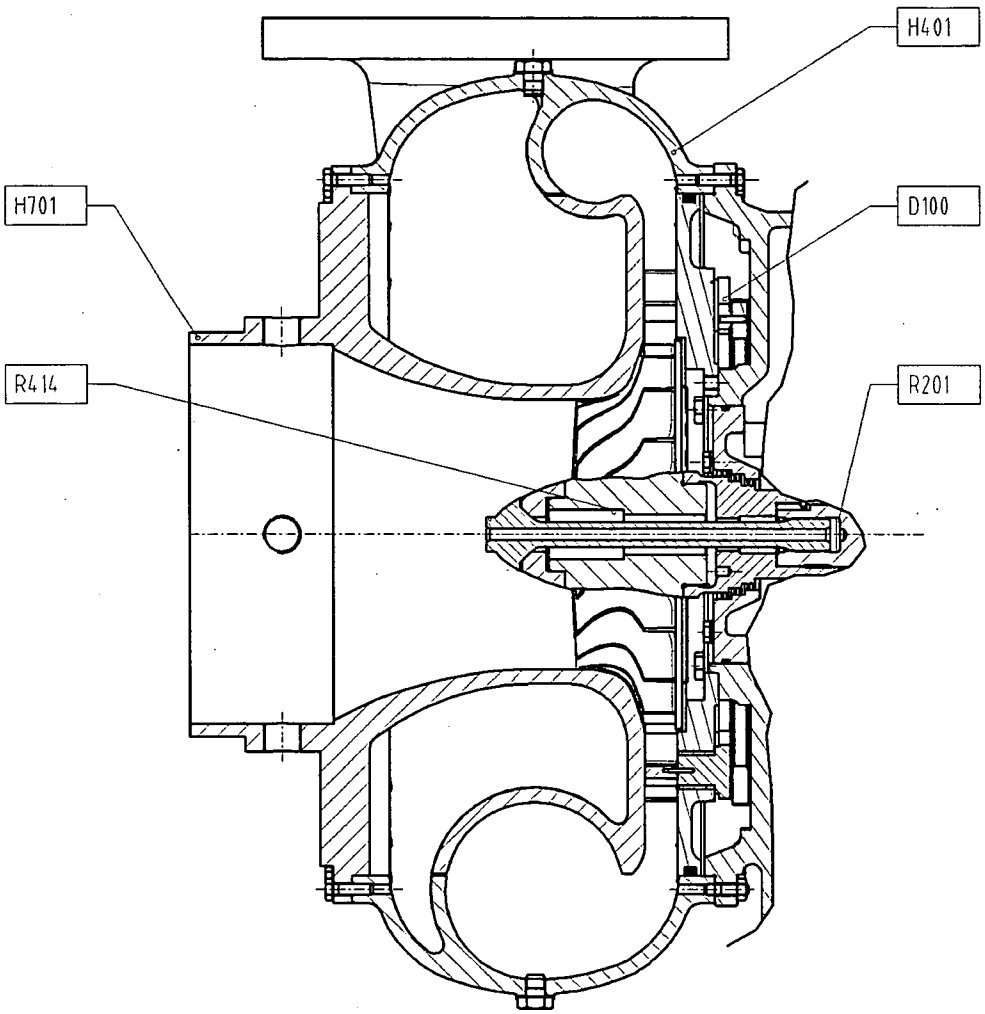


The unit is shown with mounted oil cooler. The oil cooler is not standard equipment, but can be supplied as an option.

3.2 COMPRESSOR

Main parts:

Inner diffuser	D100	Pinion shaft	R201
Outer vol. casing	H401	Impeller	R414
Inlet	H701		



The HV-TURBO compressor is a single-stage centrifugal compressor.

The passage of the medium through the compressor:

The medium is led through the inlet and past the inlet guide vanes to the impeller, which speeds up the medium. From the impeller the medium is led through the diffuser (variable), where most of the speed energy is changed into pressure, to the volute casing where it is collected, and from there out into the cone diffuser where the speed is reduced before it is led into the discharge system.

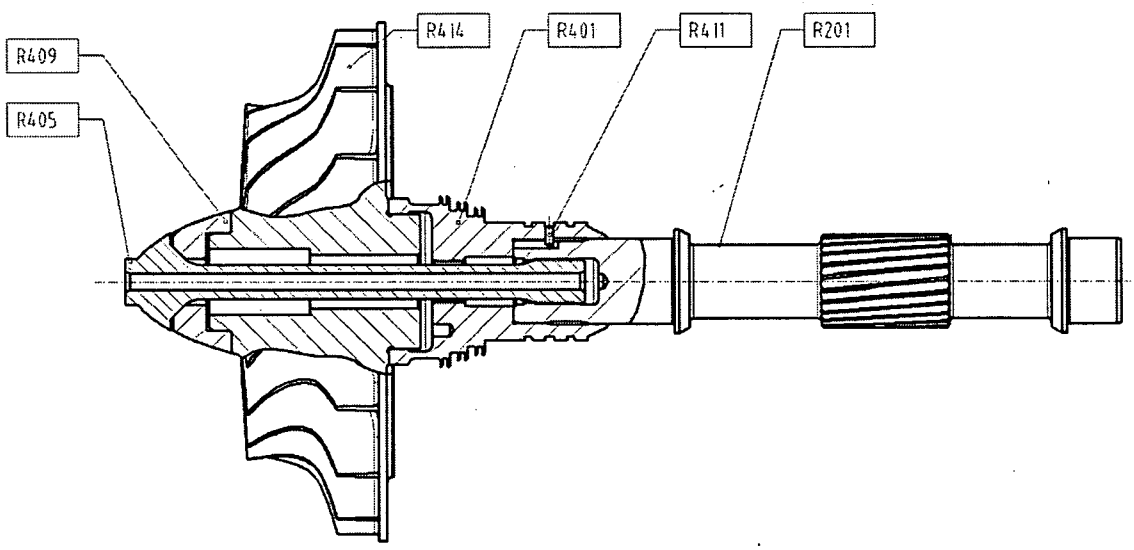
3.2.1 COMPRESSOR CASINGS

The compressor casings, consisting of outer/inner volute casing and inlet are manufactured from cast items that have been heat-treated, cleaned, and then machined. The casings have been assembled vertically, in order to facilitate handling of the individual casings when mounting or dismounting the compressor.

3.2.2 IMPELLER/ROTOR SHAFT

The rotor consists of the following main parts:

Pinion shaft	R201	Stop ring	R409
Rotor drive	R401	Screw	R411
Central screw	R405	Impeller	R414



The impeller has been milled out in one forged, solid piece, ensuring great strength and accuracy. The blades have been formed so as to ensure optimal control of the compressor as well as an optimal and stable current flow. The outer contour and diameter of the impeller have been specially adapted to the operating conditions defined in the order specification.

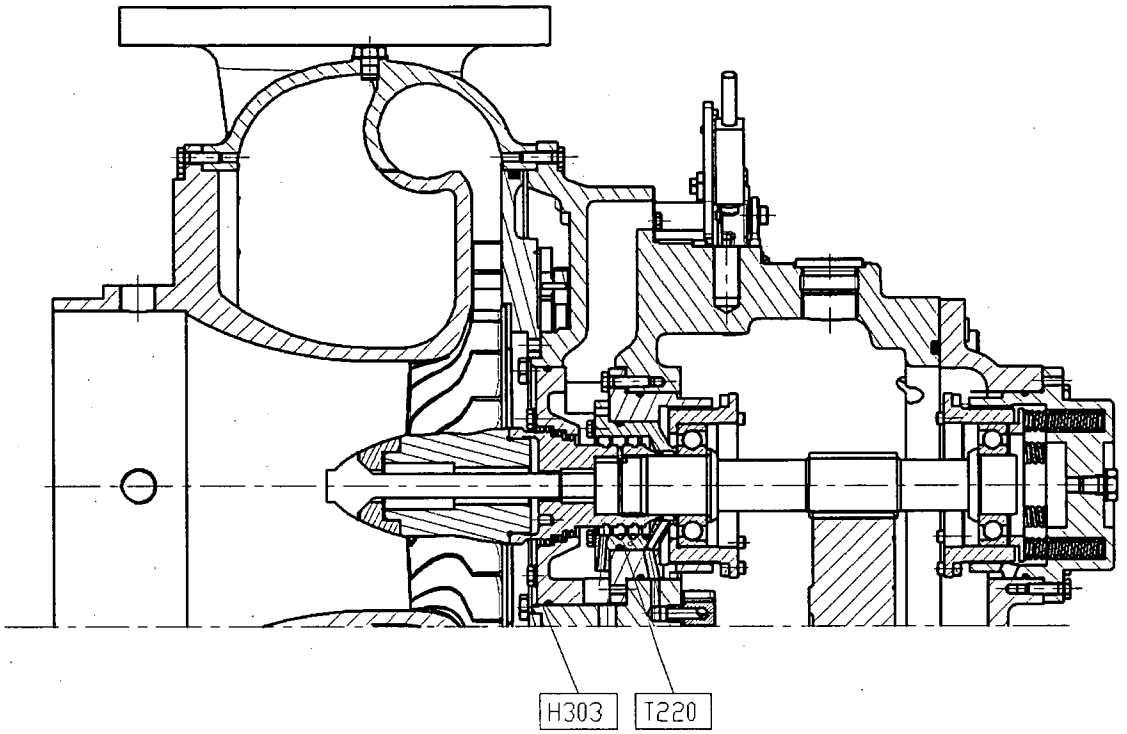
The overhung design with the impeller positioned at the end of the pinion shaft secures an operation well above first critical speed and well below second critical speed.

By the aid of tools the impeller, the rotor shaft rod, and the rotor drive are held together with the rotor and the central screw. The complete unit (rotor) has been balanced dynamically.

3.2.3 SEALINGS

Consisting of:

- Labyrinth sealing H303
- Oil sealing ring T220



Air and oil shaft seals, made of aluminium, are non-contact types and designed to prevent air and oil leakage, thus avoiding contaminating the air with oil. This type of sealing does not get worn due to the clearance between the pointed sealings and the shaft. However, a minor running-in wear may occur. The sealing prevents oil from entering into the compressor. The chambers of the sealing ring are fitted with drains, through which the oil is led back into the gear housing.

3.2.4 DIFFUSER SYSTEM

The compressor is equipped with a regulating system, a diffuser system. It can be regulated continuously within the range of two limit switches. Even a small change of the system setting will influence the ability of the compressor to make pressure and volume flow, and consequently the power consumption of the compressor will be affected.

HV-TURBO has developed a procedure, implemented in a process computer, to regulate the diffuser system to an optimum, based on measurements of:

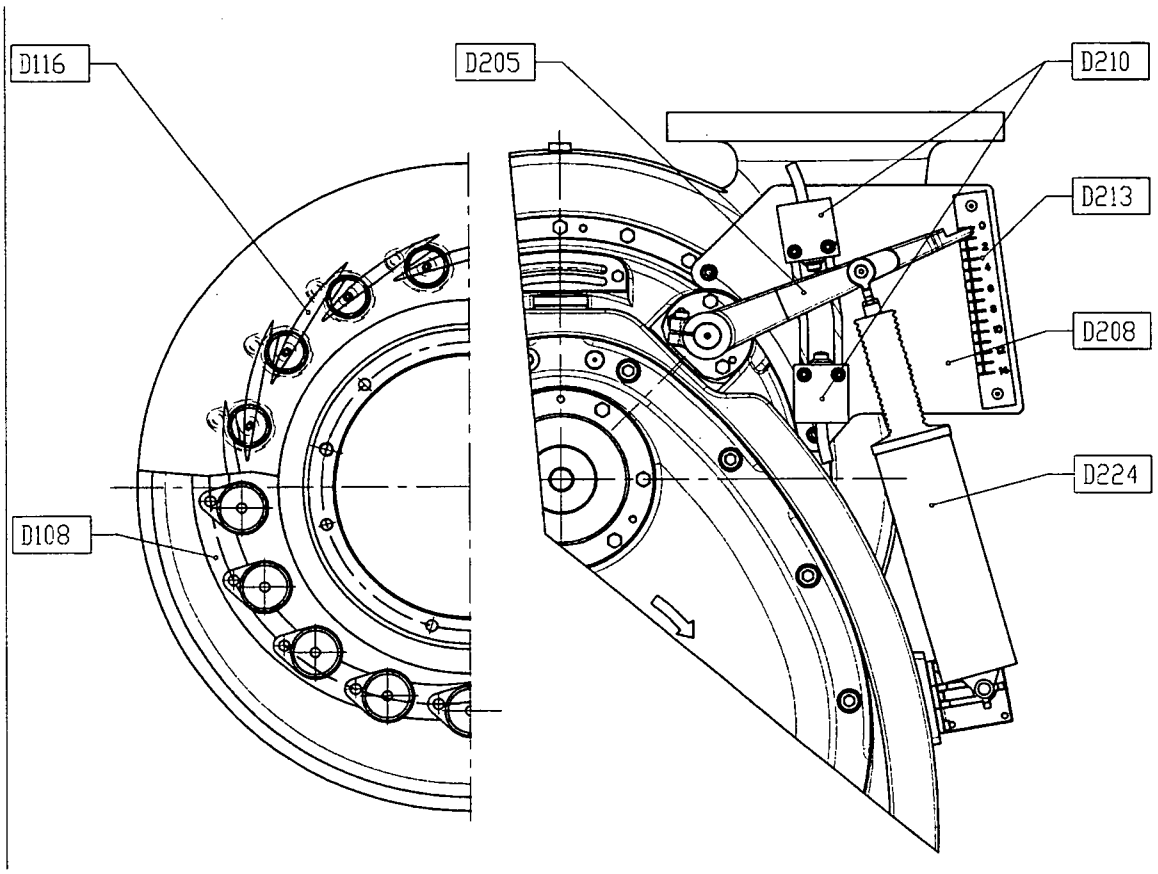
- inlet temperature
- differential pressure across compressor
- volume flow demand

Any change of the system setting will cause increased power consumption or, at worst, that the compressor starts to surge, which will release an emergency stop. If the system has been disassembled, it must be assembled and adjusted exactly as it was before the disassembling.

ADJUSTABLE DIFFUSER SYSTEM

Main parts:

Guide ring	D108	Limit switches	D210
Diffuser blades	D116	Scale	D213
Positioning lever	D205	Linear motor *)	D224
Mounting plate	D208		



The diffuser system consists of a number of adjustable vanes (optimized vanes) placed radially around the periphery of the impeller. An electric linear motor regulates the diffuser blades. A scale is mounted on the mounting plate for indication of the position of the blades. Two limit switches have been installed, which - when activated - will signal the respective MAX. and MIN. positions of the diffuser blades to the control panel.

The linear motor is controlled by the local control panel.

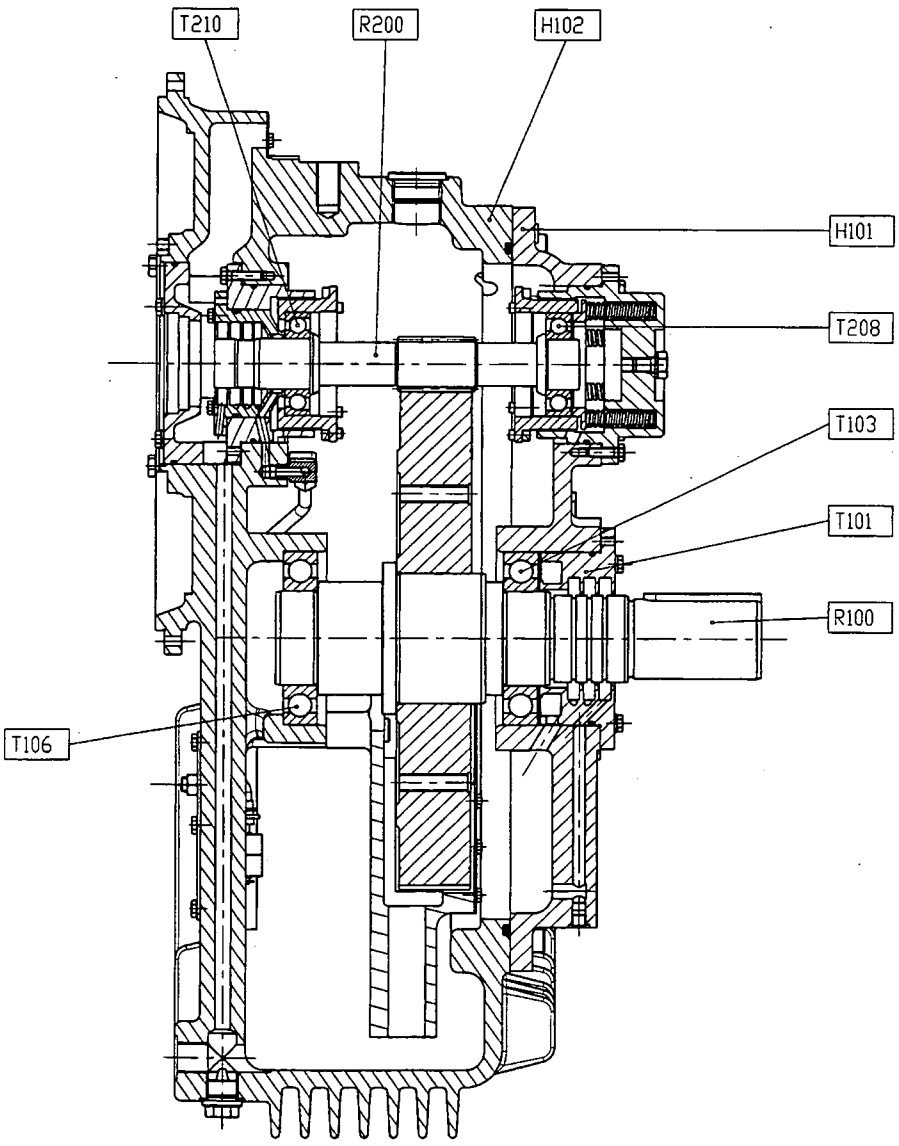
*) See enclosed description

The position of the limit switches shall not be altered, as this may cause overload of the compressor/drive motor. A signal value for the exact position of the vanes can be obtained by way of the built-in potentiometer in the linear motor.

3.3 GEARBOX

Main parts:

Gear casing part A	H101	Deep groove ball bearing	T103
Gear casing part B	H102	Deep groove ball bearing	T106
Drive shaft	R100	Angular contact ball bearing	T208
Pinion shaft	R200	Angular contact ball bearing	T210
Sealing ring	T101		



The HV-TURBO GK190 gearbox is a single-stage, helical gear, where the pinion shaft is placed above the drive shaft. The pinion shaft is supported by bearings on both sides of the gearwheel. The gear ratio has been adapted to the operating conditions as specified in the order.

The gearbox is vertically split for easy access to the shafts, bearings, and sealings.

3.3.1 GEAR CASING

The gear casing, consisting of part A and B, is manufactured from cast elements which have been heat-treated, cleaned, and then machined.

3.3.2 SHAFTS - GEARWHEELS

Shafts and gearwheels have been carburized and ground with great accuracy, to allow for the high speed and resulting stress on the teeth. A moderate backlash allows for oil film, deformations, etc.

The gearwheel on the drive shaft has been shrunk on. The gearwheel on the pinion shaft has been machined in one piece with the shaft.

3.3.3 BEARINGS

On pinion shaft: Hybrid high precision angular contact ball bearings.
On drive shaft: Deep grove ball bearings.

3.3.4 OIL SEALING

The sealing is a non-contact, labyrinth type sealing, which does not get worn due to the clearance between the pointed sealings and the shaft. However, a minor running-in wear may occur.

This sealing ensures that oil is not leaking from the gear.

Drains in the sealing chambers lead oil back into the gear casing.

3.4 BASE

The base is a welded construction manufactured with frame of steel profiles and steel plate. It serves additionally as base for all safety equipment and the local panel.

3.5 CONE DIFFUSER

The cone diffuser is manufactured from steel plate milled into shape and welded together. The two flanges are likewise welded on.

The cone diffuser is mounted on the discharge side, thereby transforming the last part of the air velocity into pressure, thus reducing the air velocity.

3.6 BLOW-OFF VALVE

The blow-off valve is a butterfly valve with electric or pneumatic actuator and end stops. The blow-off valve is mounted between two flanges. The blow-off valve functions as a pressure relief valve during start/stop to avoid surging. (For tech. data, see § 2).

3.7 CHECK VALVE

The check valve is a spring-loaded butterfly valve (dual plate) built in between two flanges. The check valve prevents the compressed air from passing backwards, thereby keeping the compressor from running backwards when not in operation. (For technical data, see § 2).

3.8 COUPLING/DRIVE MOTOR/GEARBOX

The coupling between drive motor and gear is a flexible disc type coupling which is flexible in both radial and axial direction and at the same time able to withstand excessive torsional stress. To ensure optimal operating conditions the coupling shall be aligned as described in § 12.

3.9 INLET SYSTEM (STANDARD) AND 3.10 INLET FILTER

See enclosed drawing:

The inlet system consists of inlet silencer, filter, front grid or extension piece fastened together into a unit.

Mounting

The height of the inlet silencer stud is adjusted in relation to the compressor stud, and the inlet silencer is positioned so that the air conduit between the studs is 3 - 7 mm. If the air conduit between the studs is 10 mm or more, the compressor may be damaged.

The holes in the base plate are then marked out on the floor, the silencer is removed, and the holes are bored, after which the nylon dowels supplied are placed in the holes, and the silencer put back and fastened with the supplied screws.

The air conduit between the studs of the inlet silencer and the compressor is checked and taped with the special tape supplied, after which it is covered with lead rubber and tightened together with the flexible connection supplied.
The U-pipe manometer, which registers pressure drops, is filled up with liquid from the flask supplied.

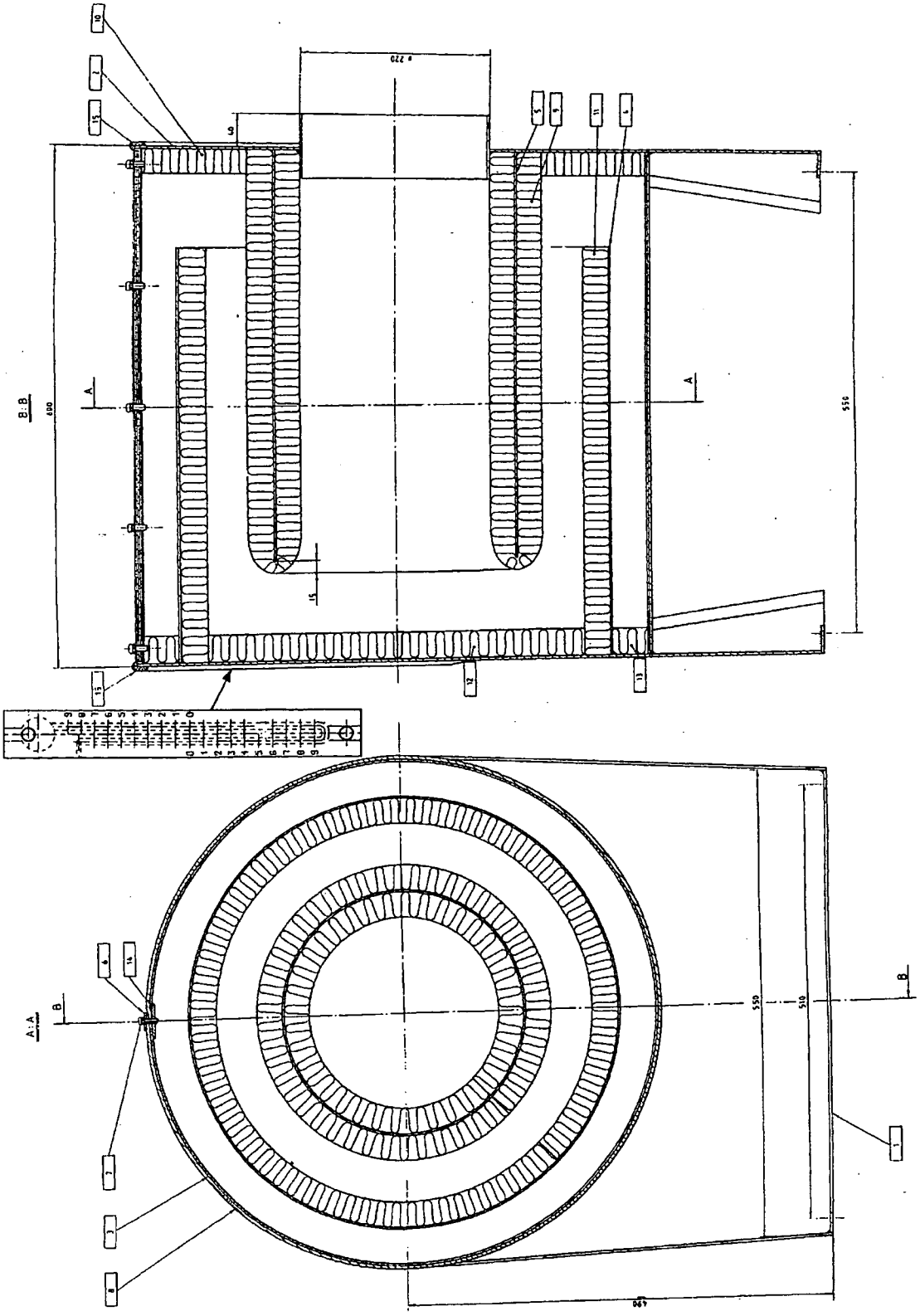
Maintenance

Pressure drops must not exceed 100 mmWC, because a too high negative pressure may cause the intake silencer plates to collapse. The filters are replaced when the pressure drop during start is observed to have increased by 20 mmWC.

Change of Filter: See Drawing

Parts List for Filter

1	End plate
2	End plate towards compressor
3	Enclosure for silencer
4	Outer pipe
5	Inner pipe
6	Filter lock
7	Screw
8	Filter cloth
9	Plastic foam
10	Plastic foam
11	Plastic foam
12	Plastic foam
13	Plastic foam
14	Filter lock
15	Clip list



4. DRIVE MOTOR

See manufacturer's directions.

5. ACOUSTIC ENCLOSURE

On request HV-TURBO supplies an enclosure, which through careful choice of design, assembly methods and sealing strips, will provide optimal noise reduction. The enclosure is equipped with sound muffling material adapted to the prevailing conditions.

The HV-TURBO acoustic enclosure is built up as a modular system on a chassis frame in which panels and doors can be inserted. This simple construction means fast mounting and dismounting of the complete enclosure or parts of it.

The enclosure is delivered as a construction kit, which requires only a minimum of space during storage and transport.

"Do it yourself" mounting instruction - technical info 930940099 - is included in the delivery. However, HV-TURBO will be pleased to mount the enclosure on request.

CONSTRUCTION

Frame construction made of OMEGA profiles (channel section with webs) mounted on bottom rails bolted to the floor. Sound absorbing elements are placed in the frames.

Dimensions: Modular system for individual adaptation.

NOISE REDUCTION

The sound absorbing elements are made of alu-zinc coated steel plate on the outside, and of alu-zinc coated perforated steel plate on the inside. The interspace is filled up with mineral wool.

The ceiling elements are placed in webs in the cross braces. The wall elements are placed in top and bottom rails.

The enclosure is fitted with detachable wall panels for inspection and service.

VENTILATION

The silencer hood is ventilated by means of a fan mounted inside the hood in one of the ceiling elements. Intake and discharge of ventilating air is done via noise reducing ducts. The outlet can be connected to a pipe channel leading the hot air out of the compressor room.

TYPICAL NOISE REDUCTION

Octave band (Hz)	31,5	63	125	250	500	1000	2000	4000	8000
Noise reduction (dB)	2	6	6	10	14	19	21	40	18

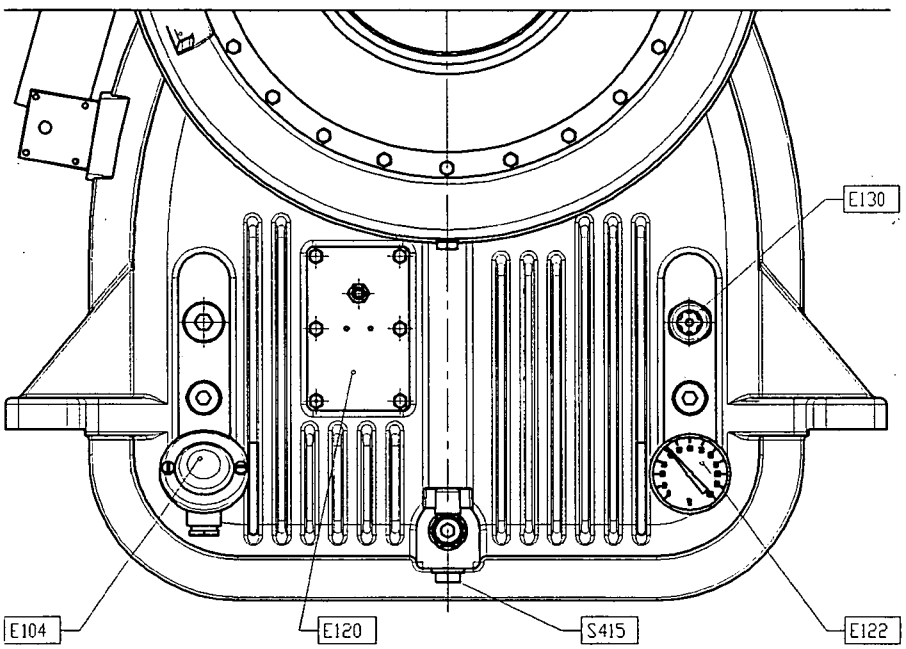
6. LUBRICATING OIL SYSTEM

6.1 OIL FILLING

The oil pan of the gearbox shall be filled with approximately 13,0 litres of synthetic oil (the type of oil must be approved by HV-TURBO).

The filler stud is placed on top of the gearbox. Check oil level on the sight glass E130, the oil level shall be in the middle of the sight glass. The oil temperature is indicated on the thermometer E122.

Change of oil: See "Service Intervals" § 11.1. Type of oil: See "Technical Specifications" § 2, Oil Specification 830870005.



During normal operation the lubricating oil temperature will be between 60ºC and 90ºC at ambient temperature 20°C.

An oil level switch E120 is installed in the oil sump. If the oil level is low the oil level switch will immediately stop the drive motor by a signal to the electrical safety chain (see paragraph concerning the electric system).

If the oil temperature exceeds 110ºC a sensor E104 will stop the compressor.

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

6.2 CHANGE OF OIL

The oil must be changed and the magnetic rod cleaned after maximum 500 hours of operation after the compressor has been put into service. The waste oil is fouled by particles and must not be reused. Synthetic oil (approximately 13,0 litres) shall be used for new oil filling. Hereafter the oil level must be checked after every 2000 hours of operation. New oil can be added up to mid level of the sight glass. After every 6000 hours of operation or at least once a year the oil must be changed.

OIL OUTLET

Open drain cock S442 for controlled oil outlet. To clean the magnetic rod S415, remove the drain plug and let the oil drain off, if major 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.

6.3 OIL TYPES

The compressor must only operate with synthetic oil types, which are approved by HV-TURBO (see § 2 "Technical Specifications"). 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 used, as particles from the atmosphere will be absorbed in the oil.

7. THE LOCAL CONTROL SYSTEM OF THE COMPRESSOR

If the unit is equipped with HV-TURBO electric control system "LC-", Local Control panel, the panel controls the daily operation and monitoring.

The following conditions of start and operation will be observed by the logic system of the local control panel:

1. When the START button is activated the automatics will open the blow-off valve and set the diffuser in MIN position. At the same time the instruments of the safety chain 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 corresponding to the operational conditions.

4. In case of errors, as too high oil temperature, too low oil level, too high counter pressure in the outlet pipe etc., the compressor is stopped.

5. When the error has been located and corrected the monitoring system has to be reset.

Important: The design of the local control panel and all its electric functions are described in the separate "Manual for the Compressor Control System".

STALLING AND RECIRCULATION

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

STALLING

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

Stalling reveals itself through audible pressure blows the frequency and strength of which are determined by among others the resonant conditions of the connected piping system on the pressure side. Strong pressure blows mean heavy load on the mechanical parts of the compressor, and therefore the compressor must be stopped. The pressure controller which is connected to the compressor housing through a pressure pipe stops the drive motor when the set MAX pressure is exceeded (see the manual for the local control panel).

RECIRCULATION (HIGH FREQUENCY STALLING)

The compressor is working in an unstable operational range. The pressure air runs backwards through some of the impeller blades and heats the inlet air. Recirculation is caused by prolonged stalling.

To avoid overheating damages to the compressor it must be stopped immediately, a sensor in the compressor inlet secures the stop.

7.2 P/I DIAGRAM

See enclosed P/I diagram, end of this paragraph.

7.3 COMPRESSOR INSTABILITY

7.3.1 SURGE

The characteristic curve of a turbo compressor with the diffuser/IGV locked in an arbitrary position is characterized by intermittent, backward expansion of the medium through the compressor. This type of operation (surge) is heard as low-frequency pressure thrusts, the frequency of which depends on the compressor type, the construction of the pipe system, etc.

Operating under these conditions will expose the mechanical parts of the compressor to heavy loads and should, therefore, be avoided.

If the compressor is operating within the unstable range, the surge control switch SUC-3 will activate the alarm and stop the compressor immediately.

The following malfunction may cause surge:

1. Too high header pressure
2. Too high inlet temperature
3. Decrease in compressor RPM as well as mechanical errors, etc.

7.3.2 RECIRCULATION

The medium recirculates through the compressor, whereby a large amount of energy is added to a small amount of medium (the medium heats up).

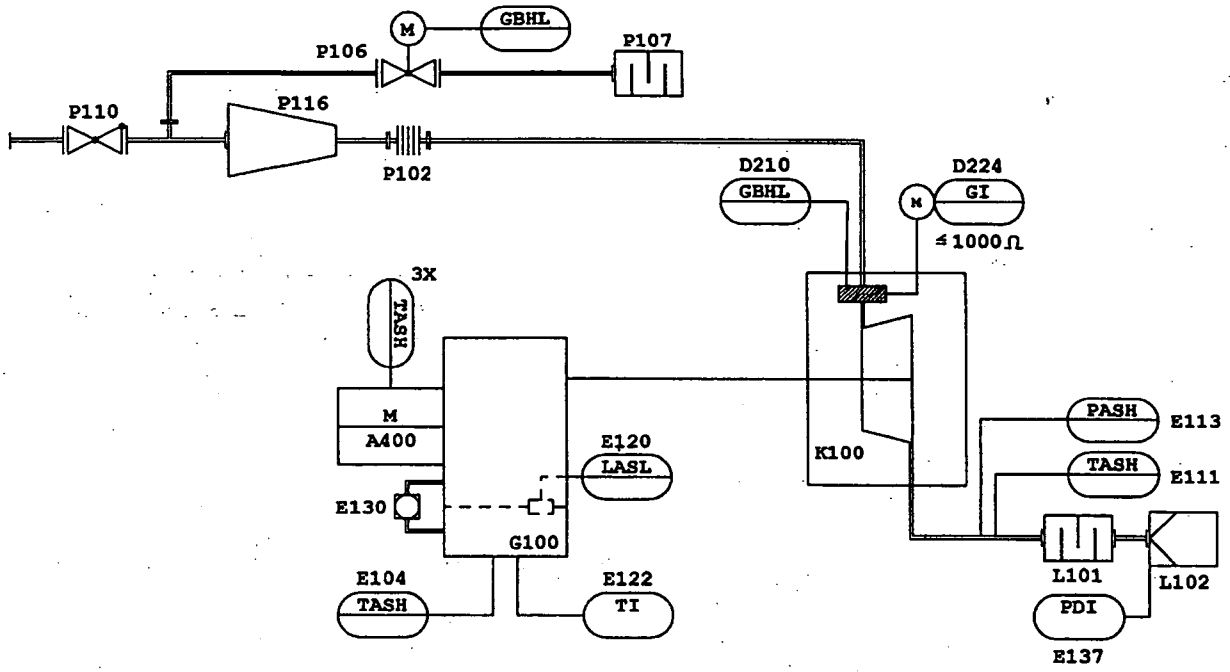
The following malfunctions may cause recirculation:

1. The diffuser/prerotation is closed completely (MIN.-setting of the limit switch has been changed)
2. The discharge from the blow-off valve is led back into the inlet duct, causing the medium to recirculate for a long time

Operating with recirculation must be avoided, as it may cause damage through overheating, and - at worst - fire in the compressor.

If the compressor is operating for a long time with recirculation, a sensor in the compressor inlet will activate the alarm signal and stop the compressor immediately.

P/I DIAGRAM - 930950001 KA2S-GK

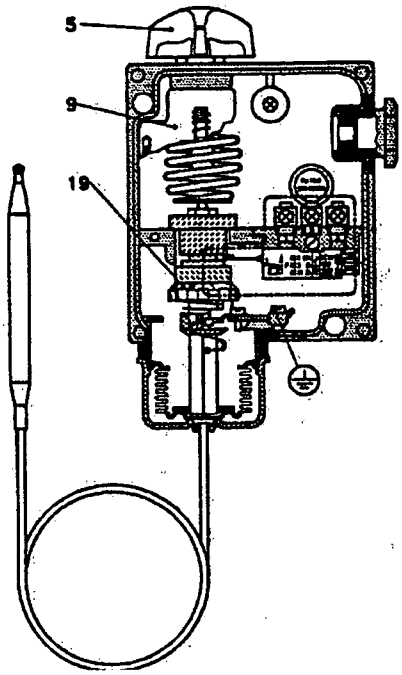


Pos.	Designation
A400	Electric motor
D210	Limit switch
D224	Actuator
E104	Thermostat (oil temperature high)
E111	Thermostat (recirculation)
E113	Pressure switch (surging)
E120	Oil level switch (oil level low)
E122	Thermometer (oil temperature)
E130	Sight glass
E137	Differential pressure indicator (inlet silencer)
G100	Gear
K100	Compressor
L101	Inlet silencer
L102	Inlet filter
P102	Compensator
P106	Blow-off valve
P107	Silencer for blow-off valve
P110	Check valve
P116	Cone diffuser

8. INSTRUMENTATION

8.1 THERMOSTAT RT107 »Oil Temperature too high« Pos. No. E104

Data : See also "Accessories"



MAX ambient temperature : -50 - +70°C
MAX sensor temperature : 300°C

Function : To stop the driving motor of the compressor at rising oil temperature, exceeding 100°C.

Setting : Dismount the front cover of the thermostat and set the differential roll 9 on MIN.

Testing : Using knob 5 the thermostat is set at dropping temperature until the switch opens. If the compressor is operating, it must be stopped. If the compressor is not operating, it must not be possible to start it. Adjust scale 9 until indicator setting of the thermostat corresponds with the oil thermometer of the gear.

Adjust thermostat with knob 5 to 100°C on scale 9.
Remount the front cover.

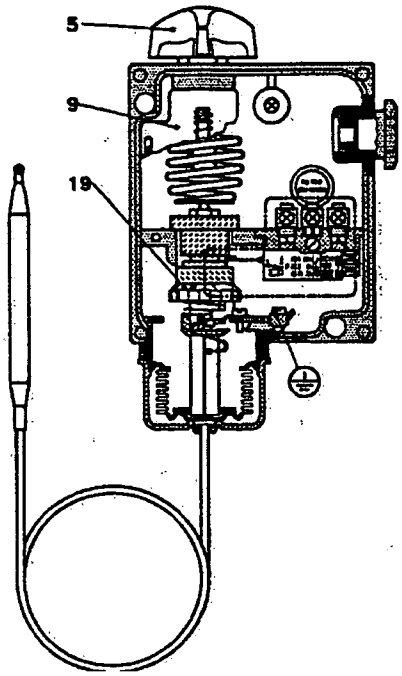
The thermostat is part of the electric safeguard, and it is sealed with lead after adjustment.

Important: During the period of guarantee set for the compressor, sealed thermostats and pressure controllers must only be adjusted by HV-TURBO personnel.

The guarantee no longer applies if the seal is broken.

8.2 THERMOSTAT RT101 »Air Temperature too high« Pos. No. E111

Data : See also "Accessories"



MAX ambient temperature : -50 - +70°C
MAX sensor temperature : 300°C

Function : To stop the drive motor of the compressor at rising air inlet temperature, exceeding 65°C. Securing against overheating caused by recirculation.

Setting : Dismount the front cover of the thermostat and set the differential roll 9 on MIN.

Set scale 9 on 65°C, using knob 5.

Testing : Set the scale 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 be stopped. If the compressor is not operating, it must not be possible to start it.

Remount the front cover.

The thermostat is part of the electric safeguard, and it is sealed with lead after adjustment.

Important: During the period of guarantee set for the compressor, sealed thermostats and pressure controllers must only be adjusted by HV-TURBO personnel.

The guarantee no longer applies if the seal is broken.

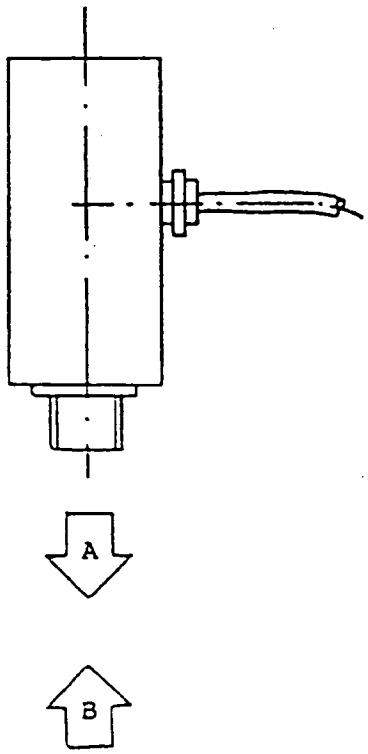
8.3 SURGE CONTROLLER SUC-3

See drawing next page.

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

Sensor : Inductive sensor.

Mounting : In the compressor inlet housing.



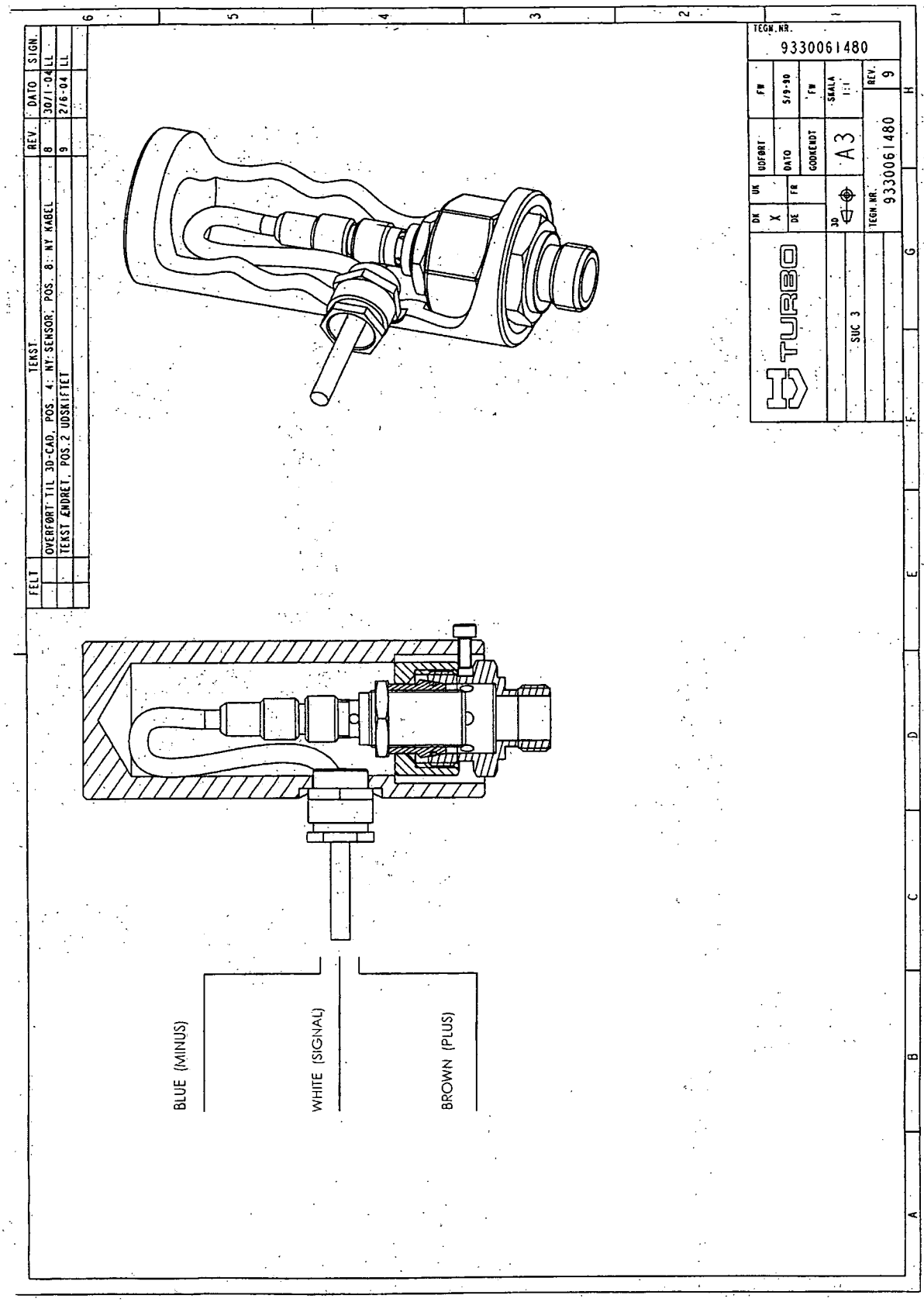
A: Pressure direction at normal operation.

B: Pressure direction at surging.

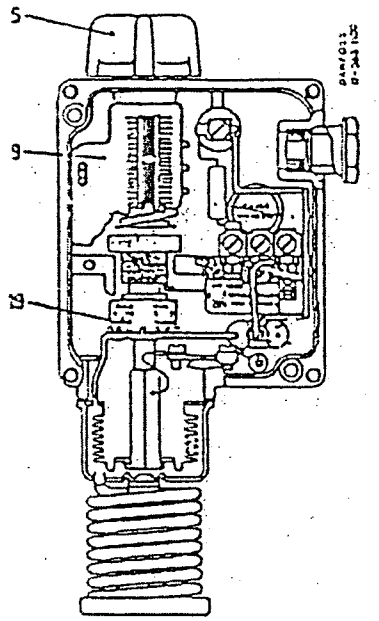
The surge indicator is mounted vertically on the compressor inlet.

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

At surging the direction of the pressure is reversed, this causes the steel disc to approach the inductive sensor, which then gives alarm.


TEGN.NR.
9330061480
REV. 9
UDFØRT
DATO
GODKENDT
SKALA 1:1
A3
TEGN.NR. 9330061480
SUC 3
REV. DATO SIGN.
8 30/1-04 LL
9 2/6-04 LL
TEKST
OVERFØRT TIL 3D-CAD, POS. 4: NY SENSOR, POS. 8: NY KABEL
TEKST ÆNDRET, POS.2 UDSKIFTET
FELT
BLUE (MINUS)
WHITE (SIGNAL)
BROWN (PLUS)

8.1 Thermostat RT103 »Acoustic Enclosure Temperature above 35°C Pos. No. E151



Data : (See also section 2, Tech. Specifications)

MAX ambient temperature	:	-40 - +70°C
MAX sensor temperature	:	100°C
Function	:	Start and stop of ventilator fan at temperatures above/below 35ºC in silencer hood.
Setting	:	Dismount the front cover of the thermostat and set the differential adjusting nut 19 on MIN. Set scale 9 on 35°C using knob 5.

9. START-UP

9.1 PREPARATIONS

The list below is applicable to the first start-up.

The automatic control system shall fulfil the minimum requirements as described in § 7.

When the automatic control system is delivered by HV-TURBO the customer is referred to the LC/MCP documentation, which includes operating instructions for the local control panel.

1. Check oil pan for impurities and/or water. Drain-off possible condensate.

   Fill up the compressor with lubricating oil, check the oil level. Fill on only NEW and absolutely CLEAN oil. Check oil level in sight glass.

   If lubricating oil has already been filled on, check quality of oil as well as oil level.

   For type of oil, see technical specifications, § 2.

2. Turn the compressor manually, very carefully, one entire revolution in reverse. (This is easily done by means of the coupling between drive motor and gear).

3. Check the compressor suction system, silencer(s), compensators and air filters (internal/external) for correct mounting and cleanliness.

   IMPORTANT! Check especially the area in front of the impeller, the inlet, and the inlet pipe. Check the flexible connection between the inlet pipe and inlet filter/inlet duct for correct mounting.

4. Check diffuser cone, blow-off valve and non-return check valve on pressure side of compressor for correct mounting. The check valve must be mounted with vertical shaft. An arrow indicates the sense of direction of the air.

5. Check the non-return check valve for correct function and control. Check the limit switch function.

6. Check that function and adjustment of the regulation system of the diffuser are correct. Check the limit switch function.

7. Check the acoustic enclosure fan for correct function and check the sense of rotation.

9.2 SIMULATED TEST RUN OF COMPRESSOR

In order to check start/stop sequence and cable connections a simulated test run is performed. It may be performed with dismounted coupling lamellas on the motor-end.

When simulating operation the safety monitoring equipment shall be tested with satisfactory result. (For temperature see § 2).

- Turn compressor manually to check that rotation is smooth. This is most easily done at the coupling between drive motor and gear.
- Start up compressor (motor) briefly, max. 2-3 seconds, to check direction of rotation. If direction of rotation is wrong, repole motor.

  IMPORTANT! Wrong direction of rotation of the gear for more than a few seconds may cause permanent damage to gear bearings and journals.

  Note: Do not restart more than 4 times per hour. Repeated starts within 15 minutes will block the drive motor for restart for one hour (to protect motor coils).

  Check that mounting of the coupling and tightening of the screws is correct (see § 12). Check the coupling alignment before start-up (see § 12).

9.3 TEST RUN OF COMPRESSOR

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

- Opening and closing of blow-off valve. Normally the blow-off valve will indicate "closed" max. 180 sec. after start-up (depending on valve type and site conditions).
- Function of recirculation-valve.
- Build-up of air pressure in pressure pipe.
- Lubricating oil temperature shall be stable.
  Lubricating oil temperature during operation (see § 2).
- Test diffuser adjustment manually.
- Test safety monitoring, oil level switch and emergency stop during operation.
- Test normal start and stop sequence.
- Motor overload protection (diffuser limitation).
- Check for oil leaks at operating temperature.
- Check of cable connections from compressor control panel to master control panel.

9.4 MASTER CONTROL (if installed)

Check at start-up of Master Control (MCP): Start/stop function, priority sequence and adjustment procedure for all compressors.

- Check and adjustment of step controller (adjustment of diffuser via mA-signal).
- Check of output signal from pressure and oxygen transmitter.

9.5 START

5 seconds approx. after start-up the valve between the compressor and the manifold is opened. The blow-off valve is closed.

At plants equipped with non-return valve between compressor and manifold: Close the blow-off valve approx. 5 seconds after start.

The compressor can now be set for max airflow, during which the counter pressure and the power consumption of the motor are surveyed. At low counter pressure the airflow may increase considerably and the motor will be overloaded (see performance certificate).

The compressor electric control system (Local Control Panel) will monitor all necessary functions before and after start, when the start order is given by pressing the respective button. In case of errors or if the starting conditions are not fulfilled the local control panel will indicate "ERROR" (see "Manual for Electric Control System").

DURING OPERATION

Pos. Nos. refer to aggregate drawing/instrument panel drawing. Operating temperature (see § 2).

During operation the following is checked:

Oil level:	Pos. No	E130	Sight glass
	-	E120	Level switch
Oil temperature:	Pos. No.	E122	Thermometer Min. 10°C at start-up.
	-	E104	Sensor
Compressor surging	Pos. No. 113		SUC-3, pressure switch
Vibrations:			To be measured at the HV-TURBO test point; 10-1000 Hz: ISO.
Power consumption:			Ammeter on control panel. Test by means of a tongs ammeter.

9.6 GENERAL

When the compressor has been put into operation, the starting priority of the machines shall be changed periodically by the machine operator in order that all compressors of an installation are frequently in operation and over a period will have an equal number of operation hours.

On plants where the diffuser 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 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 followed:

Set the local panel on "MANUAL" and start the compressor briefly with completely open blow-off valve,

NOTE AFTER START-UP

1. The screws of the coupling shall be checked after approx. 100 hours of operation.

2. Operation with electric motor: Grease lubricated bearings must be lubricated according to the prescriptions in the supplier's manual or acc. to indications on the name plate of the motor. The first lubrication is to take place immediately after start-up (always with a warm compressor). The lubrications are to be continued at stated intervals. A scheme of lubrication intervals should be established.

3. Check for possible oil leaks.

10. TROUBLE SHOOTING

When trouble shooting, compare all operational data with the specifications in § 2.

	§
Flow, no pressure at start-up	10.1
Insufficient flow	10.2
Excessive power consumption	10.3
Surge (pressure pulsation)/ Recirculation (overheating)	10.4
Noisy operation/too high vibration level	10.5
Lubricating oil temperature too high	10.6
Drive motor	See separate instruction book 4.

10.1 NO FLOW, NO PRESSURE AT START

Possible causes:

- Drive motor error, current failure.
- Wrong direction of rotation.

  NOTE: Drive motor and compressor are rotating in opposite directions.

- A coupling or shaft has broken.
- A shaft has been blocked.

10.2 INSUFFICIENT FLOW

Possible causes:

- Blow-off valve completely or partly open.
- Pipe system leaking or a valve is open.
- Inlet diffuser blades/- guide vanes completely closed.
- Inlet system partly blocked.

10.3 TOO GREAT POWER CONSUMPTION

Possible causes:

- Low flow pressure compared to design pressure with stuck diffuser.
- Maladjusted diffuser.
- Mechanical defect in gear or compressor (defective bearings, gearwheels or shaft).

  NOTE: If the electric motor has been wrongly poled (connected to the external power supply), the power consumption may rise excessively.

10.4 SURGE (PRESSURE PULSATION)/ RECIRCULATION (OVER-HEATING)

Possible causes:

- Too low RPM.
- Header pressure too high compared to design pressure (see rating plate).
- Inlet duct/- silencer defective/ fouled up.
- Inlet air filters blocked due to fouling (inlet pressure-loss too high).
- Inlet temperature too high.
- Inlet guide vanes/diffuser blades maladjusted or too closed.
- Clearance between impeller and contour ring too large.
- Impeller damaged.
- Blow-off valve defective; causes surging at start/stop only.
- Defective counter valve and blow-off valve.

10.5 NOISY OPERATION /VIBRATION LEVEL TOO HIGH

Possible causes:

Gear:

- Defective gearwheel or bearings.
- Defective coupling or bad alignment.

Compressor:

- Defective bearings.
- Rotor/impeller out of balance.
- Defective sealings.
- Defective coupling or bad alignment.

10.6 OIL TEMPERATURE TOO HIGH

Possible causes:

- Too high ambient temperature.
- Wrong type of oil.
- Defective bearings, gearwheels, etc.

11. MAINTENANCE

INTRODUCTION

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

Control and cleaning is most important. Some vital parts of the compressor and gear require dismounting. Instructions of such dismounting and remounting are given below. Follow these instructions carefully, and if any doubt please contact HV-TURBO for assistance.

The HV-TURBO compressor is built with very fine tolerances and operates at very high speeds. Therefore, be very careful during maintenance works. Use the correct tools only and avoid any kind of bumps and blows on the compressor parts.

Observe proper cleanliness.

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

11.1 SERVICE INTERVALS GEARBOX / COMPRESSOR

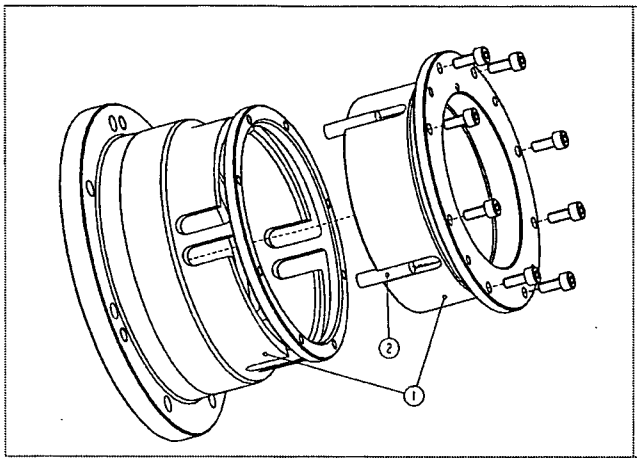
Below is a table of the service intervals recommended by HV-TURBO, with references to the various §s giving a more detailed description of what is to be done.

Local conditions may cause deviations from the norm. Therefore, read each § carefully with a view to local conditions before the service intervals are laid down. This applies especially to the parts in touch with the medium. The frequency with which these parts shall be cleaned may vary to some extent, and the service instructions shall be progressively evaluated.

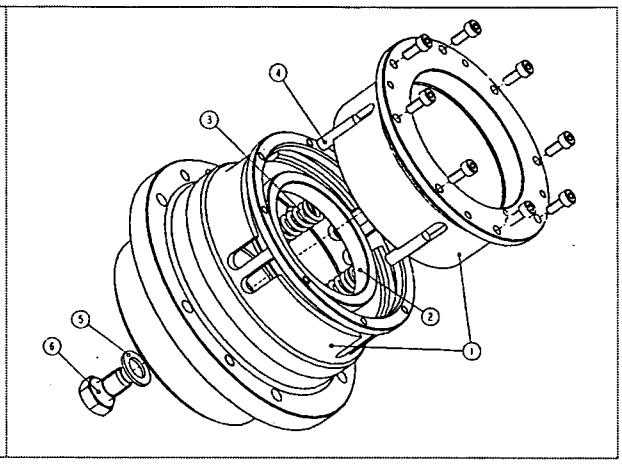
HV-TURBO's standard instructions are as follows:

Job to be done	See §	Intervals
First oil change	6	After 500 hrs.
Oil change	6	Every 6000 hrs, however, at least once a year.
Bearing change gearbox incl. O-rings in bearing housing	3.3.3	Every 24000 hrs. See drawings next page
Bearing change on inlet shaft		Every 48000 hrs
Service	11.2	Every 24000 hrs
Inlet filter		At max. pressure drop according to technical specifications.
Inlet silencer	11.6	Shall be cleaned during service.
Drive motor		See manufacturer's instructions or contact the local HV-TURBO representative.

BEARING HOUSING GEARBOX



① Bearing housing
② O-ring



① Bearing housing
② Race
③ Spring
④ O-ring
⑤ Washer
⑥ Screw

11.2 SERVICE

Service requires cleaning and checking of all parts exposed to the medium; as well as checking/replacing of all flexible gaskets; test and, if necessary, adjustment of control panel; test run.

If the diffuser ceases to operate smoothly (due to impurities in the compressor) before the 24.000 hrs have lapsed, the first service check shall be moved forward and the services following it timed accordingly, as a dirty compressor is less effective than a clean one.

CHECK LIST

- Test run of compressor to check oil-tightness.
- Vibration level in test point (RMS-value) measured before disassembling of compressor.
- Dismounting of air inlet duct.
  - Dismounting of silencer and air-inlet filter.
  - Dismounting of silencer.
  - Check and cleaning/replacement of air-inlet filter.
  - Check of silencer.
  - Repair of silencer.
- Dismounting of outer diffuser drive system.
- Dismounting of inlet housing, spiral casing, contour ring, impeller/rotor and diffuser plate.
  - Check and cleaning of all air-exposed surfaces, especially of impeller/rotor.
  - Disassembling of inner diffuser drive system.
  - Check, lubrication, and cleaning of all parts in the diffuser drive system.
  - Assembling and measuring of diffuser drive system. Check of throat area.

- Disassembling of gear.
  - Visual check of gearwheel and sealings
  - Replacement of sealings (optional).
  - Replacement of ball bearings and O-rings.
  - Cleaning of all parts.
  - Assembling of gear.
  - Check and measuring of axial play in gear.
- Assembling of compressor. Visual check of all parts, including check of clearance of axial bearing in rotor.
  - Check of clearance between impeller and covering.
  - Replacement of O-rings.
- Mounting, check, and adjustment of outer diffuser drive system. Check of mechanical limit switch to stop at scale value "0". Check of limit switch.
- Mounting of silencer.
- Mounting of silencer and air-inlet filter.
- Mounting of air-inlet duct.
- Check of coupling (alignment).
- Check of drive motor (cleaning of fan and lubrication).
- Check of blow-off valve and non-return valve (functional test).

11.3 SIMULATED TEST RUN OF COMPRESSOR

In order to check the start/stop sequence as well as the cable connections a simulated test run shall be undertaken.

When simulating operation the entire safety monitoring equipment shall be tested with satisfactory result. For pressure and temperatures, see technical specifications § 2.

Turn compressor manually to check that rotation is smooth. This is most easily done at the coupling between drive motor and gear.

11.4 TEST RUN OF COMPRESSOR

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

- Opening and closing time of blow-off valve. The blow-off valve shall normally signal "closed" at max 180 seconds after start (depending on type of valve and plant conditions).
- Function of non-return valve.
- Build-up and stability of air pressure in pressure pipe.
- Lubricating oil pressure and temperature shall be stabilized. *)

*) Lubricating oil pressure and temperature see technical specifications § 2.

- Test diffuser adjustment manually.
- Test safety monitoring system and emergency stop during operation.
- Test normal start and stop sequence.
- Adjust motor overload protection (diffuser limit).
- Check for oil leaks at operating temperature.

11.5 MASTER CONTROL PANEL (if supplied)

Check and start-up of Master Control Panel (MCP), during which the start/stop sequence, the priority sequence and control sequence are tested on all compressors.

- Check of cable connections from Local Control Panels to Master Control Panel.
- Check and adjustment of step controller (adjustment of diffuser via mA signal).
- Check of output signal from pressure/oxygen transmitter.

11.6 INLET SILENCER

The inlet silencer is designed for atmospheric air and lined with sound-absorbing material. Cleaning of the sound-absorbing baffles can be done by a vacuum cleaner during service. Avoid bending the baffles.

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

IMPORTANT: Organic solvents will damage the material and its adhesion to the supporting frames.

11.7 DISPOSAL OF WASTE

Disposal of waste according to the instructions of the local authorities.

A compressor in operation shall have air filter elements and lubricating oil changed at regular intervals.

Used air filter elements or used filter cloth can be disposed of as combustible waste. Used lubricating oil to be treated as chemical waste and disposal according to the instructions of the local authorities. Oil moistened cloths used for oil absorption and used oil filters can be disposed of as combustible waste. Iron and metal from the replacement of compressor parts can be removed as scrap.

11.8 ORDER FOR SPARE PARTS

Orders for spare parts shall state in writing serial number, type of compressor and gear, and position number of each part.

12. DISMOUNTING / REMOUNTING

12.1 COUPLING ALIGNMENT (TECH. DOC. 930920041UK)

1. The following directions are only applicable when aligning couplings on standard, single-stage turbocompressor units operated by an asynchronous motor with anti-friction bearings. The coupling must be of the Flender Arpex type, but not necessarily a Flender product. The alignment requirements apply only to couplings with standard "spacer lengths" mounted between motor and gear, hence they are not to be used when aligning "fast running" couplings mounted between gear and compressor.

2. The alignment requirements, as indicated in Table 1, correspond to approx. 25% of the max. allowable deviations specified by the suppliers of couplings, and have thus been approved by suppliers of couplings and drive motors to HV-TURBO.
Improved alignment requirements ensure that vibrations caused by errors of alignment will not be affecting the overall vibration level.

3. The couplings are aligned during mounting of the unit in HV-TURBO's workshop. The alignment is safeguarded against changes during transport/erection, due to the fact that the bases are very stiff. The coupling alignment must always be checked prior to starting up the compressor.

4. The procedure stated in the following points describes alignment with application of a dial gauge. Alternatively laser equipment can be used for the same purpose.

5. Having shrunk one of the coupling halves onto the drive shaft, the compressor/gear unit is mounted on its base. Two guide rods are then placed in the gear support. Now place the electric motor - with the other coupling half mounted - on the four supports with four 10 mm shims between motor and base. Make sure that the motor is resting on all four points of support; this prevents it from being twisted during the tightening. If more than 0,05 mm of shims is needed under any one of the supports, place a suitable number of 'thin' shims under the support until the motor is resting evenly on all points of support.
Make sure that measure **S** is maintained while positioning the motor; see Table 1 and figure 1.

   On GA, GB, GC, GL, and GK2/B3 the drive shafts of gear and motor shall be pulled towards one another while measuring **S**. While bearing in mind the possibility of heat expansion make sure that the tolerance of **S** is a +tolerance in order to minimize the load on the thrust bearing of the gear. In other words, the gear shaft and the drive shaft shall be pulled towards one another.

   On GK190 and GK200 the shaft of the motor shall be pulled towards the gear, while the drive shaft of the gear shall be pressed away from the motor when measuring **S**. While bearing in mind the possibility of heat expansion, make sure that the tolerance of **S** is a +tolerance.

6. As indicated in figures 2 and 3, the angular and parallel misalignments are measured with a dial gauge, which is bolted to the coupling shaft and measures on the motor shaft (see fig. 2 & 3). Do not use a dial gauge with magnet foot. The rest of the measuring setting-up should also be as inflexible as possible to avoid measuring faults caused by deflexion.

   When measuring, make sure that the two coupling halves are rotating synchronously, e.g. by using a trailing rod.

   When the coupling is rotated one full revolution, the measuring dial must not go beyond the tolerances set for parallel and angular misalignments, as indicated in Table 1.

The alignment is carried out partly by adjusting the thickness of the shims, partly by adjusting the motor position on the base.
The parallel misalignment should be suppressed, partly because a major display will entail an important deviation of the radial misalignment, partly to adjust for unevenness between the two plate packs.

As already stated (point 4), the motor is not to be tightened definitively until it is resting evenly on all four supports. If necessary, use thin shims under one of the supports.

When measuring the angular and parallel misalignments, it is a good idea to mount a spring between the flange on which the dial gauge is fixed and the flange too measured on. In this way the axial position of motor shaft and gear shaft is maintained.

7. The coupling bolts are tightened by means of a torque wrench or by measuring the elongation of the bolts. When mounting and tightening, follow the instructions of the supplier.

In general, couplings of the Flender Arpex and Mönninghoff Arcoflex types are used. The mounting instructions for these makes are different. See instructions on page 5 - 7. For both types the thread of the bolts must be greased. Do not use Molykote or similar instead of oil for the greasing. When tightening the bolts, the bolt head must be fixed while the nut is turned.

If other types of couplings than the above mentioned are mounted, the mounting instructions for the coupling make in question must be required.

TABLE 1

Coupling Size (Flange dia.) *	S Tolerance ** + Tolerance to be used	Concentric Running RL** Gauge indic.	Gyratory Running PL** Gauge indic.	Gyratory Running mm/100mm
168 or less	± 0,3	0,24	0,29	0,17
180	± 0,4	0,24	0,31	0,17
200	± 0,4	0,24	0,34	0,17
205	± 0,4	0,24	0,36	0,17
215	± 0,4	0,24	0,38	0,17
235	± 0,5	0,31	0,41	0,17
250	± 0,5	0,31	0,44	0,17
270	± 0,5	0,31	0,44	0,17
300	± 0,6	0,31	0,52	0,17
320 ***	± 0,6	0,31	0,56	0,17

* For deviating flange diameters, the tolerances for the closest - and smaller - flange diameter are used.

** The misalignment tolerances are valid for standard spacer lengths of 250 mm, but may also be used at spacer lengths over 250 mm.

*** For high torque series, the same alignment tolerances apply.

All measurements are in mm.

Figure 1.

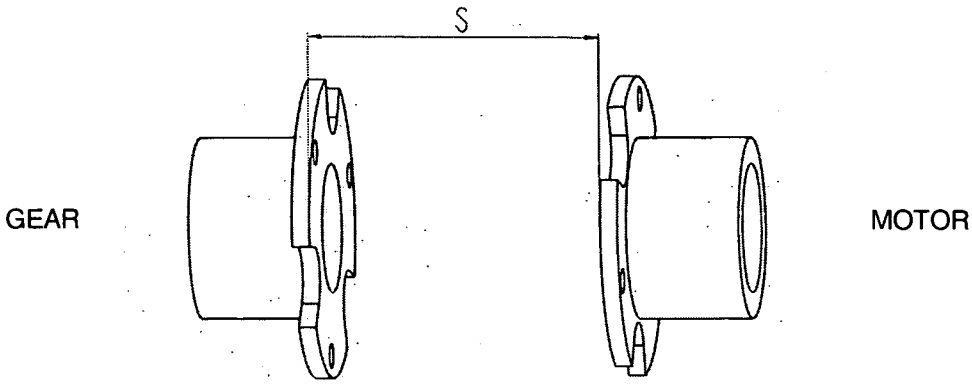


Figure 2. **Concentric Running: RL**

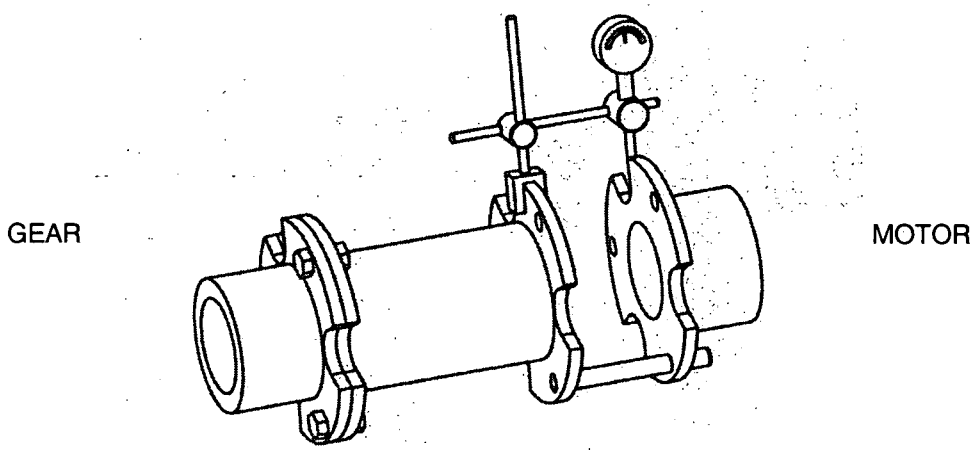
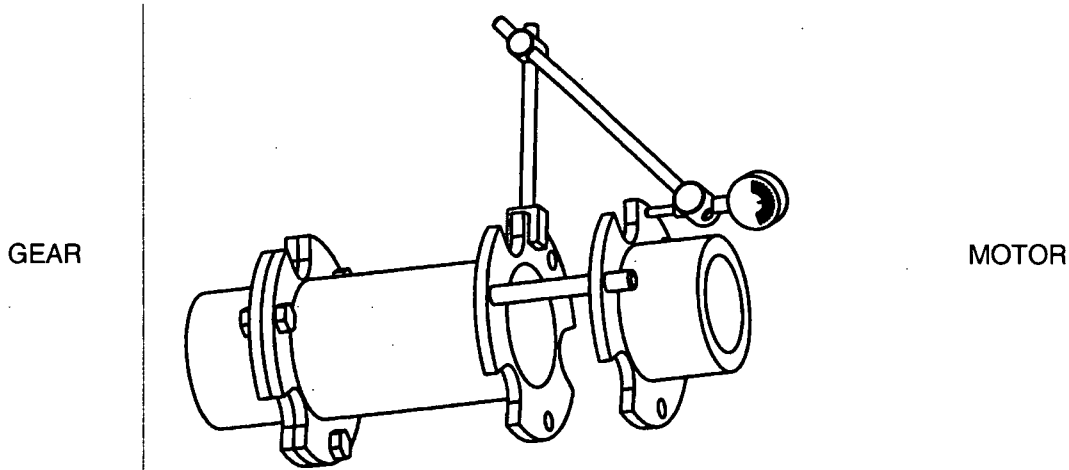


Figure 3. **Gyratory Running: PL**



FLENDER ARPEX COUPLINGS

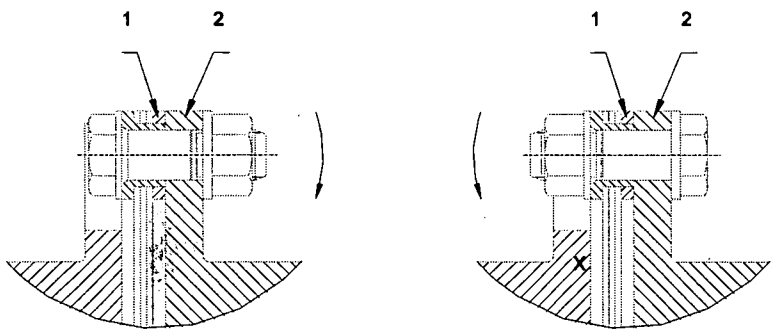
Coherence between coupling size, dowel screws, key width, torque T_A, and possible screw extension at T_A.
*NB! The torque T_A of the dowel screws only applies to clean, greased threads. Use compressor lube oil.

Size = Flange Diam. mm	Screws metric	Key Width mm	* Torque T_A nm	Screw Extension ΔL_s mm (T_A)
78	M6	10	15	-
80	M6	10	10	-
92	M6	10	10	-
102	M6	10	10	-
105	M6	10	15	-
125	M8	13	36	-
128	M8	13	25	-
140	M8	13	36	-
145	M8	13	25	-
165	M10	17	71	
168	M10	17	55	-
175	M12	19	120	-
180	M12	19	95	-
195	M14	21	190	-
200	M16	24	240	-
205	M16	24	240	-
210	M16	24	300	-
215	M16	24	240	-
235	M20	30	460	-
240	M18	27	410	-
250	M20	30	460	-
255	M20	30	580	-
270	M20	30	460	-
280	M22	32	790	-
300	M24	36	820	-
305	M24	36	-	0.17-0.19
320	M24	36	820	-
335	M27	41	-	0.20-0.22
350	M30	46	1660	0.19-0.21
370	M30	46	1660	0.19-0.21
372	M30	46	-	0.21-0.24
400	M30	46	1660	0.19-0.21
407	M33	50	-	0.24-0.27
440	M36	55	3000	0.23-0.25
442	M36	55	-	0.27-0.30
460	M36	55	3000	0.23-0.25

Size = Flange Diam. mm	Screws metric	Key Width mm	* Torque T_A nm	Screw Extension ΔL_s mm (T_A)
480	M36	55	3000	0.23-0.25
487	M39	60	-	0.30-0.33
500	M36	55	3000	0.23-0.25
522	M42	65	-	0.33-0.36
572	M45	70	-	0.35-0.39
600	M48	75	7440	0.31-0.34
602	M48	75	-	0.38-0.42
620	M48	75	7440	0.31-0.34
660	M48	75	7440	0.31-0.34
667	M52	80	-	0.40-0.44
690	M48	75	7440	0.31-0.34
720	M56	85	11600	0.35-0.39
722	M56	85	-	0.44-0.49
740	M56	85	11600	0.35-0.39
770	M56	85	11600	0.35-0.39
820	M56	85	11600	0.35-0.39

The correct mounting of the plate packs is shown in figure 1. The ring, pos. 1, shall face the coupling flanges (shaft/spacer) pos. 2. If space is narrow, invert the screws as shown in Figure 2.

Important! Check the screw torque after approx. 10 hrs operation.



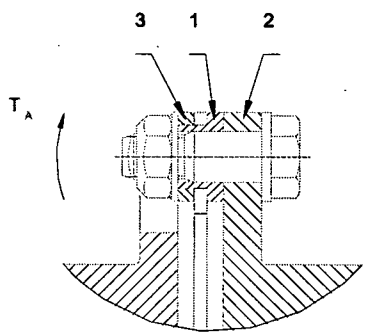
MØNNINGHOFF ARCOFLEX COUPLINGS TYPE 314.XX.3.1

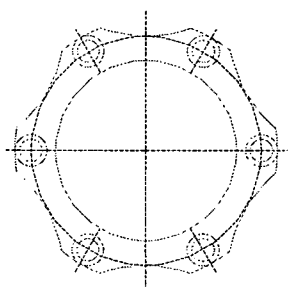
Coherence between type of coupling, shaft diameter, dowel screws, key width and torque T_A. *NB! The torque T_A of the dowel screws only applies to clean, greased threads. Use compressor lube oil.

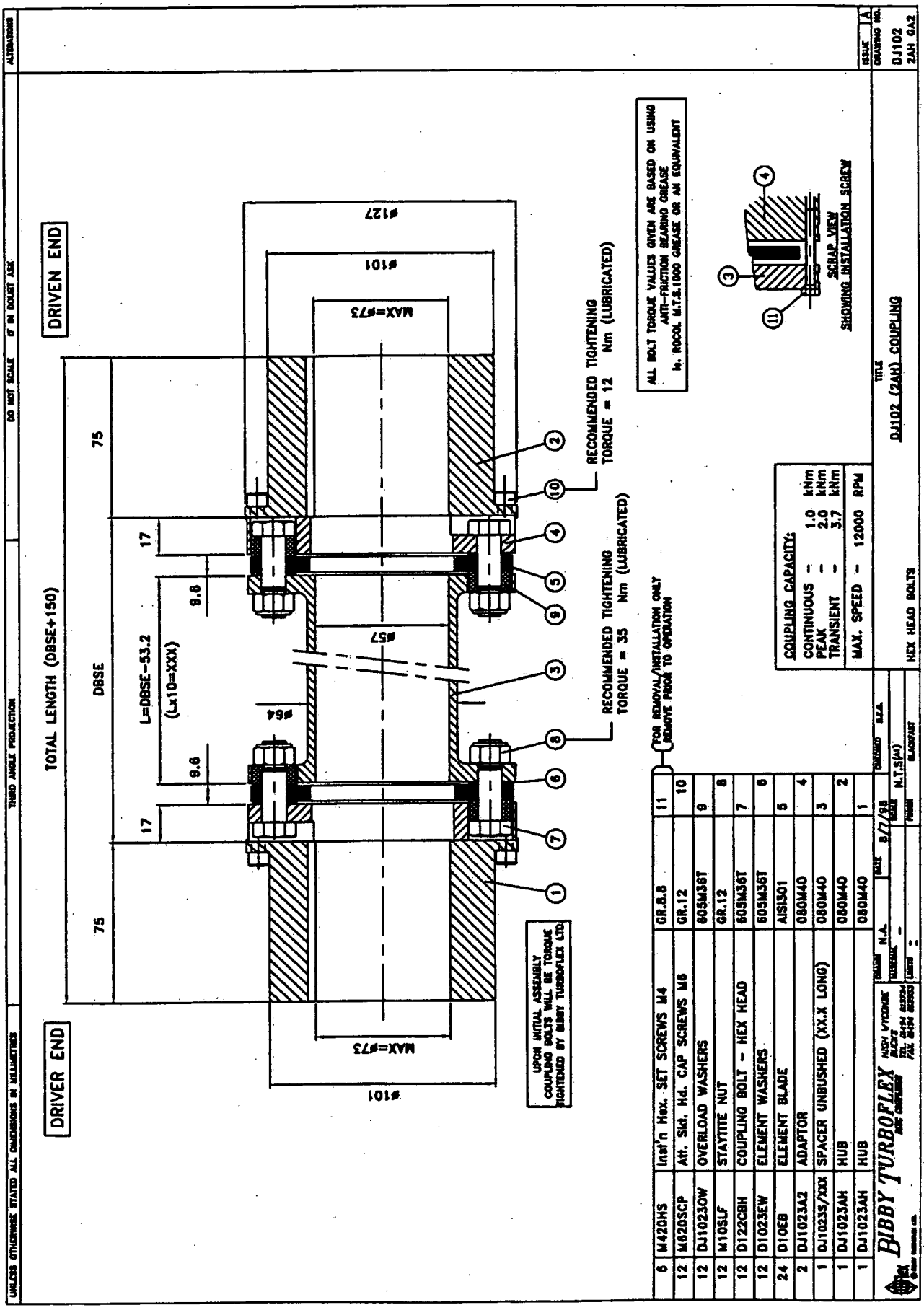
Coupling Type XX	Shaft Diam. mm	Dowel Screws metric	Key Width mm	*Torque T_A Nm
55	128	M8	13	18
65	145	M8	13	18
75	168	M10	17	40
80	180	M12	19	60
85	200	M16	24	150
90	215	M16	24	150
98	250	M20	30	270

The correct mounting of the plate packs is shown on below drawing. The screws must be mounted in the coupling flanges (shaft/spacer) pos. 2. The bushings pos. 1, of the plate packs must face the coupling flanges (shaft/spacer) pos. 2. Do not forget to mount the washers pos. 3.

Important! Check the screw torque after approx. 10 hrs operation.






DRIVEN END
DRIVER END
TOTAL LENGTH (DBSE+150)
DBSE
75
75
17
17
9.6
9.6
L=DBSE-53.2
(Lx10=XXX)
ø127
ø101
MAX=ø73
ø57
ø64
RECOMMENDED TIGHTENING TORQUE = 12 Nm (LUBRICATED)
RECOMMENDED TIGHTENING TORQUE = 35 Nm (LUBRICATED)
FOR REMOVAL/INSTALLATION ONLY REMOVE PRIOR TO OPERATION
UPON INITIAL ASSEMBLY COUPLING BOLTS WILL BE TORQUE TIGHTENED BY BIBBY TURBOFLEX LTD
ALL BOLT TORQUE VALUES GIVEN ARE BASED ON USING ANTI-FRICTION BEARING GREASE ie. ROCOL M.T.S.1000 GREASE OR AN EQUIVALENT
SCRAP VIEW SHOWING INSTALLATION SCREW
COUPLING CAPACITY:
CONTINUOUS = 1.0 kNm
PEAK = 2.0 kNm
TRANSIENT = 3.7 kNm
MAX. SPEED = 12000 RPM
DJ102 (2AH) COUPLING
HEX HEAD BOLTS
BIBBY TURBOFLEX
DJ102
2AH GA2
THIRD ANGLE PROJECTION
DO NOT SCALE IF IN DOUBT ASK
UNLESS OTHERWISE STATED ALL DIMENSIONS IN MILLIMETRES
ALTERATIONS
ISSUE
DRAWING NO.
8/7/98
N.T.S(A4)
BLACKPOOL
6 M420HS Inst'n Hex. SET SCREWS M4 GR.8.8 11
12 M620SCP Alt. Skt. Hd. CAP SCREWS M6 GR.12 10
12 DJ10230W OVERLOAD WASHERS 605W36T 9
12 M10SLF STAYTITE NUT GR.12 8
12 D122CBH COUPLING BOLT - HEX HEAD 605W36T 7
12 D1023EW ELEMENT WASHERS 605W36T 6
24 D10EB ELEMENT BLADE AISI301 5
2 DJ1023A2 ADAPTOR 080M40 4
1 DJ10233/XXX SPACER UNBUSHED (XX.X LONG) 080M40 3
1 DJ1023AH HUB 080M40 2
1 DJ1023AH HUB 080M40 1

12.2 DISMOUNT/REMOUNT OF OUTER DIFFUSER SYSTEM

See drawing next page.

Aids: Torque wrench and ordinary hand tools.

Joint paste: None

Dismount: Dismount pin bolt connection D219 at the positioning lever D205.

Unscrew D206 and remove pin bolt D219 from the positioning shaft D207.

Separate the limit switch cables from their compressor fixings without disconnecting the cables from the terminal box. The position of the limit switches, defined and set by HV-TURBO, shall not be changed, as this will influence the capacity of the compressor.

The cables on the linear motor D224 shall not be disconnected.

After removal of screws D227, D219 and D229 the mounting plate D208 and the linear motor D224 can be dismounted.

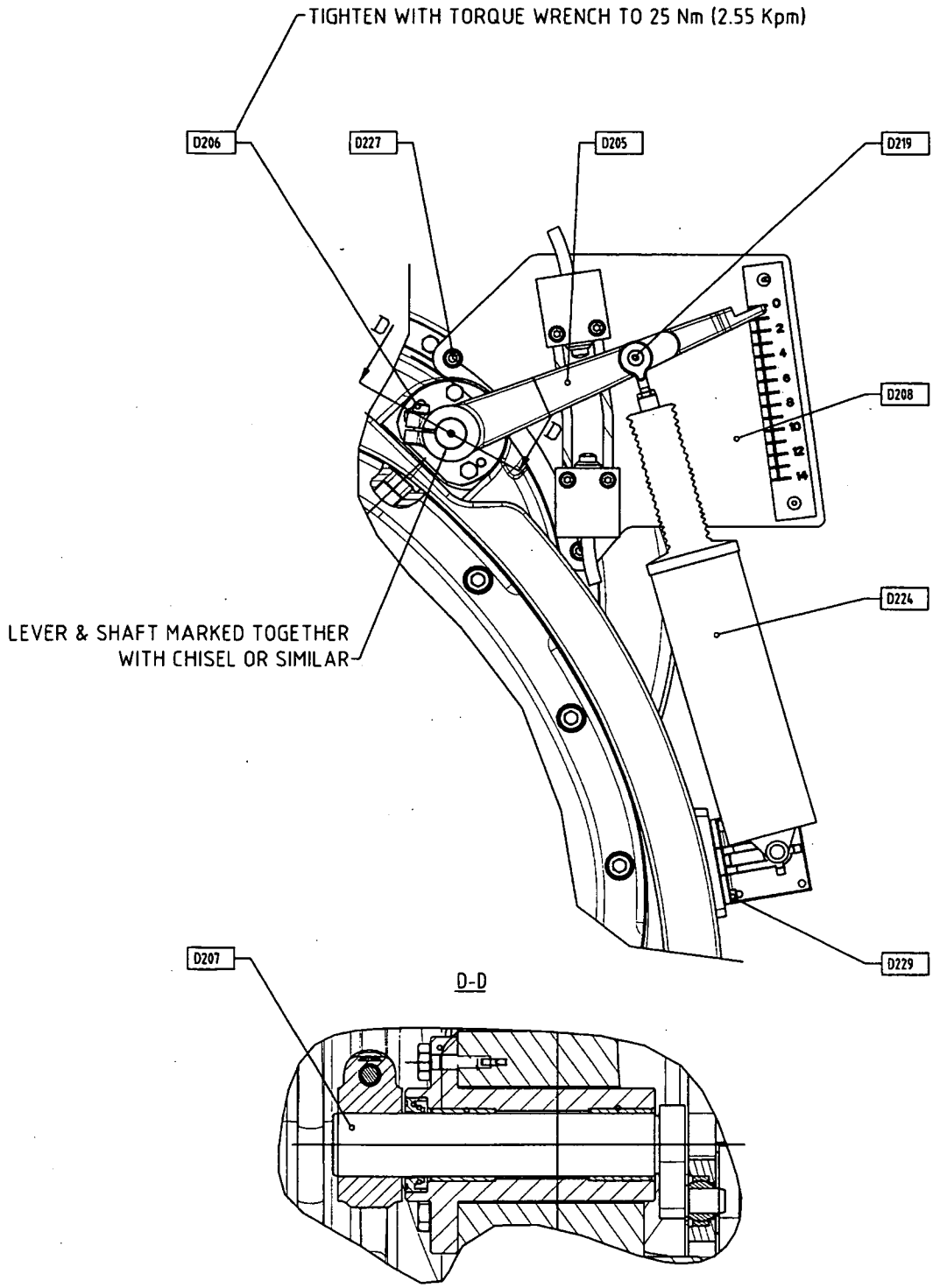
Loosen nut D206 and remove the position lever D205.

Remount: The reinstallation to be carried out in reverse order.

IMPORTANT! Position lever D205 shall be placed into exactly the same position on the positioning shaft D207 as before dismounting (indicated by marks on shaft and lever). Tighten the nut D206 with torque wrench to 25 Nm.

When the diffuser is closed to the min. mechanical end-stop, the lever position must show 0 on the scale.

OUTER DIFFUSER SYSTEM



12.3 ADJUSTMENT OF CLEARANCES

See drawing next page.

Internal Gaps Sp1, Sp2 and Sp5 according to tech. info 930920036 (enclosed).

GAP SP2 BETWEEN IMPELLER AND CONTOUR RING/INNER VOLUTE CASING

Mount tool GK190V001 with nut in bearing housing T204, to lock the shaft R201 (and prevent axial movement).

Measure gap Sp2 by means of lead imprinting.

Centre inner volute casing in relation to impeller R414.

Inner volute casing H505 shall be turned off (on face X) until the desired gap Sp2 has been reached.

Check gap Sp1.

MEASURING OF DIFFUSER HEIGHT

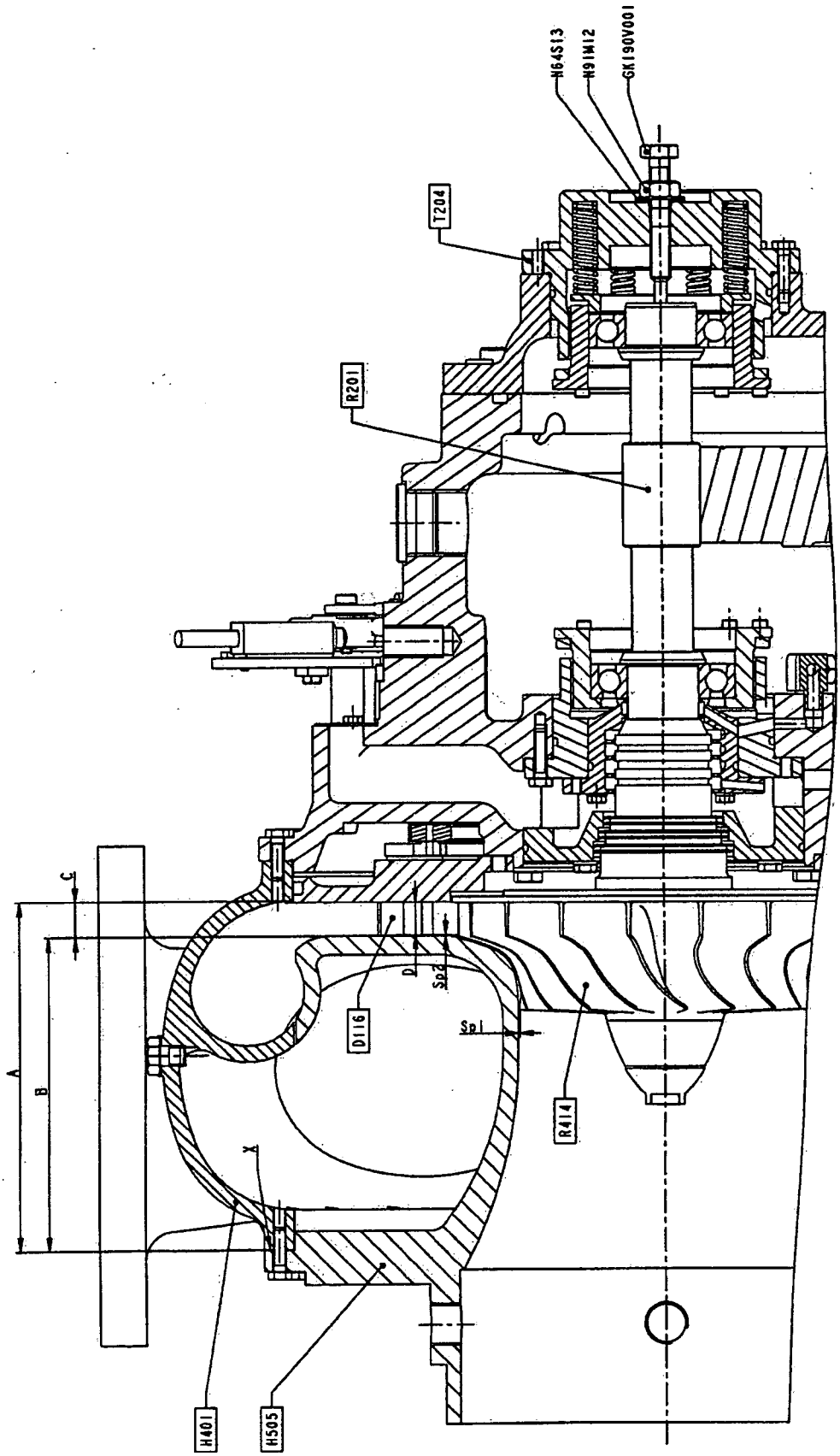
Measurements A and B are measured by means of a straightedge at minimum 4 measuring points evenly distributed.

Diffuser width C is equal to: $C = A - B$.

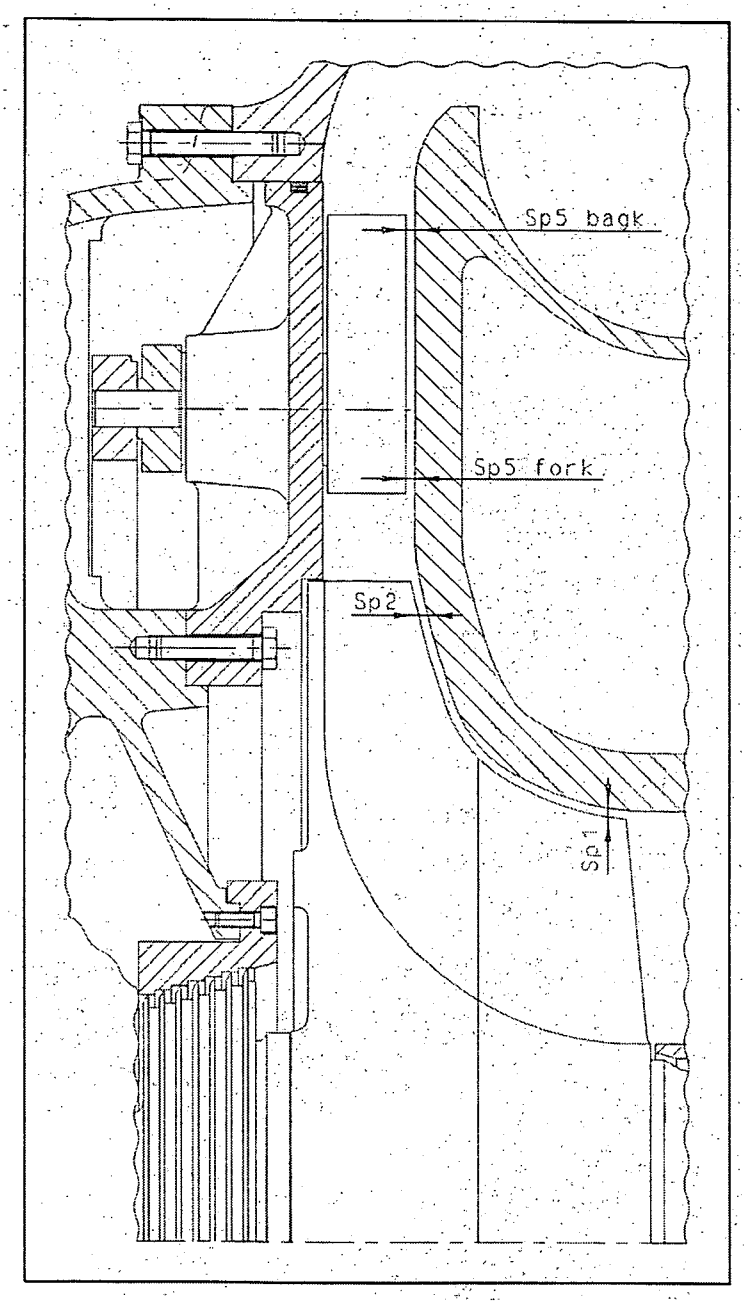
Height D of diffuser blades, pos. D116 is equal to: $D = C - Sp5$ (min.)

Record Sp1, Sp2, Sp5 and blade height in the measuring diagram.

ADJUSTMENT OF CLEARANCES



INTERNAL GAPS - TURBOCOMPRESSORS WITH ALU IMPELLER
OVER PRESSURE DUTY (TECH. DOC. 930920036UK)



TYPE	SP1	MAX / MIN	SP2	MAX / MIN	SP5	MAX / MIN	(SP5)*
KA2-GK2 KA2-GK190 KA2-GL180 KA2-GB255	0,8	+0,1 0	0,6	+0,05 0	0,2	+0,05 0	0,45

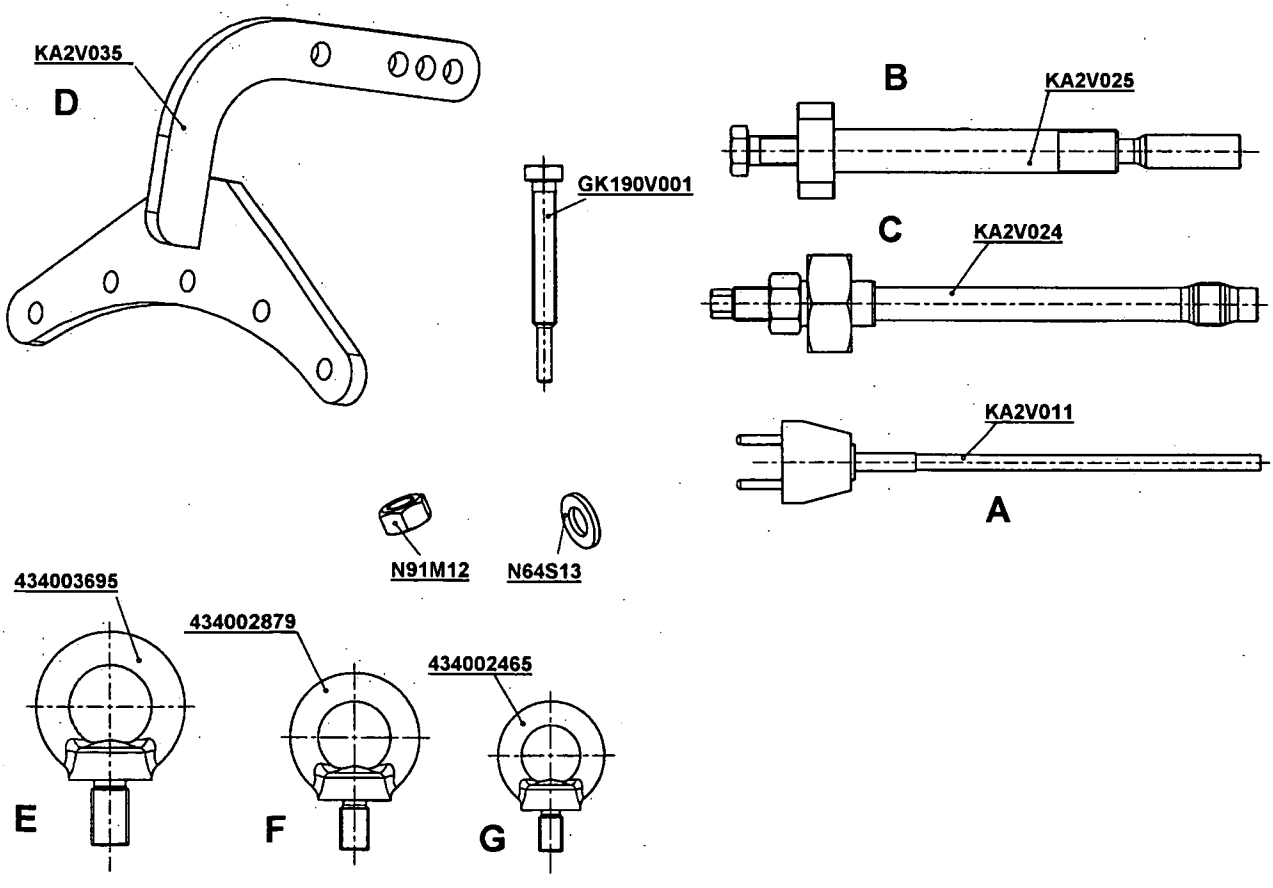
(SP5)*: When measuring gap SP5 by means of lead-imprinting (min. 4 measuring points evenly distributed) at least one measuring point shall be within the tolerance stated in column SP5 MAX/MIN, and no other measuring points must exceed the gap (SP5)*. (SP5)* indicates max. permitted non-parallelism in the diffuser.

12.4 WEIGHT OF SINGLE PARTS

Pos. No.	Description	Weight approx.
H701	Inlet housing	80 kg
H501	Inner volute casing	50 kg
R400	Rotor complete	5,5 kg
D101	Diffuser plate	8,5 kg
R100	Drive shaft	43 kg
H101	Gear casing - part A	23 kg
H102	Gear housing - part B	122 kg

12.5 SPECIAL TOOLS

Info	Qty	Description	Tool No.	Fig.
V505	1	Heating element for centre screw	KA2V011	A
V501	1	Extractor for impeller	KA2V025	B
V504	1	Mounting tool for impeller	KA2V024	C
V102	1	Lifting hook for inlet	KA2V035	D
V202	1	Eye bolt for gear housing	434003695	E
V103	1	Eye bolt for spiral casing	434002879	F
V701	1	Eye bolt for drive shaft	434002465	G
V405	1	Special screw	GK190V001	
V405	1	Nut	N91M12	
V405	1	Spacer ring	N64S13	



12.6 Tightening Torque

Where nothing else is stated for the tightening torque of the bolts and screws used in HV-TURBO compressors, the below mentioned values (ISO-m) are valid. The values are for ordinary bolts with strength 8.8 (DIN 267) and socket head bolts and Insex screws.

M	3	4	5	6	8	10	12	14	16	20	24	30
Nm	1,37	3,10	6,15	10,5	26	51	89	141	215	390	675	1160

Wrench Width: Hexagon Screws

M	3	4	5	6	8	10		12		14		16	20	24	30
Width	5,5	7	8	10	13	16	(17)	18	(19)	21	(22)	24	30	36	46

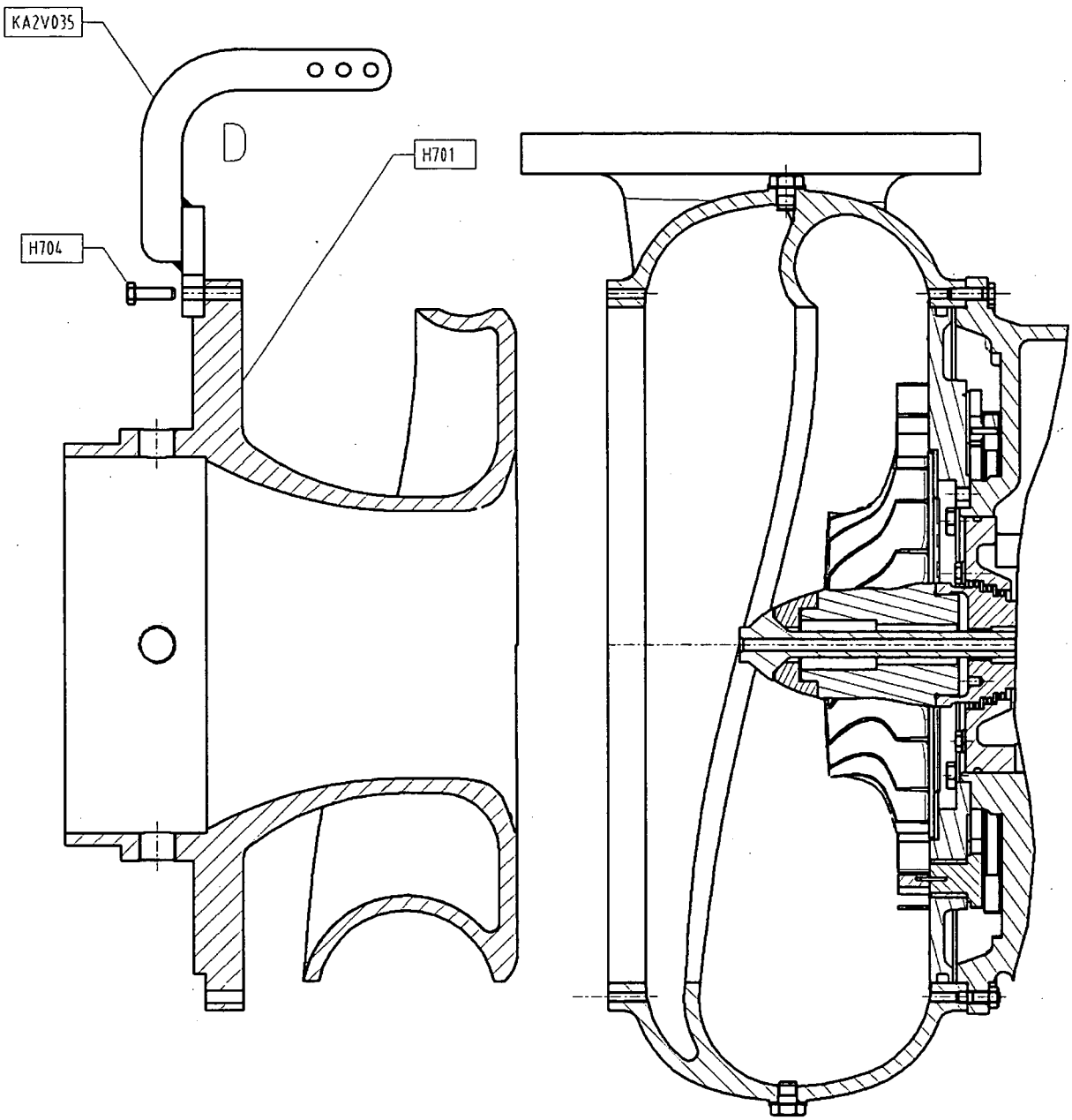
Wrench Width: Insex Screws

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

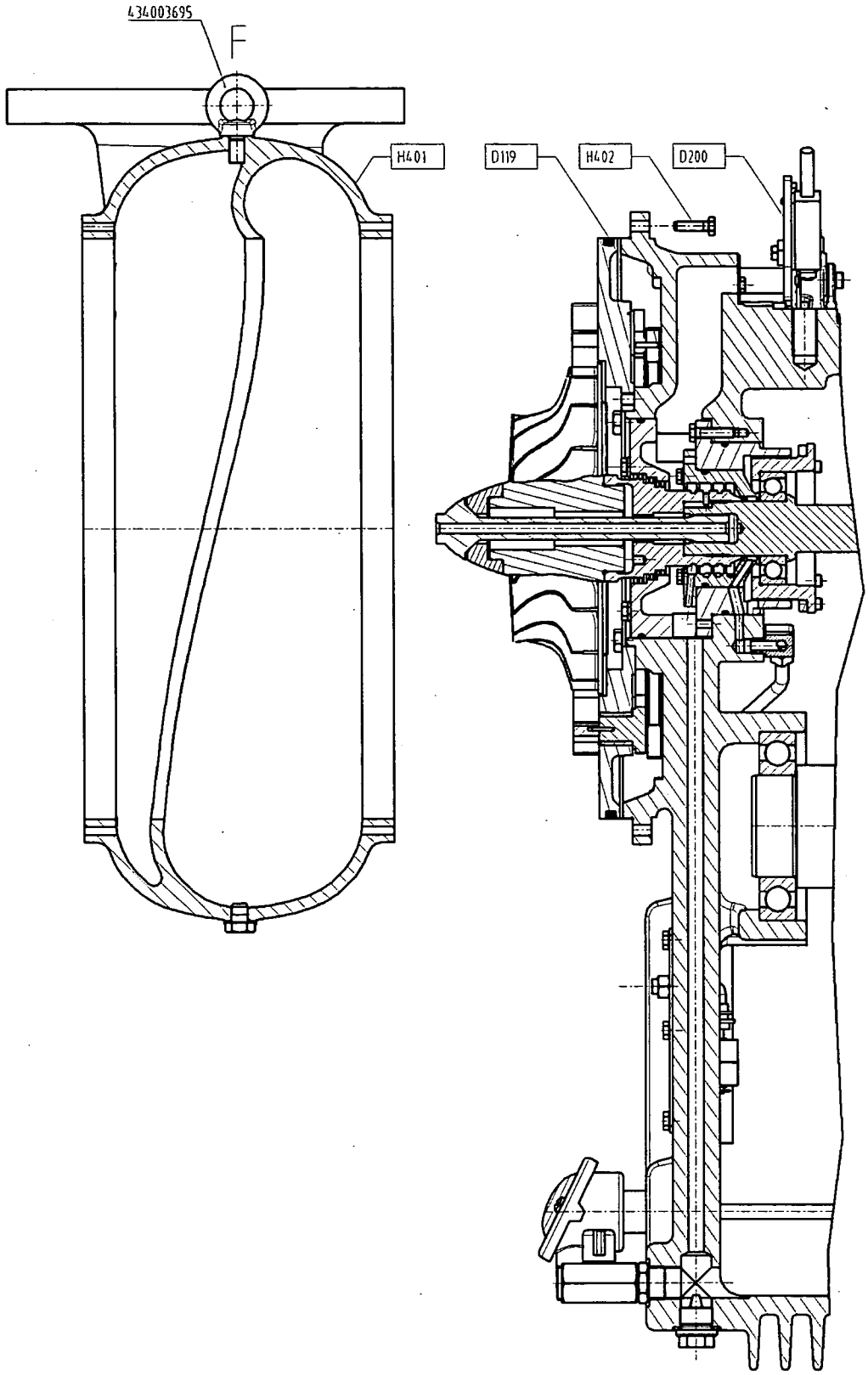
NB! Wrench widths are in accordance with ISO 4014/4017, except figures in () which are according to DIN 931/933.

12.7 DISMOUNT / REMOUNT DRAWINGS

COMPRESSOR INLET DISMOUNT

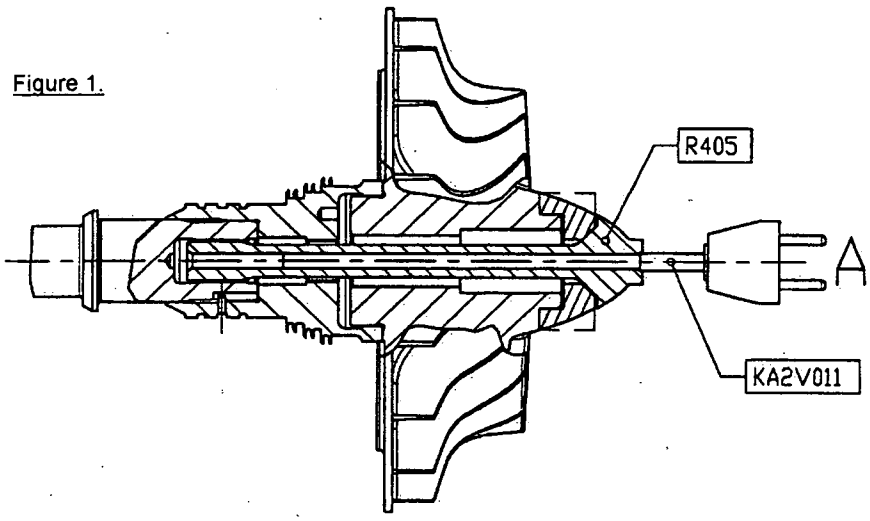


SPIRAL CASING DISMOUNT



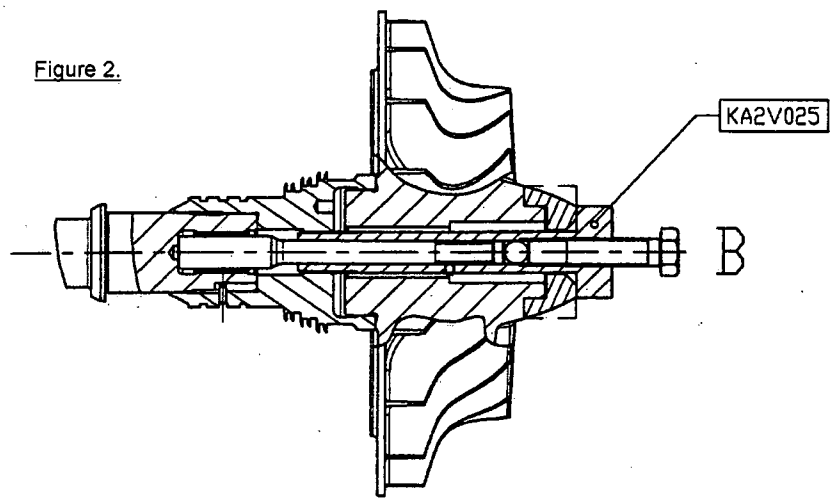
IMPELLER DISMOUNT

Figure 1.



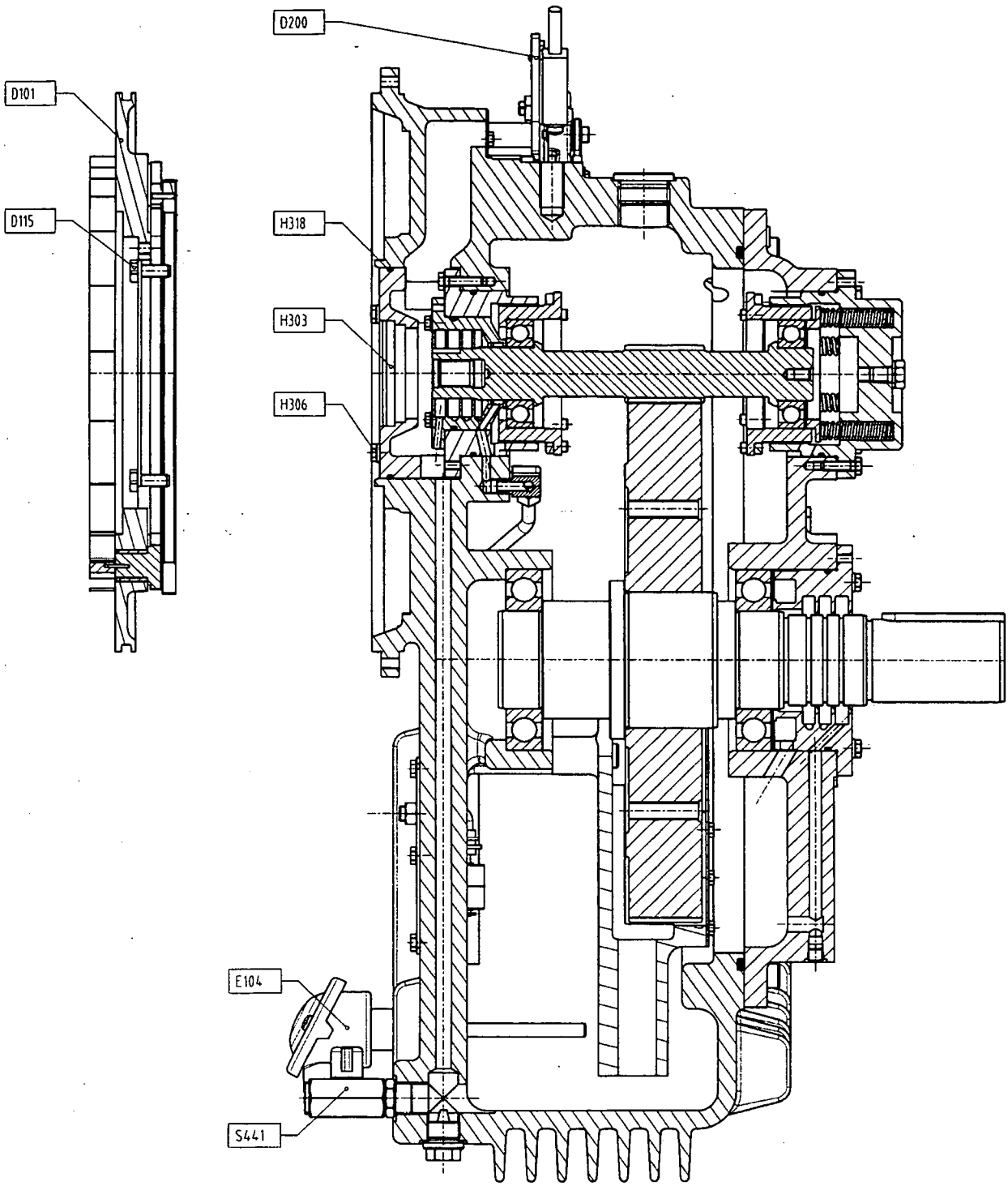
1. Insert and tighten the heating screw KA2V011 by hand.
2. Heat the centre screw for approx. 3-4 min. (max. 6 min.) with the heating screw to extend the screw. Secure the heat transfer with cupper paste or similar.
3. Loosen the heated centre screw in clockwise direction and remove it.

Figure 2.

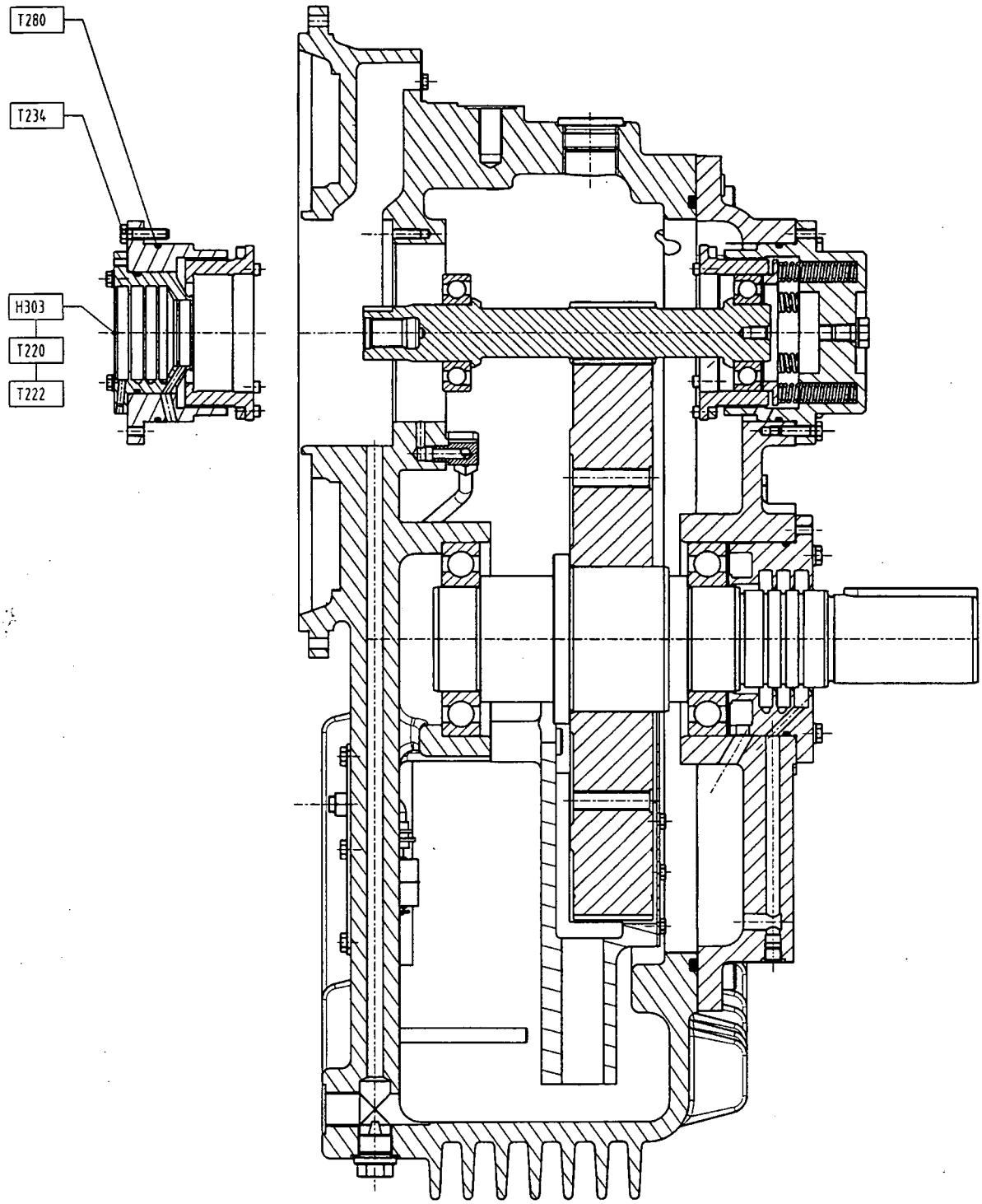


4. Dismount the impeller complete by means of the extractor KA2V025.

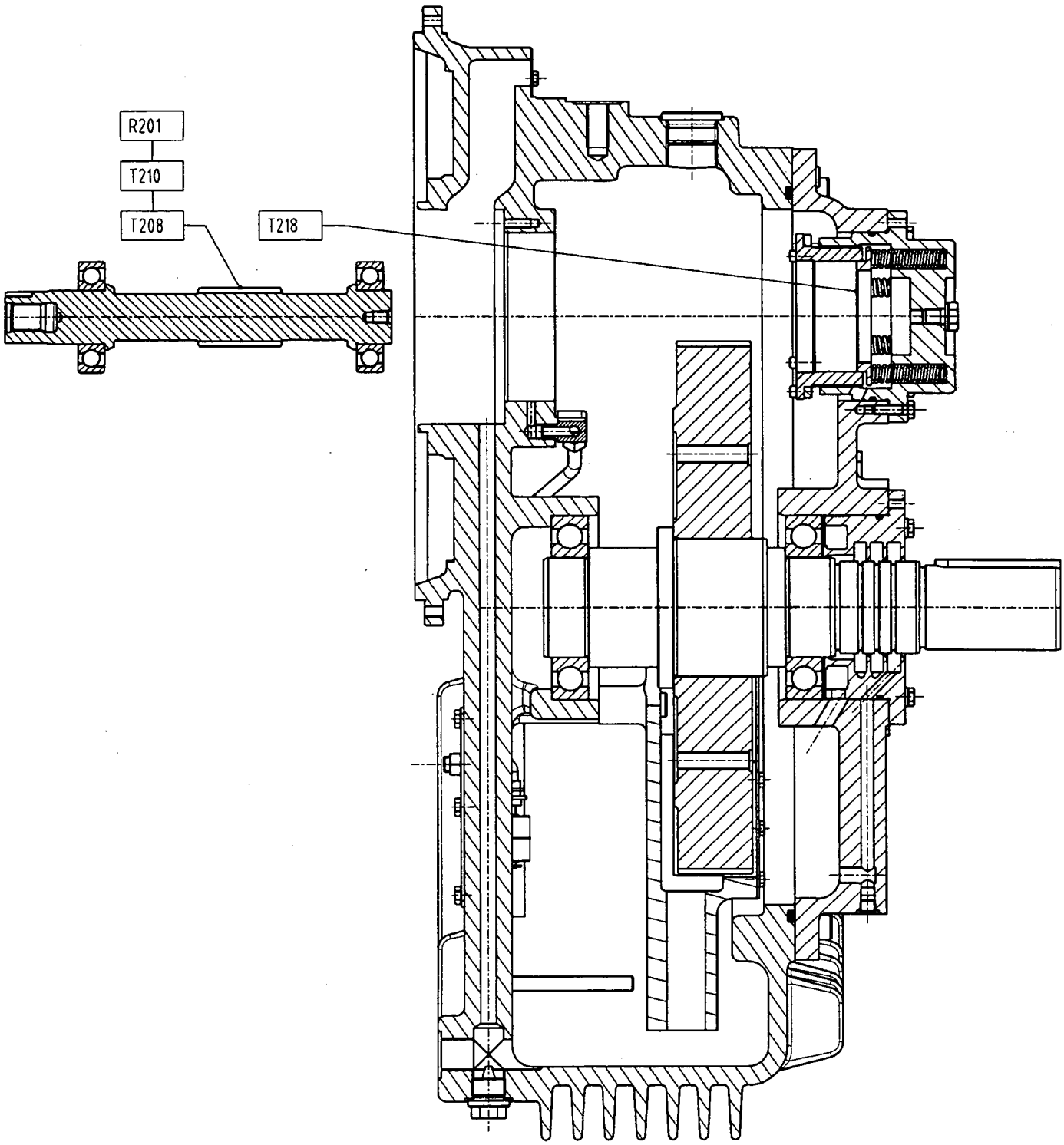
DIFFUSER DISMOUNT



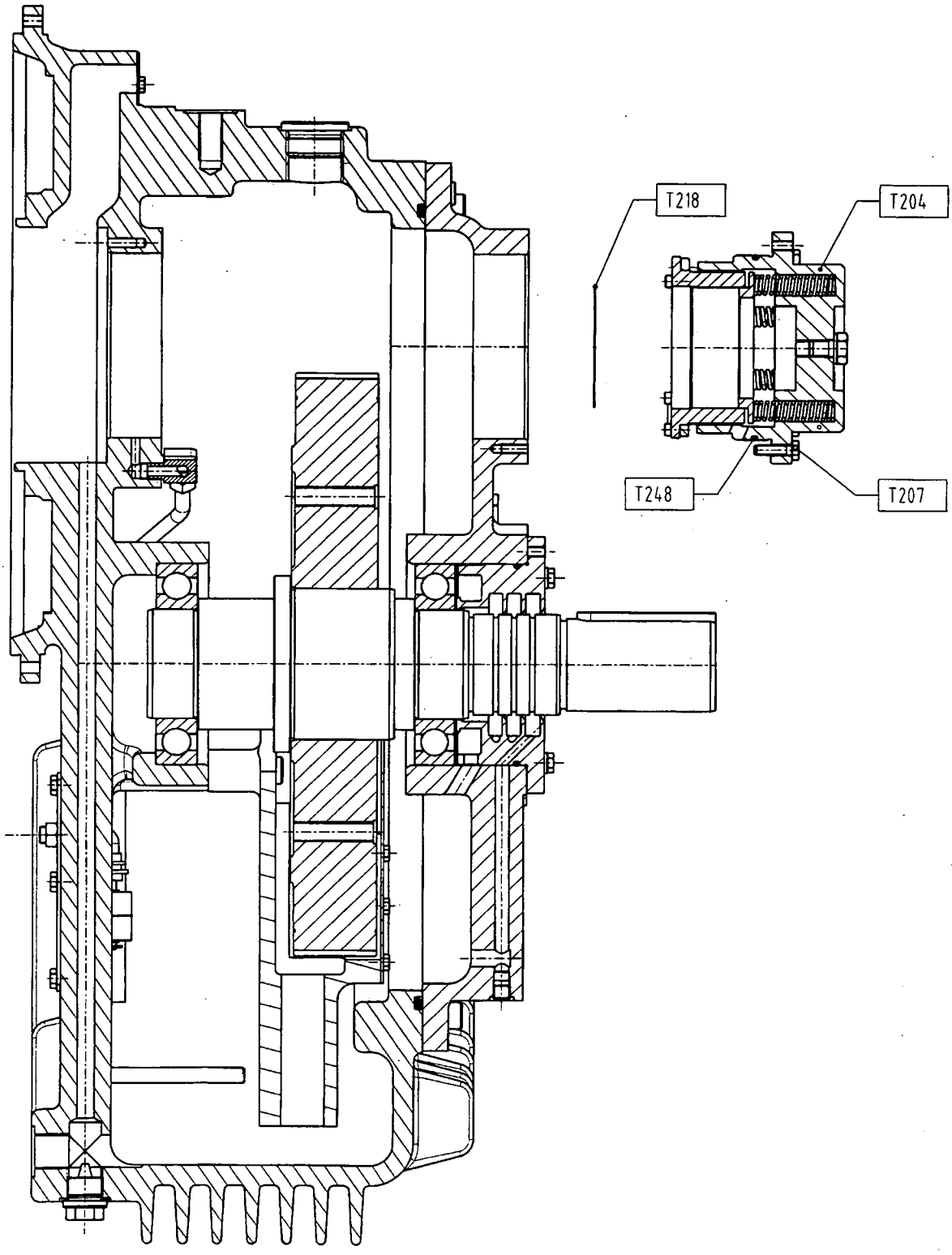
INNER SEALING RING AND BEARING HOUSING DISMOUNT



PINION SHAFT DISMOUNT



OUTER BEARING HOUSING DISMOUNT



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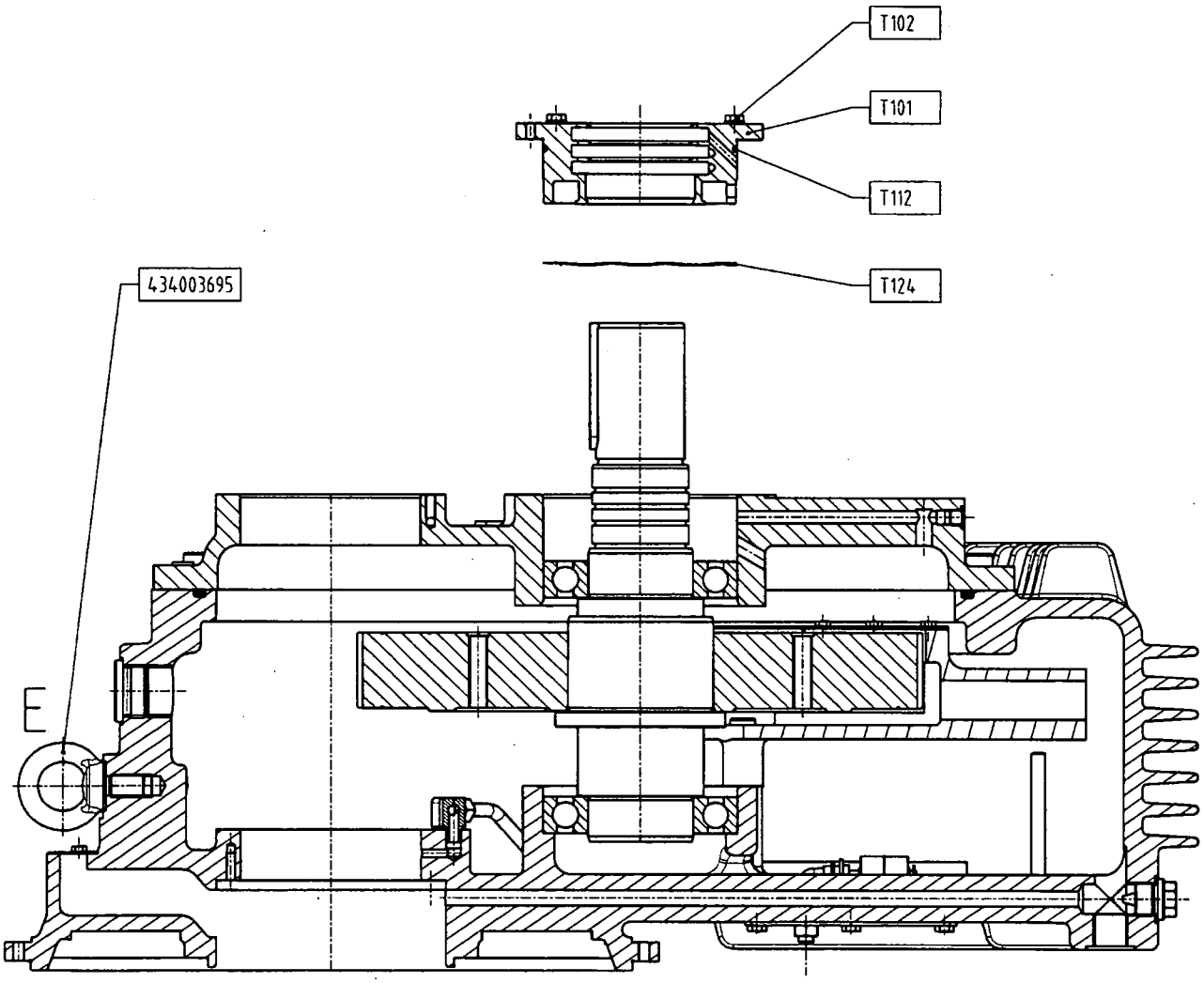
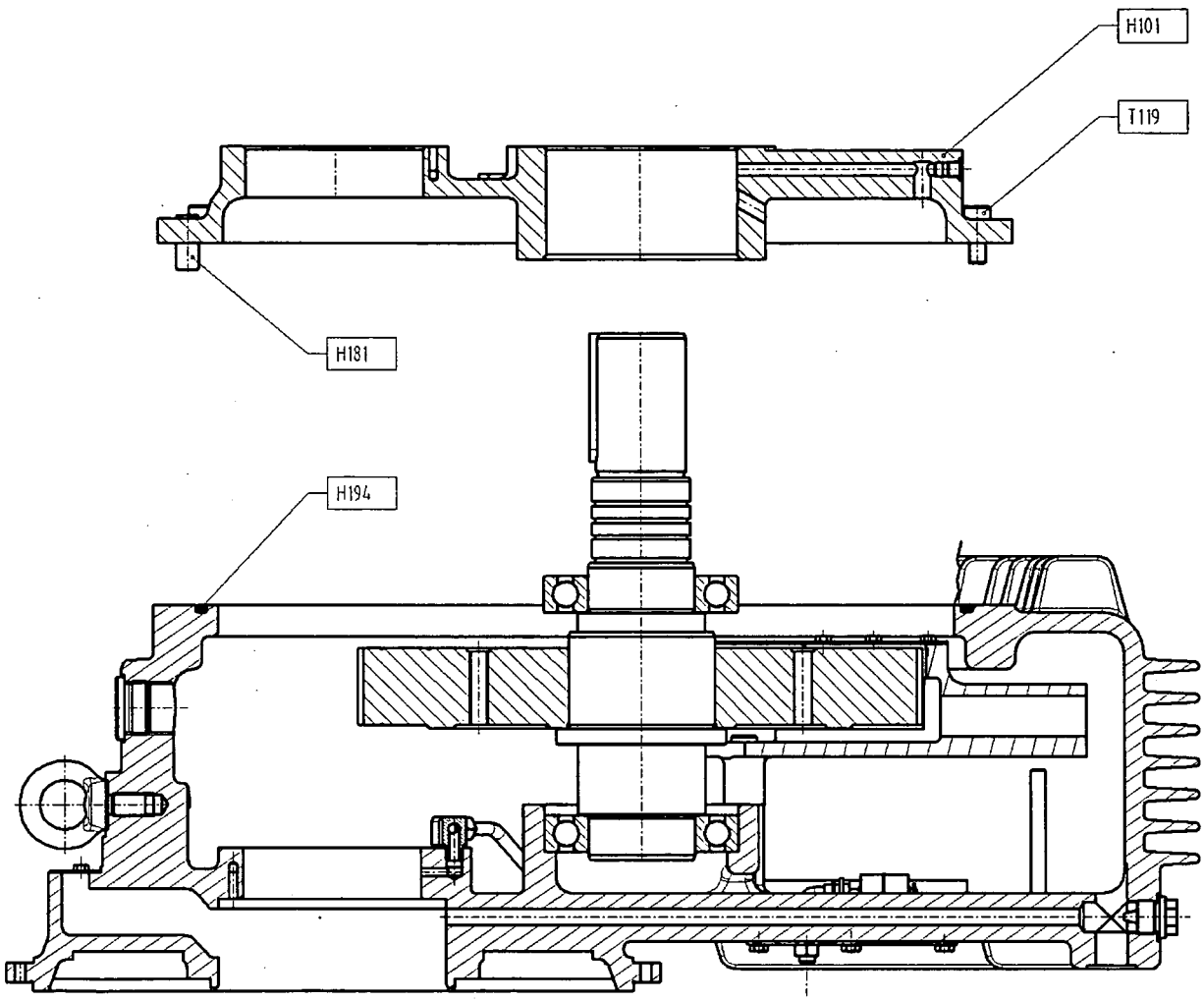
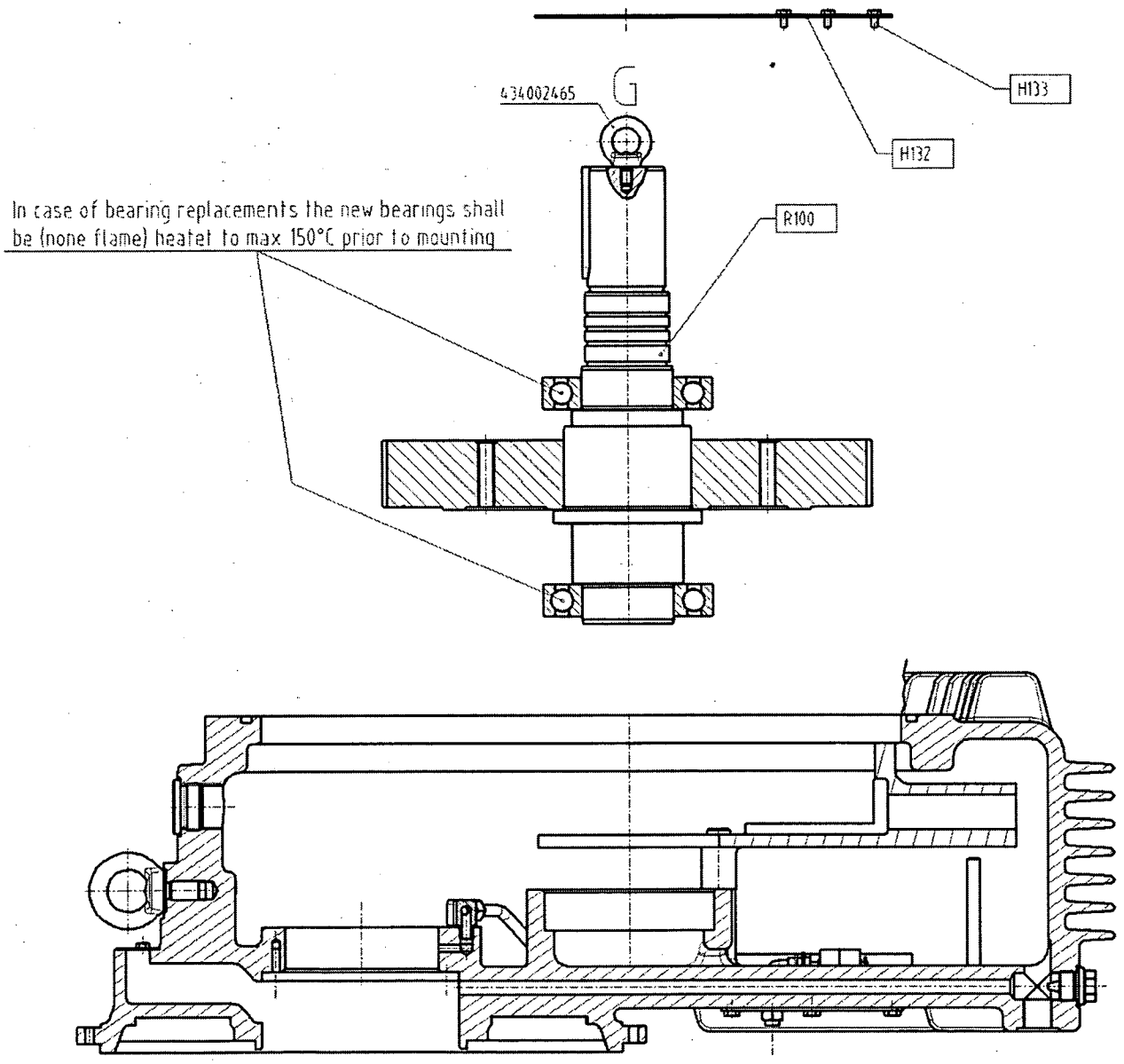


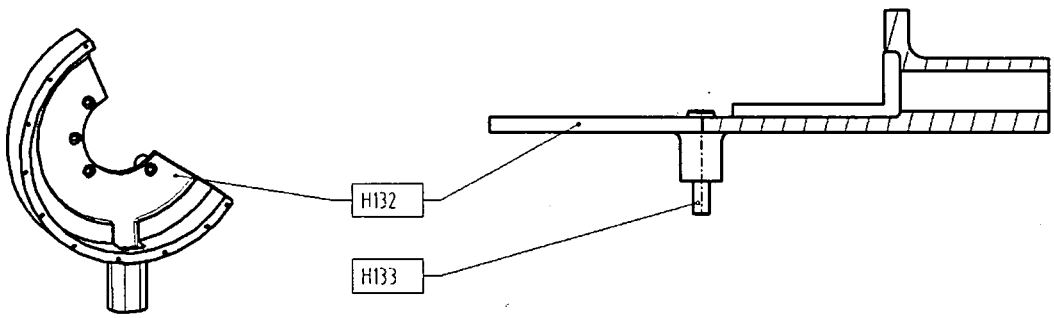
GEAR HOUSING - PART A DISMOUNT

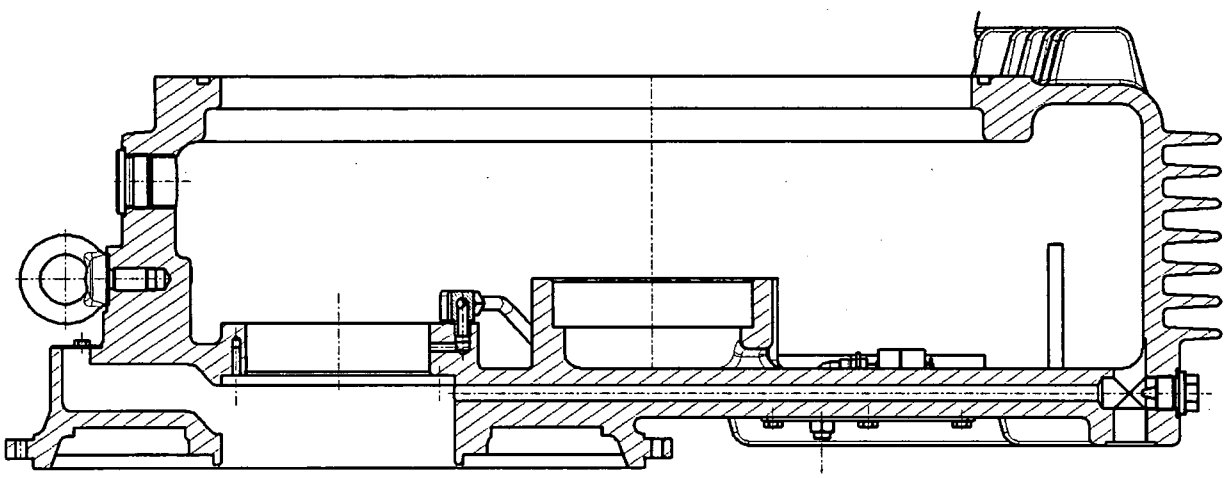


DRIVE SHAFT DISMOUNT

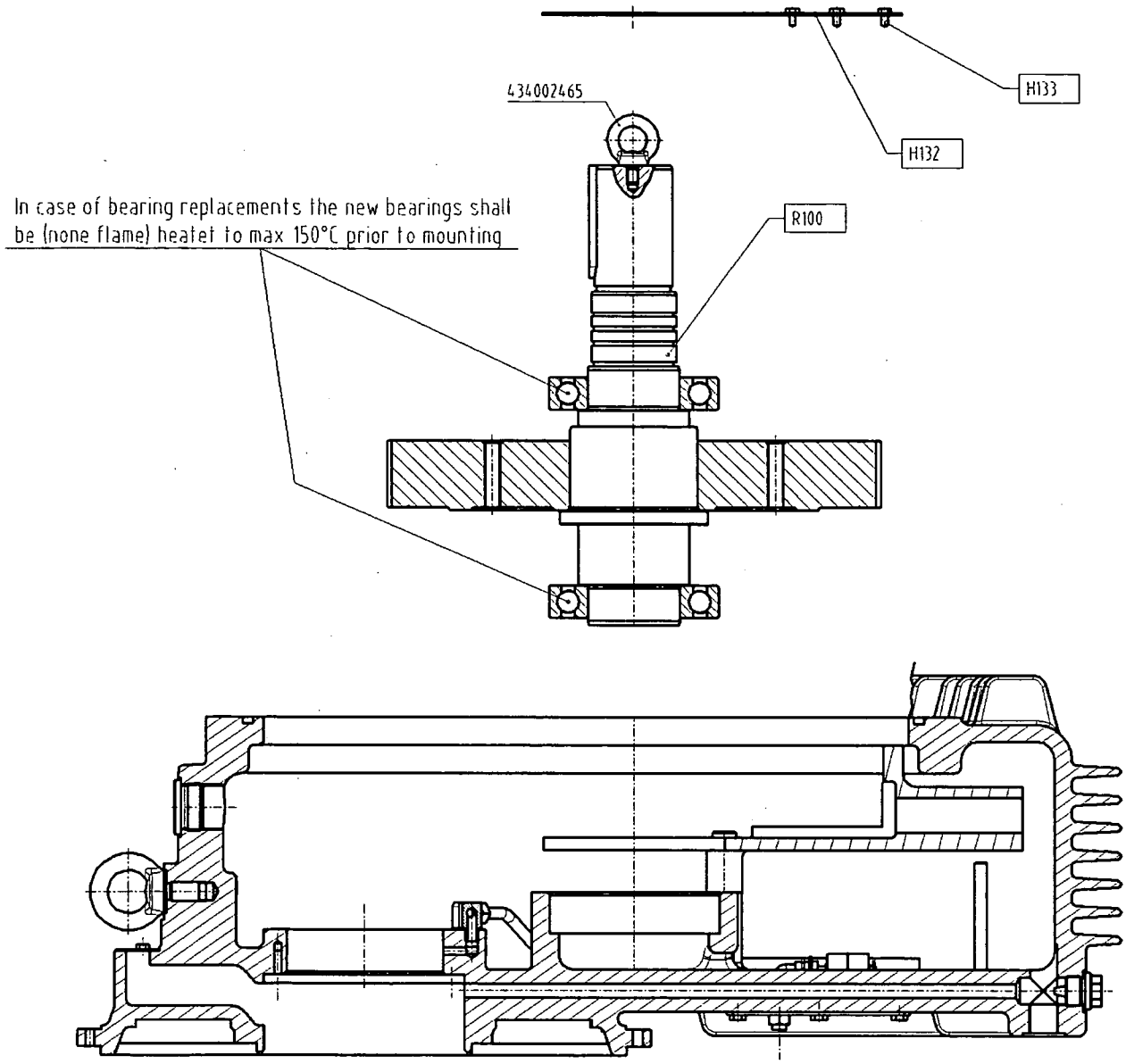


OIL SHIELD DISMOUNT

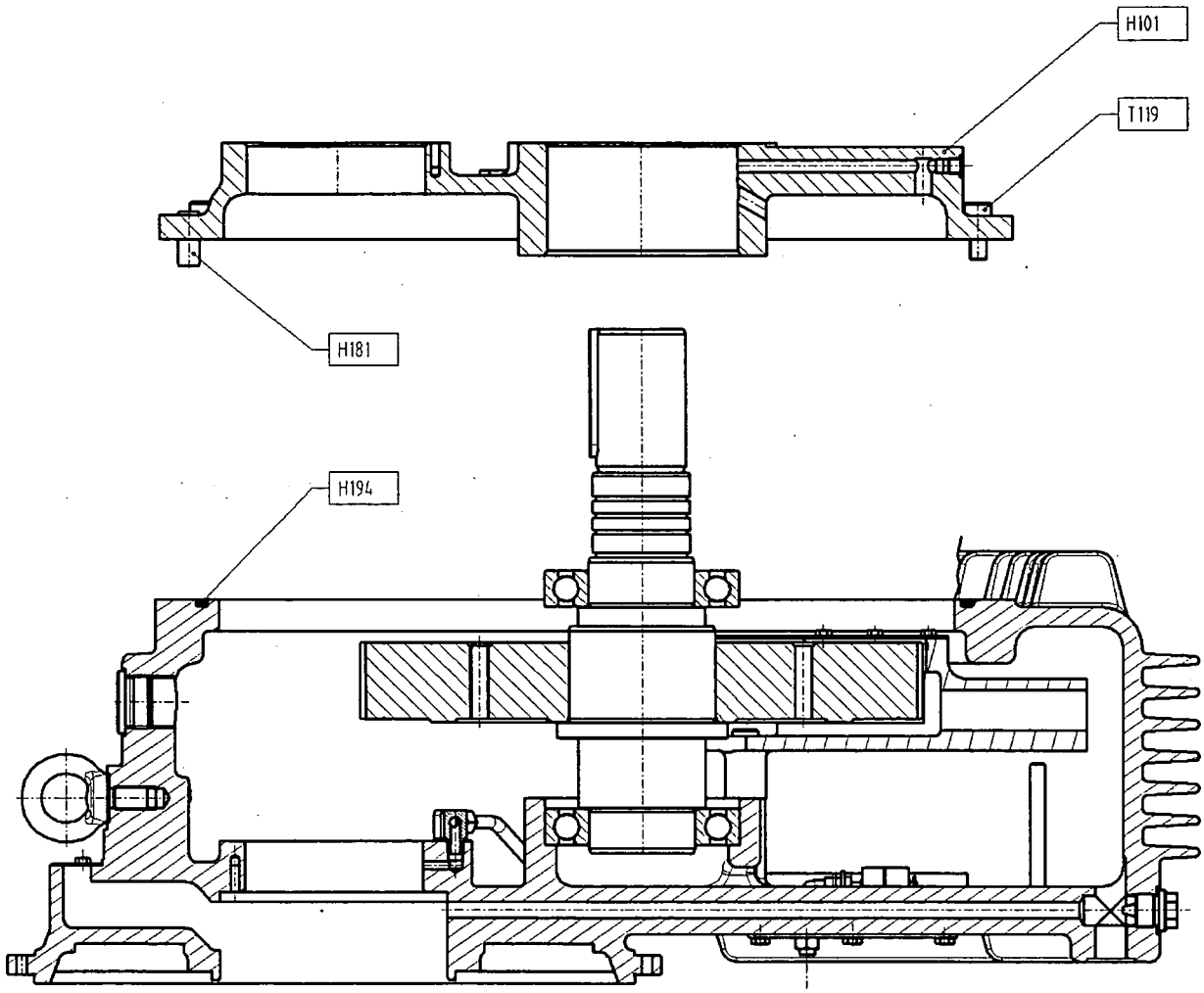




DRIVE SHAFT REMOUNT



GEAR HOUSING - PART A REMOUNT



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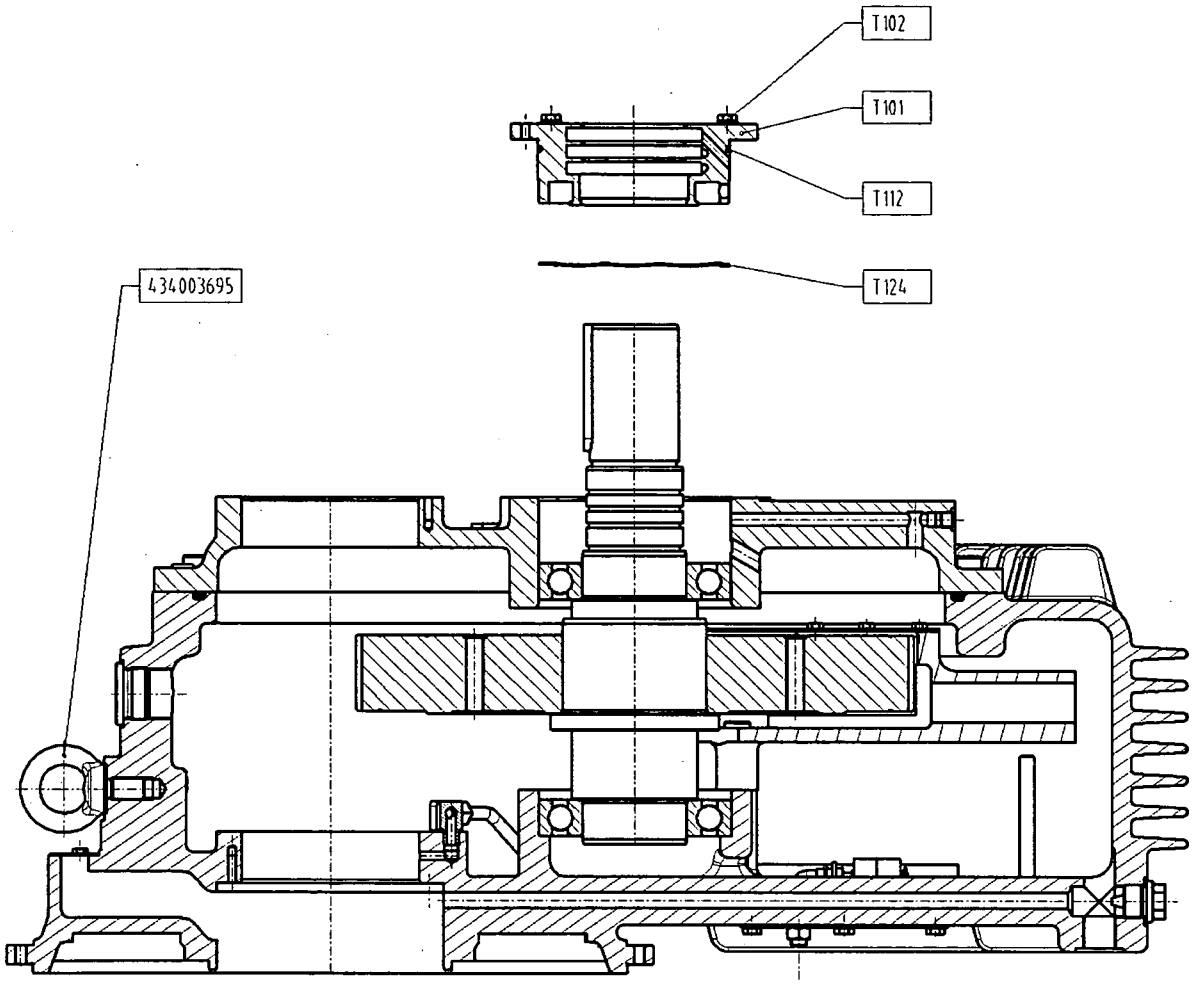

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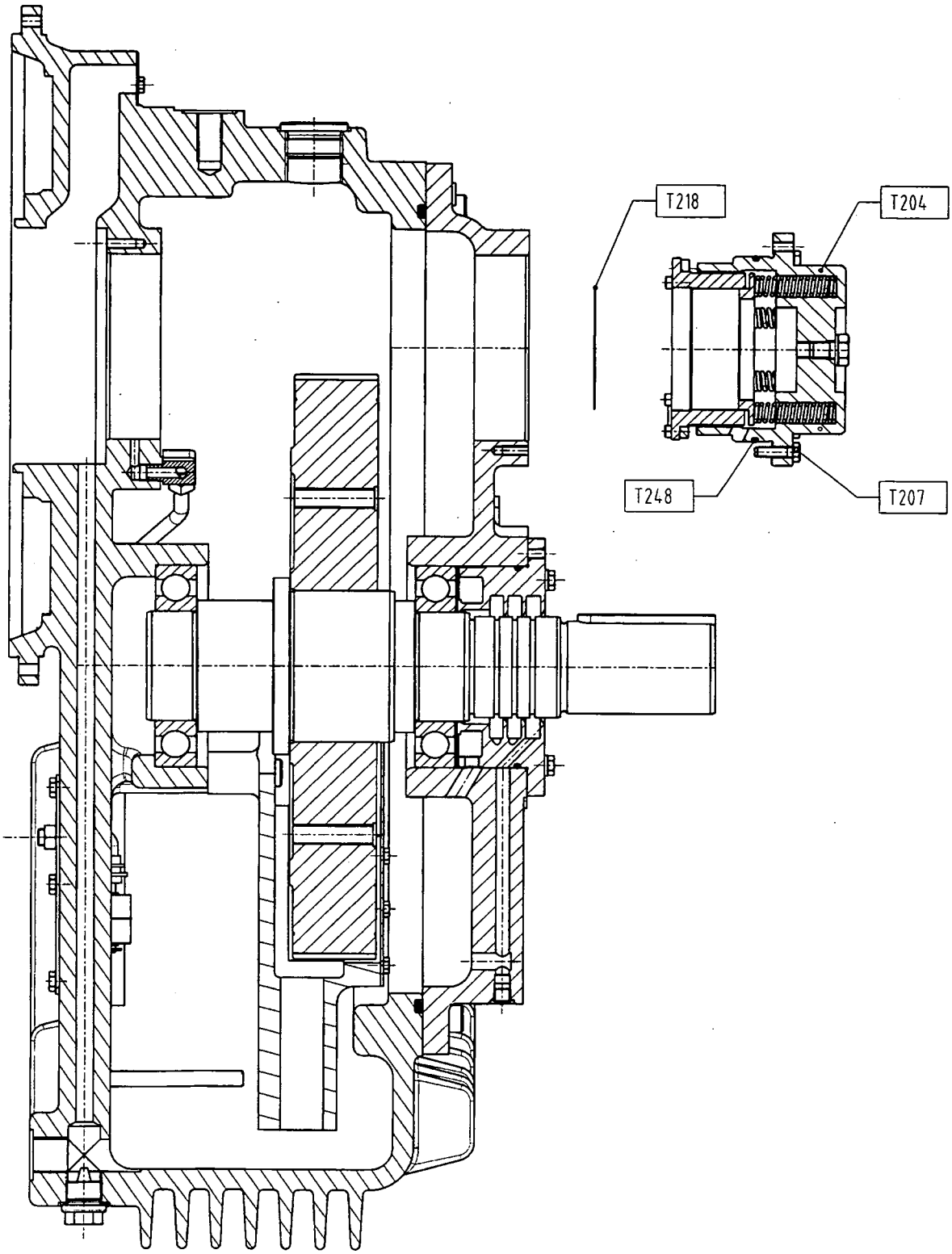
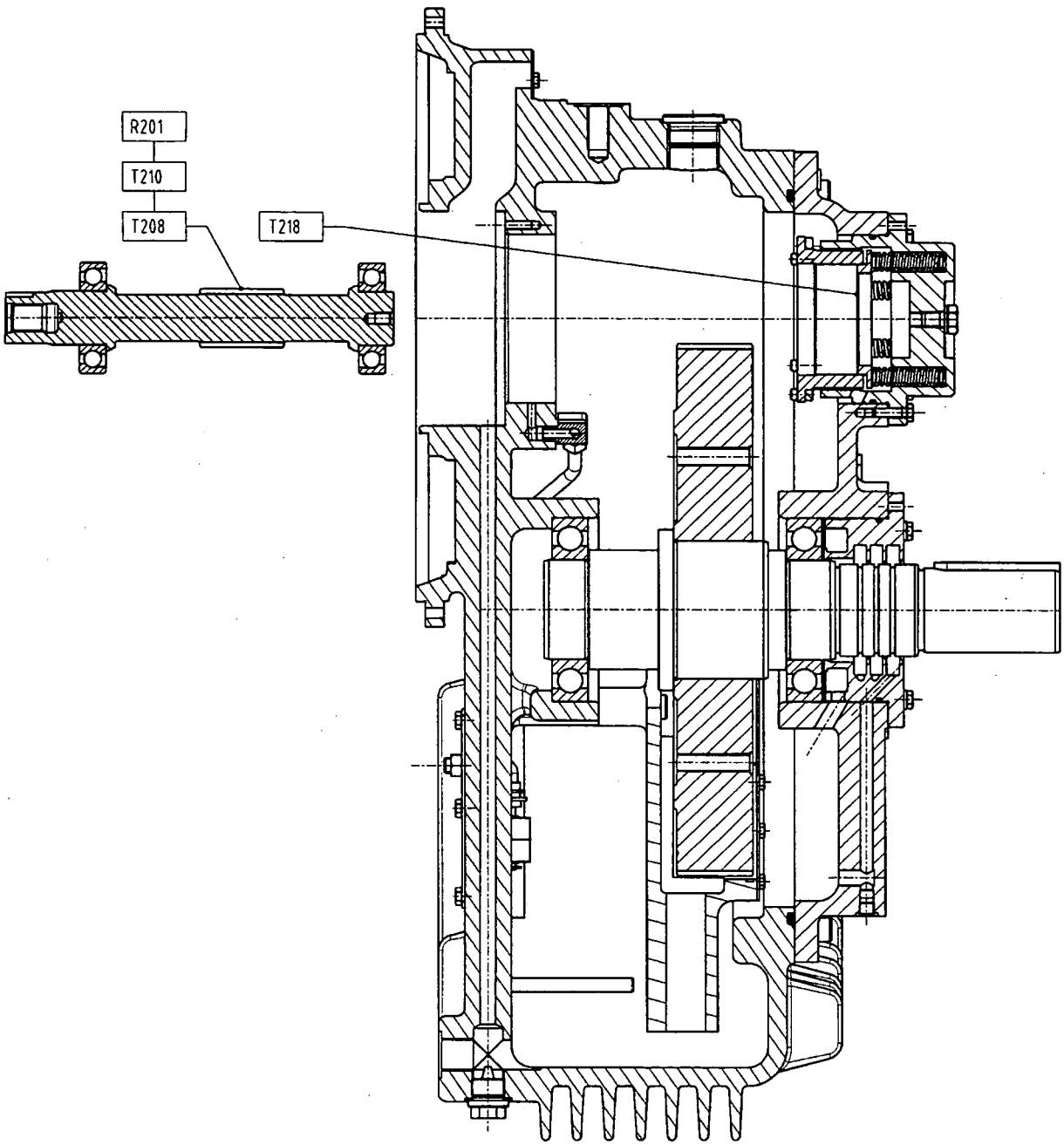
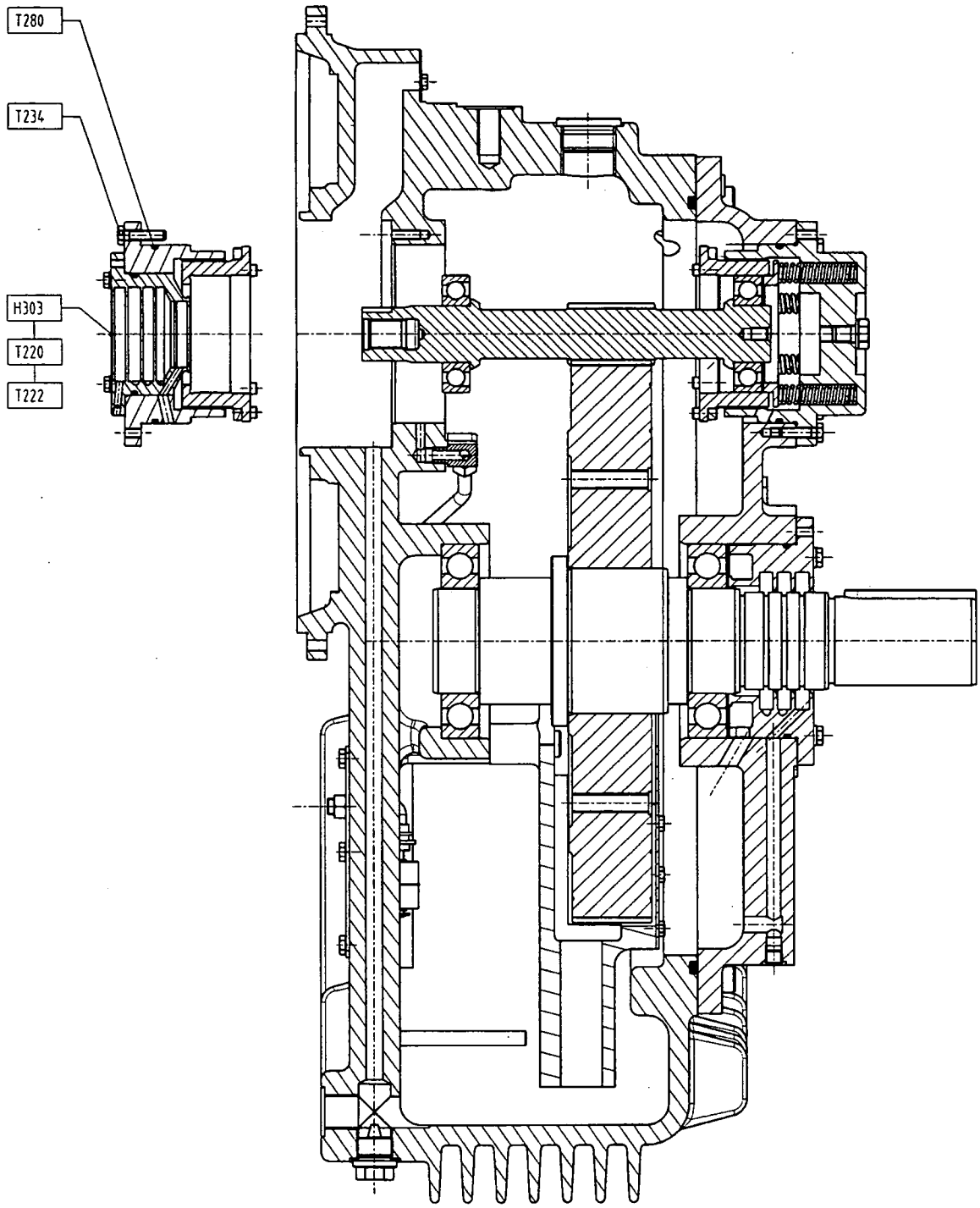


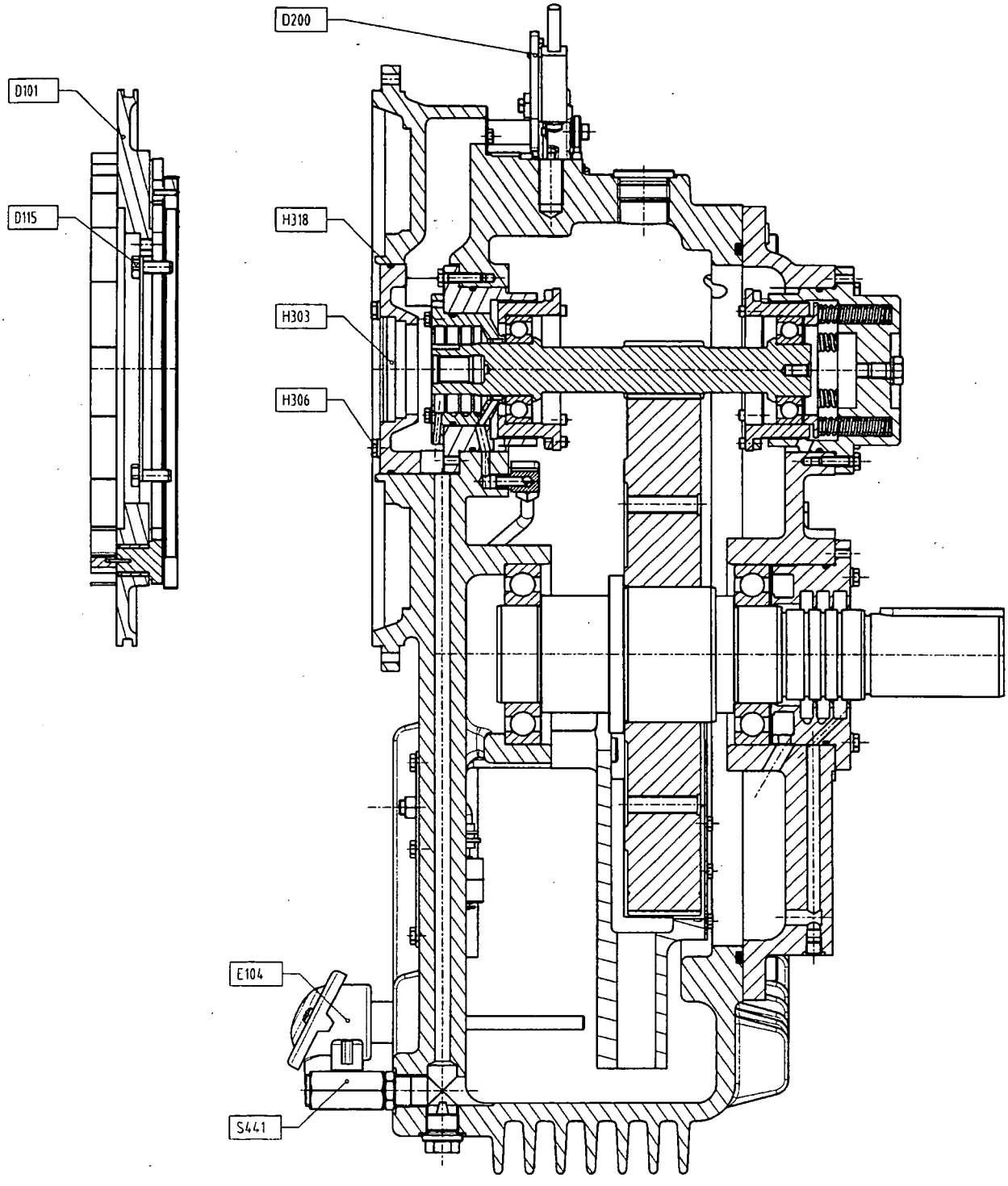
PINION SHAFT REMOUNT



INNER SEALING RING AND BEARING HOUSING REMOUNT



DIFFUSER REMOUNT



IMPELLER REMOUNT

Figure 1.

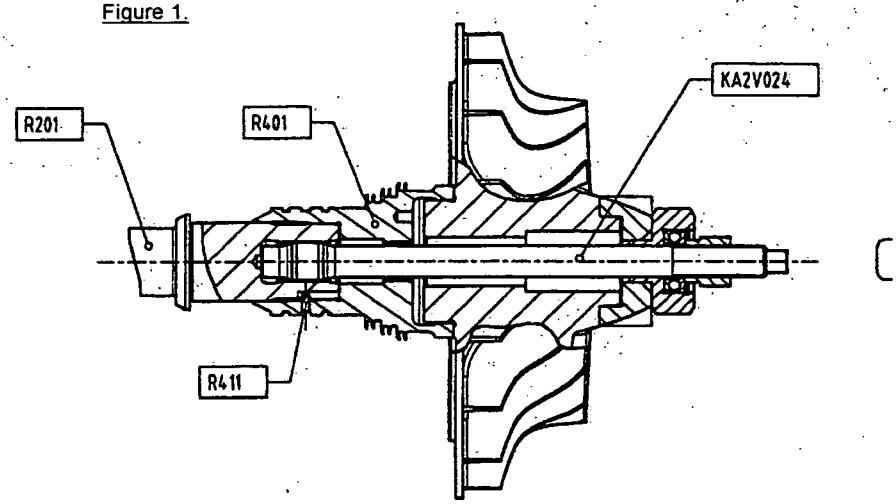


Figure 2.

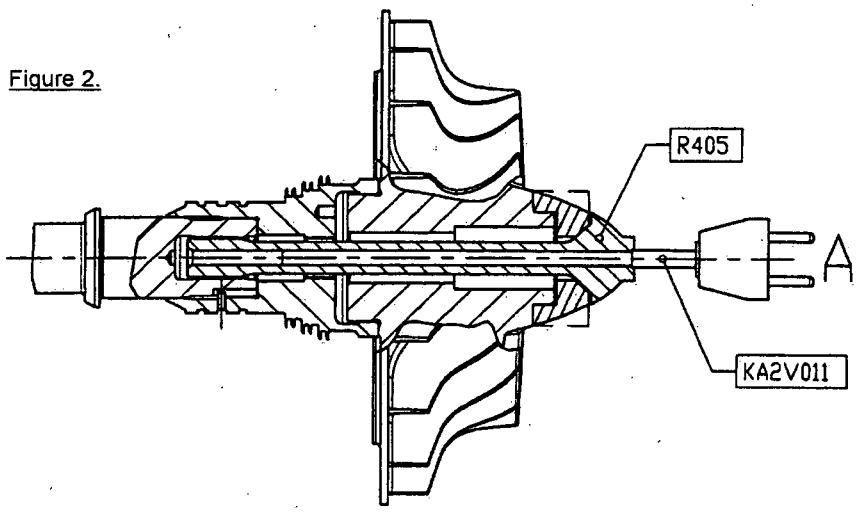


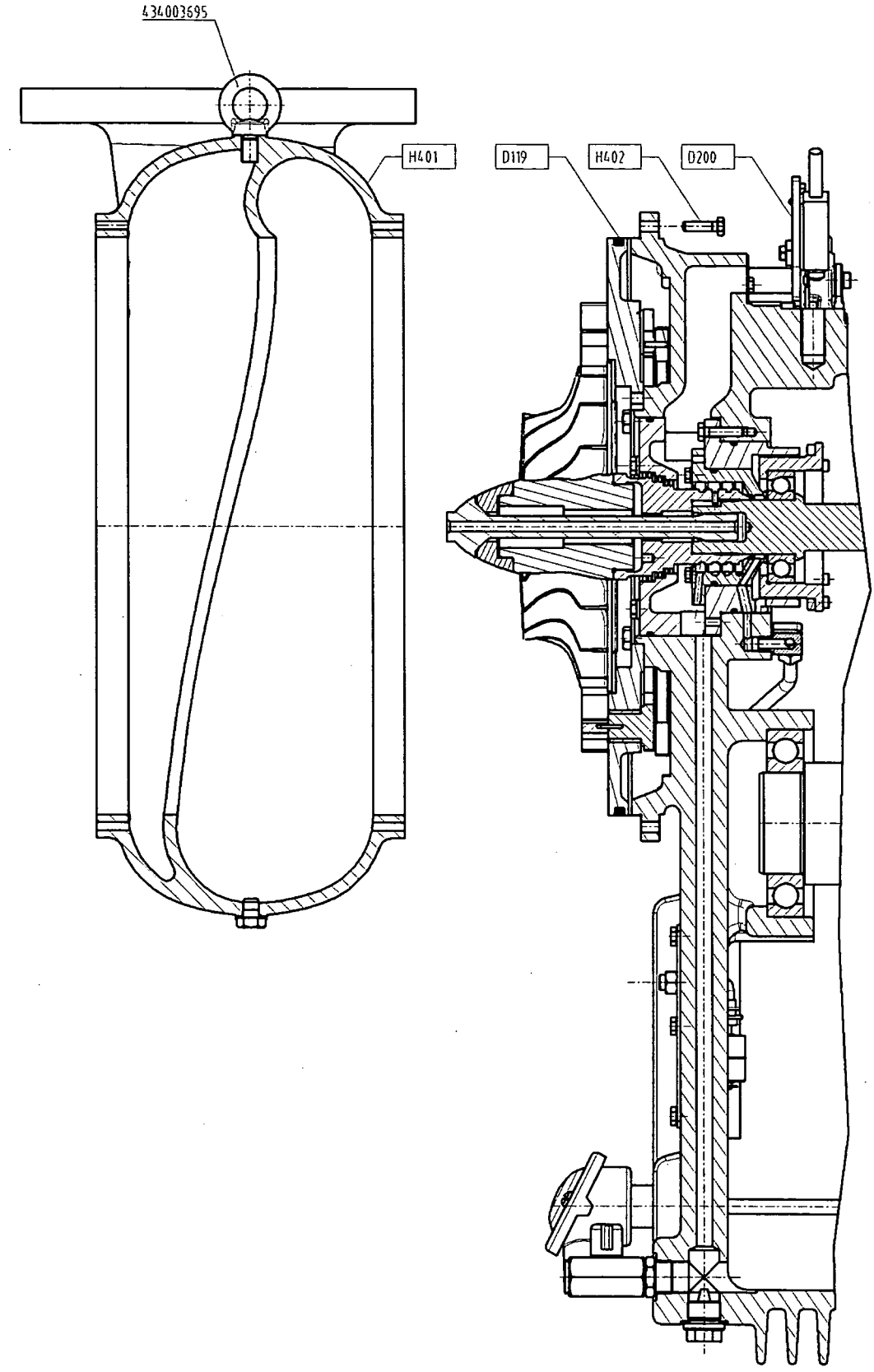
Figure 1.

1. Check that screw, pos. R411, is engaged in the rotor drive, pos. R401.
2. Apply a non-abrasive between the shaft, pos. R201, and the rotor drive, Pos. R401, and between the centre screw and the impeller complete. Apply the non-abrasive thoroughly; wipe off the superfluous leaving only a very thin layer.
3. Press the impeller complete onto the output shaft by means of tool KA2V024.
4. Remove the tool when the impeller is positioned and engage by hand the central screw, pos. R405.

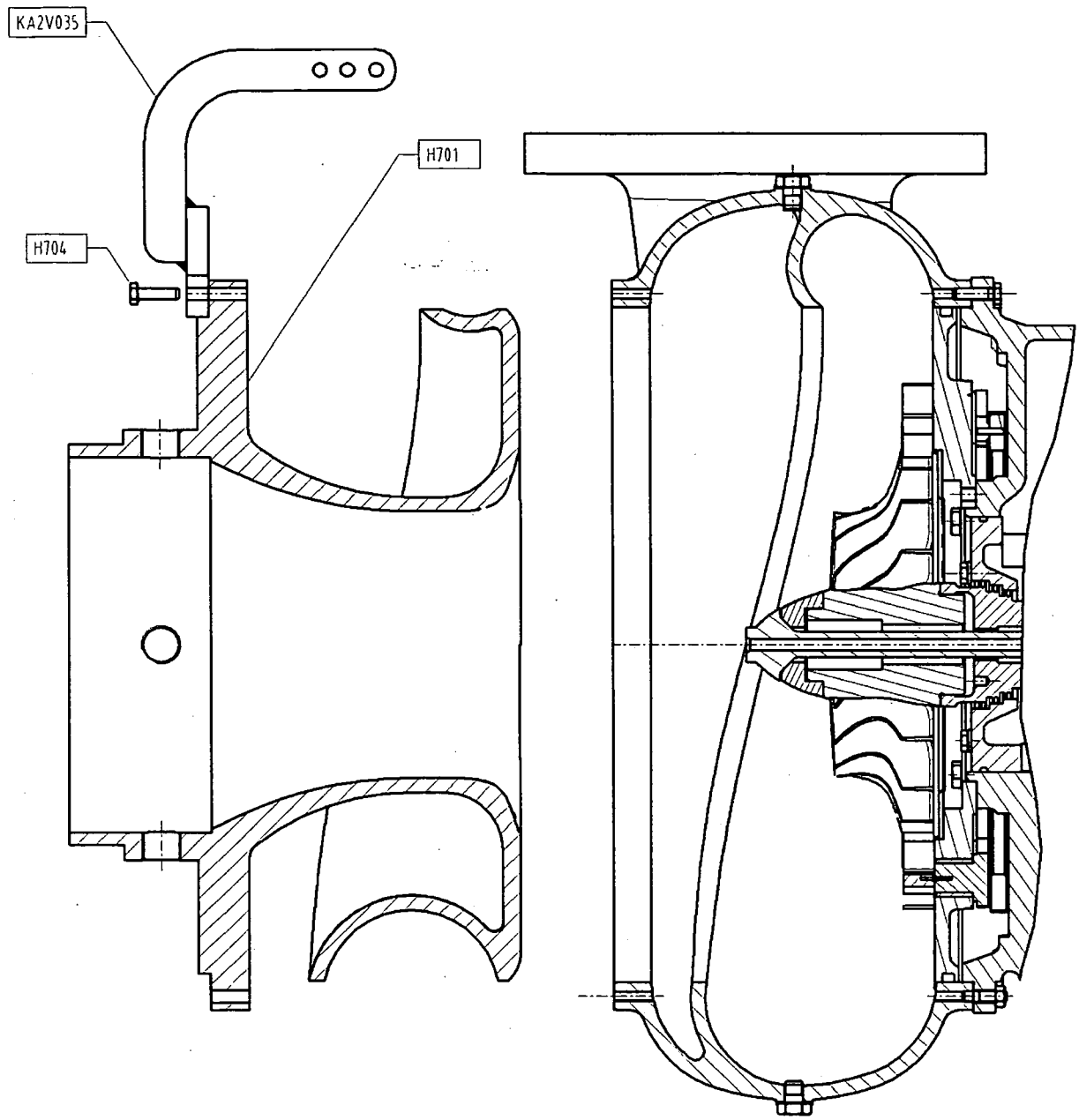
Figure 2.

5. Heat the central screw for approx. 3-4 min. (max. 6 min.) by means of heater KA2V011 to extend the screw. Secure the heat transfer from the heater to the screw with cupper paste or similar.
6. Turn the heated screw 90° in the tightening direction (left direction) corresponding to the distance between two marks on the central screw.
7. The entire rotor is cooled down to ambient temperature. When cooling down the central screw tightens up and the parts settle.
8. After the cooling, heat again as in point 5., and loosen the central screw by turning it a couple of turns in clockwise direction
   Note: Repeated heating without intermediate cooling has no purpose and may damage the heater.
9. Cool the rotor again to ambient temperature. The central screw tightens up and the parts settle.
10. Repeat points 5. and 6. and let the rotor cool down.
11. All parts including the central screw are marked with serial no. in order to secure the balancing.

SPIRAL CASING REMOUNT



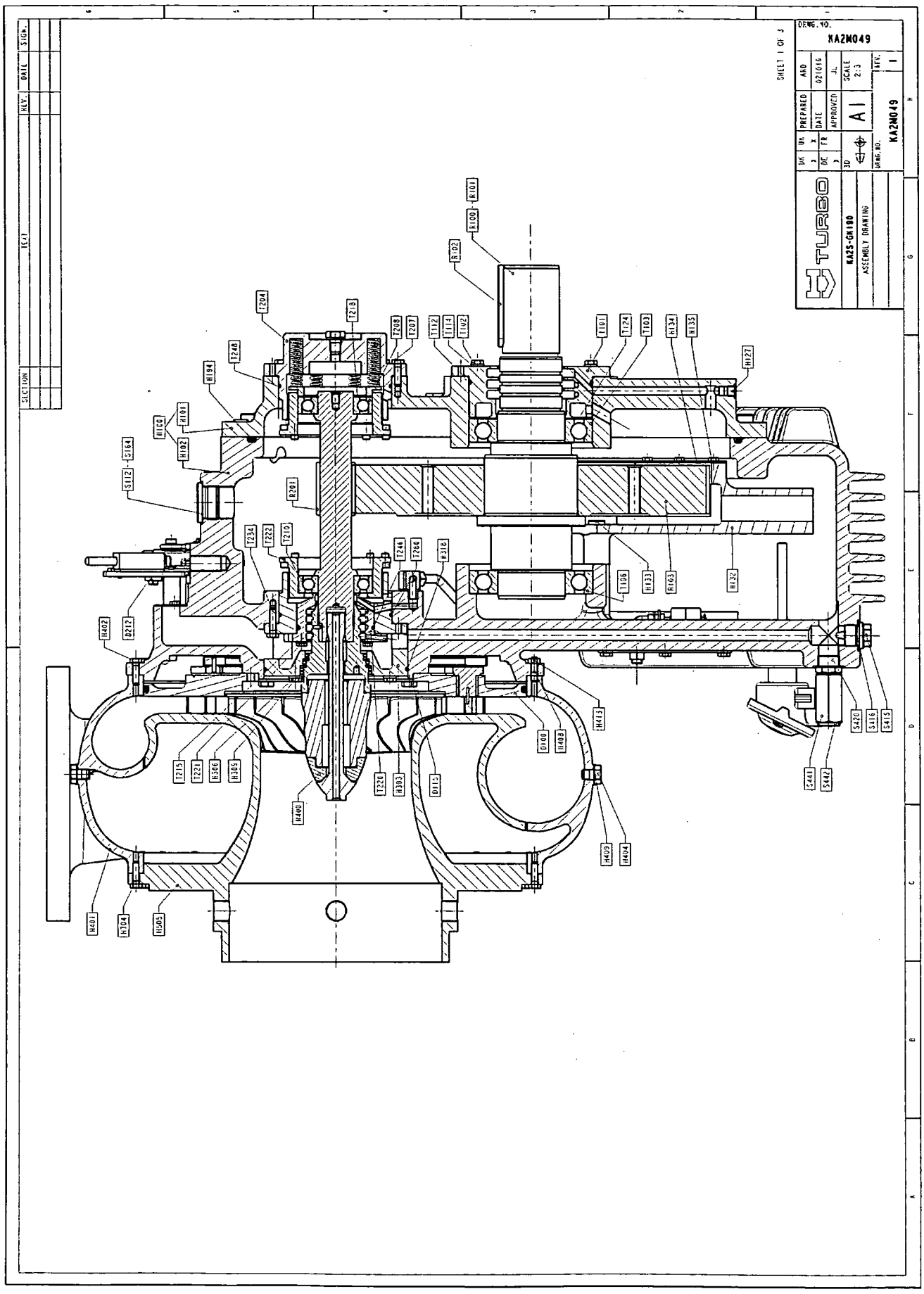
SPIRAL CASING REMOUNT



12.8.1 COMPRESSOR GEARBOX DRAWING No.KA2M049.1

DRAWING 1 OF 3

Pos. no.	Description	Pos. no.	Description
D100	Inner diffuser drive	T101	Sealing ring
D115	Screw	T102	Screw
D212	Backstop	T103	Thrust/journal bearing, motor end
		T106	Thrust/journal bearing, compr. end
H101	Gear casing/bear. shield part A	T112	O-ring
H102	Gear housing part B	T114	Washer
H127	Plug	T124	Crinkle washer
H132	Oil shield	T204	Bearing housing
H133	Screw	T207	Screw
H134	Cover plate	T208	Journal bearing, motor end
H135	Screw	T210	Journal bearing, compressor end
H194	O-ring	T215	Washer
H303	Labyrinth sealing	T218	Shim
H306	Screw	T220	Sealing ring, inner
H309	Washer	T221	Screw
H318	O-ring	T222	Bearing housing
H401	Outer volute casing	T234	Screw
H402	Screw/stud	T246	O-ring
H404	Plug	T248	O-ring
H408	Screw	T280	O-ring
H409	Gasket		
H413	Nut		
H505	Contour ring with inner volute casing		
H704	Screw		
R101	Drive shaft		
R102	Key		
R103	Gearwheel		
R201	Pinion shaft		
R400	Rotor, complete		
S112	Stud for oil filling		
S164	Gasket		
S415	Magnet plug		
S416	Gasket		
S420	Hexagon fitting		
S441	Ball valve		
S442	Plug		


DRWG. NO.
KA2M049
KA2S-GK190
ASSEMBLY DRAWING
SECTION

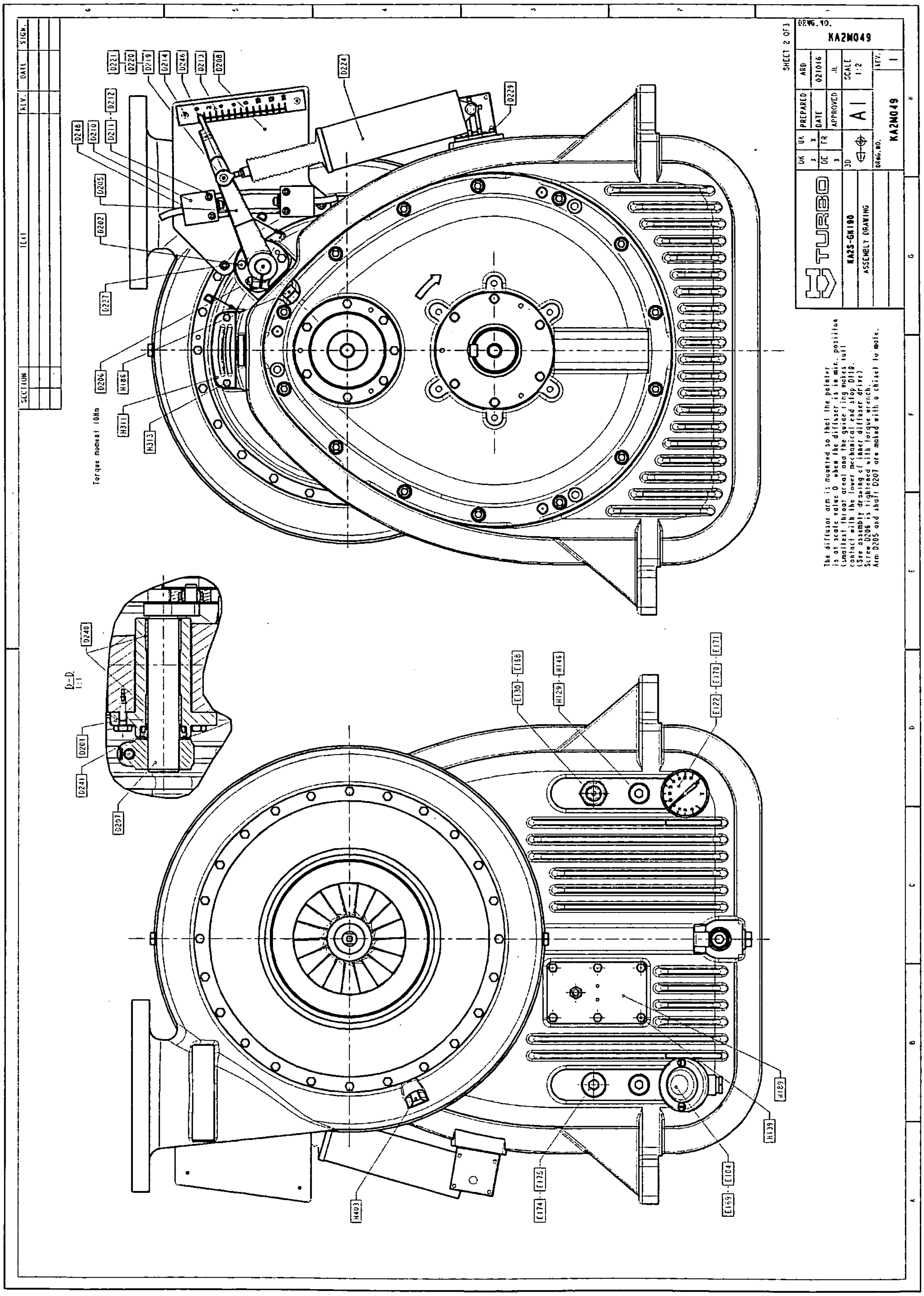
12.8.2 COMPRESSOR GEARBOX DRAWING No.KA2M049.1

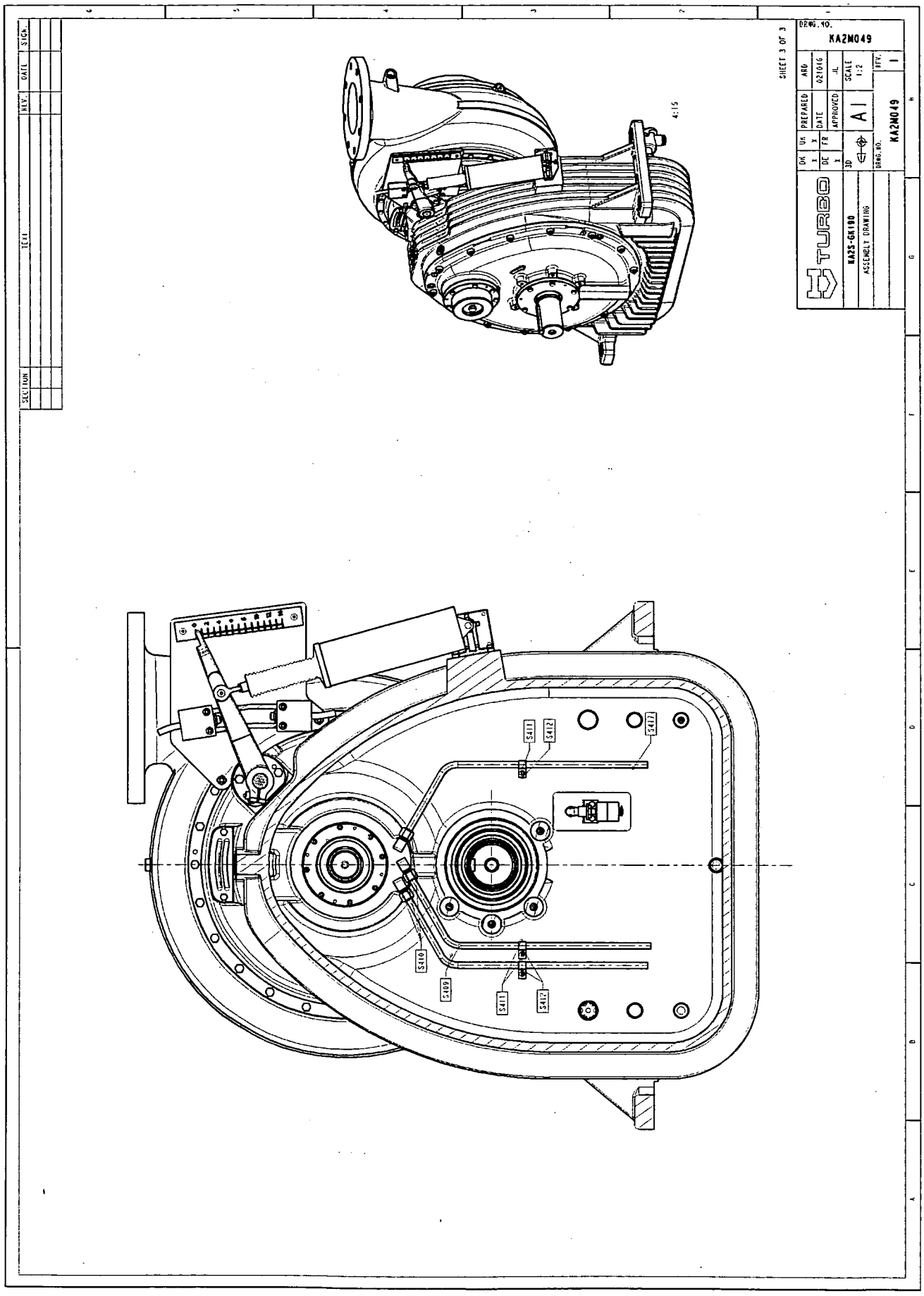
DRAWING 2 OF 3

Pos. no.	Description	Pos. no.	Description
D201	Excenter housing	H129	Plug
D202	Screw	H139	Screw
D205	Positioning lever	H146	Gasket
D206	Screw	H186	Screw plug
D207	Excenter shaft	H189	Cover complete assembly
D208	Mounting plate	H311	Cover for aeration
D210	Limit switch	H313	Screw
D211	Screw	H403	Screw for spiral casing position
D212	Backstop		
D213	Scale		
D214	Screw		
D219	Fitted bolt		
D220	Washer		
D221	Nut		
D224	Linear motor		
D227	Screw		
D229	Screw		
D240	Bearing		
D241	Gasket		
D246	Connecting link		
D248	Support		
E104	High oil temperature switch		
E122	Thermometer (oil temperature)		
E130	Level glass		
E168	Gasket		
E169	Gasket		
E170	Sensor pocket		
E171	Gasket		
E174	Plug		
E175	Gasket		

12.8.3 DRAWING 3 OF 3

Pos.	Description		
S409	Drain pipe		
S410	Fitting		
S411	Pipe strap		
S412	Screw		
S417	Pipe		


KA2M049
KA2S-GK190
ASSEMBLY DRAWING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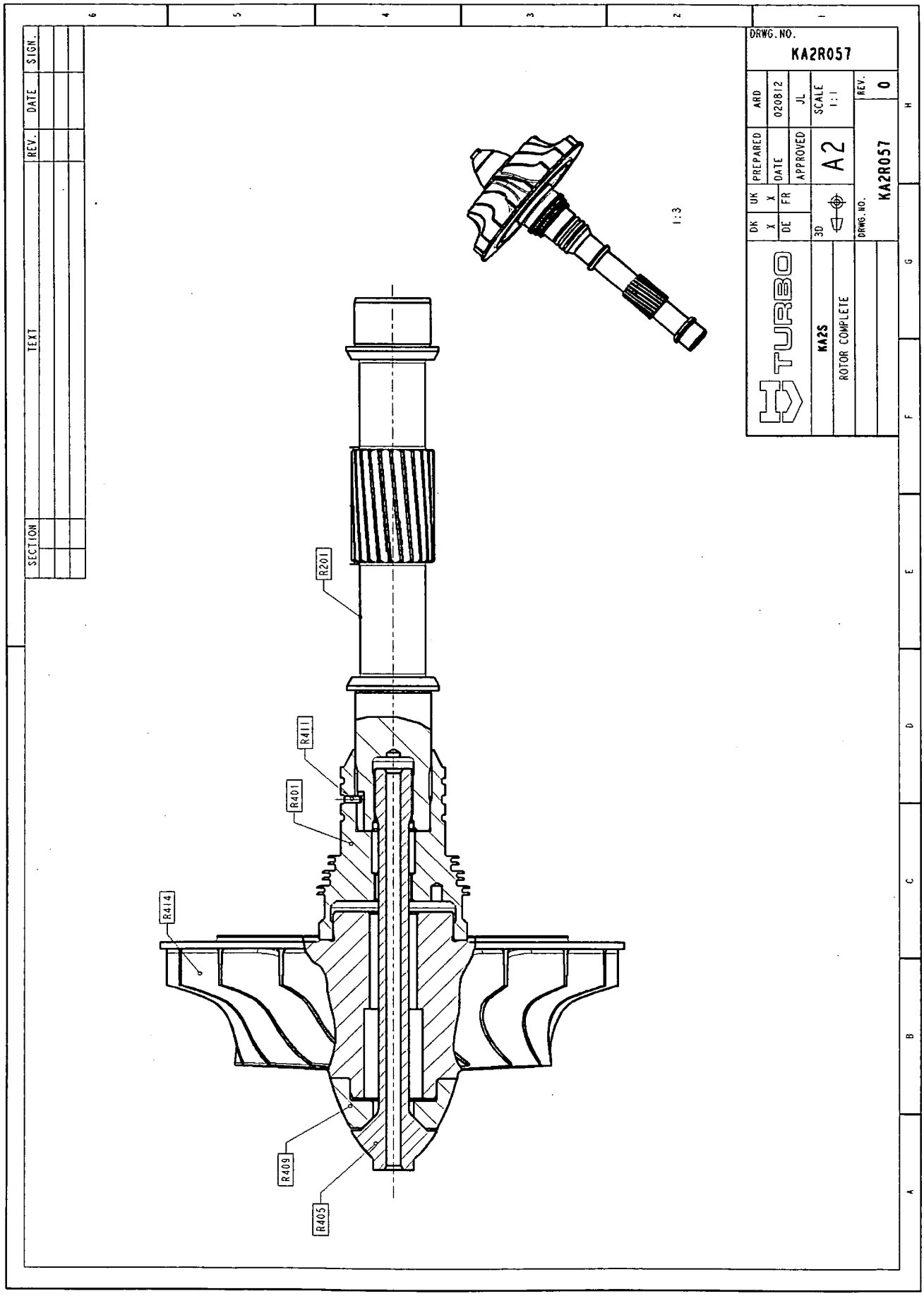
KA2M049
SHEET 3 OF 3
PREPARED
DATE
APPROVED
SCALE
1:2
A1
KA2S-GK190
ASSEMBLY DRAWING
KA2M049
4:15
S411
S412
S417
S410
S409
S411
S412

12.9 ROTOR DRAWING No. KA2R057.0

See drawing next page.

Pos. No.	Description
R201	Pinion shaft
R401	Rotor drive
R405	Central screw
R409	Stop ring
R411	Dowel
R414	Impeller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ARD
020812
JL
SCALE
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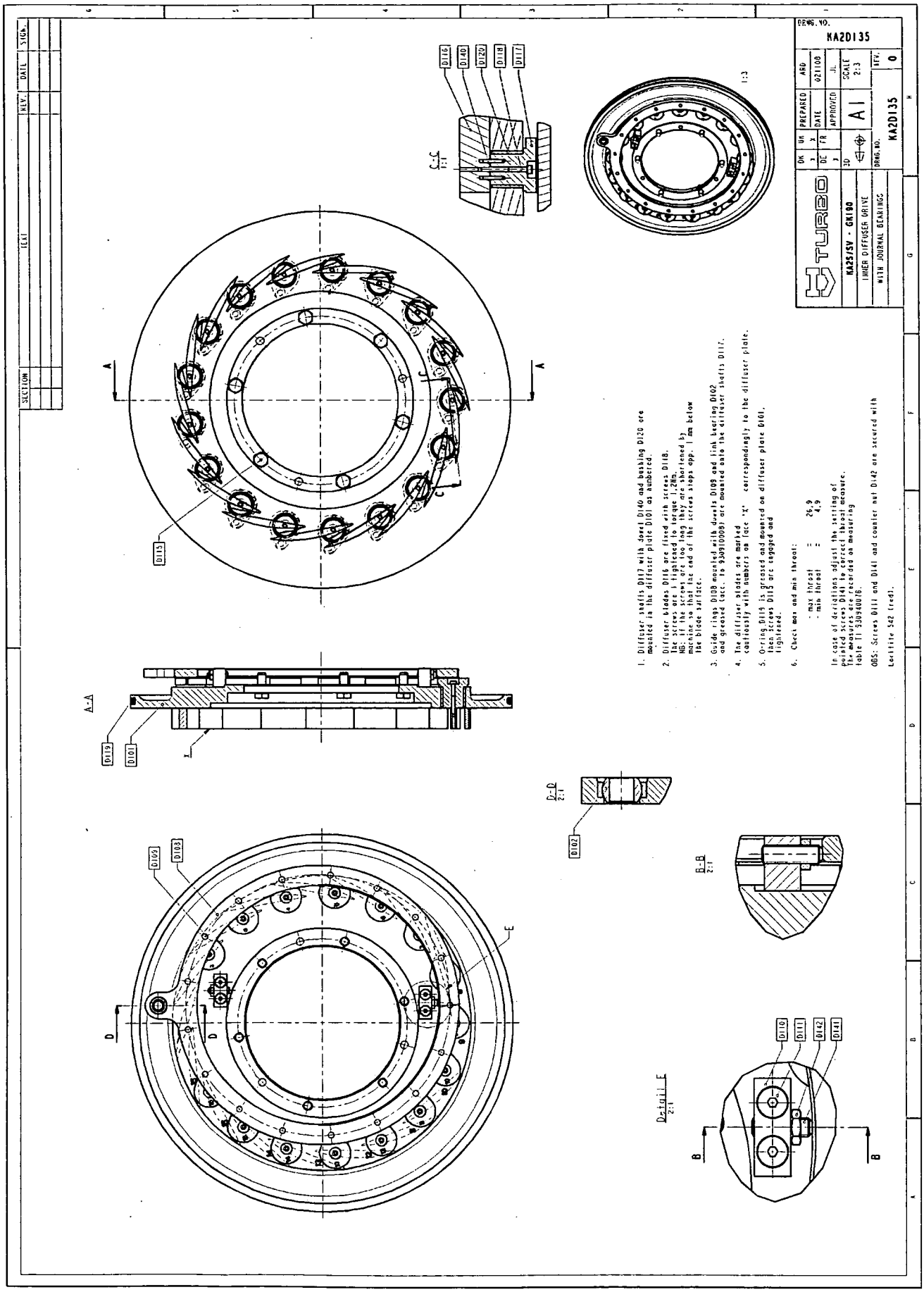
REV.
0
PREPARED
DATE
APPROVED
A2
UK
X
FR
DK
X
DE
3D
DRWG.NO.
KA2R057
TURBO
KA2S
ROTOR COMPLETE
SIGN.
DATE
REV.
TEXT
SECTION
1:3
R201
R411
R401
R414
R409
R405

12.10 INNER DIFFUSER SYSTEM, DRAWING No. KA2D135.0

See drawing next page.

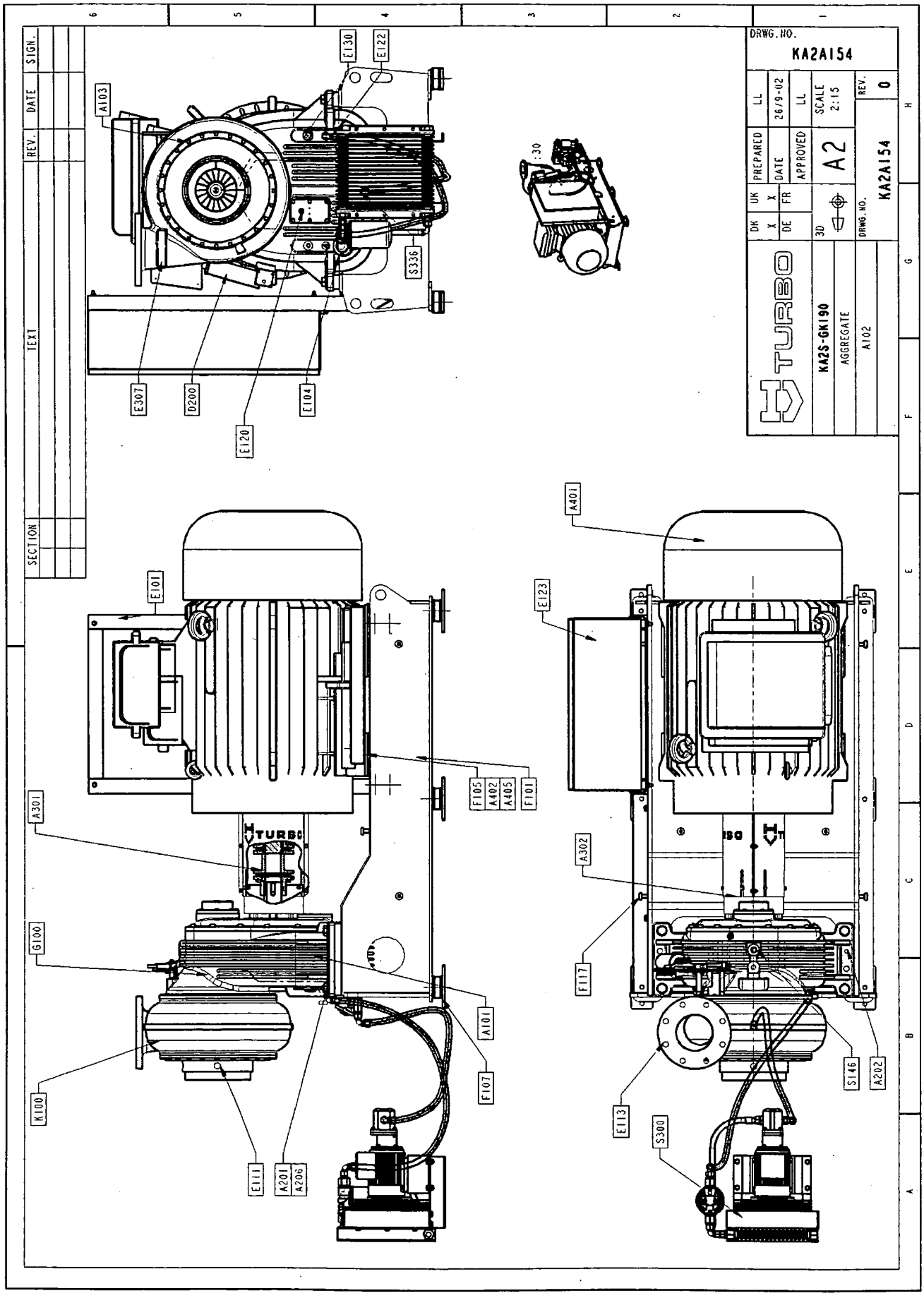
Pos. No.	Description
D101	Diffuser plate
D102	Swivel joint
D108	Guide ring
D109	Dowel
D110	Stop for guide ring
D111	Screw
D115	Screw
D116	Diffuser blade
D117	Shaft for diffuser blade
D118	Screw
D119	O-ring
D120	Bushing
D140	Dowel
D141	Stop screw
D142	Counter nut


DRWG. NO.
KA2D135
KA2S/SV - GK190
INNER DIFFUSER DRIVE
WITH JOURNAL BEARINGS
SCALE 2:3
A-A
B-B
C-C
D-D
E
Detail F
1. Diffuser shafts D117 with dowel D140 and bushing D120 are mounted in the diffuser plate D101 as numbered.
2. Diffuser blades D116 are fixed with screws D118.
The screws are tightened to torque 1.2Nm.
NB: If the screws are too long they are shortened by machine so that the end of the screws stops opp. 1 mm below the blade surface.
3. Guide rings D108 mounted with dowels D109 and link bearing D102 and greased lacc. to 9309100081 are mounted onto the diffuser shafts D117.
4. The diffuser blades are marked continously with numbers on face "X" correspondingly to the diffuser plate.
5. O-ring D119 is greased and mounted on diffuser plate D101. Then screws D115 are capped and tightened.
6. Check max and min throat:
- max throat = 26,9
- min throat = 4,9
In case of deviations adjust the setting of painted screws D141 to correct throat measure. The measures are recorded on measuring table TI 9309400176.
ODS: Screws D111 and D141 and counter nut D142 are secured with Loctite 542 (red).

12.11 AGGREGATE DRAWING NO.KA2A154.0

Pos. No.	Description
A101	Serial number plate
A103	Nameplate
A201	Screw
A202	Dowel
A206	Washer
A301	Coupling
A302	Guard complete
A401	Drive motor
A402	Screw
A405	Washer
D200	Outer diffuser system
E101	Console for terminal box
E104	High oil temperature switch
E111	High temperature switch
E113	Pressure controller SUC-2
E120	Oil level switch
E122	Thermometer (oil temperature)
E123	Local control panel
E130	Level glass
E307	Temperature transmitter
F101	Frame
F105	Shim
F107	Vibration damper
F117	Support for cable tray
G100	Gear complete
K100	Compressor complete
S146	Tank cover
S300	Oil cooler system
S336	Valve (drain)

Shown oil cooler is not standard equipment, but can be supplied as an option.


DRWG.NO.
KA2A154
REV. 0
SCALE 2:15
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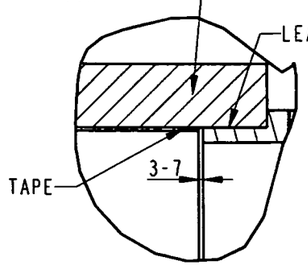
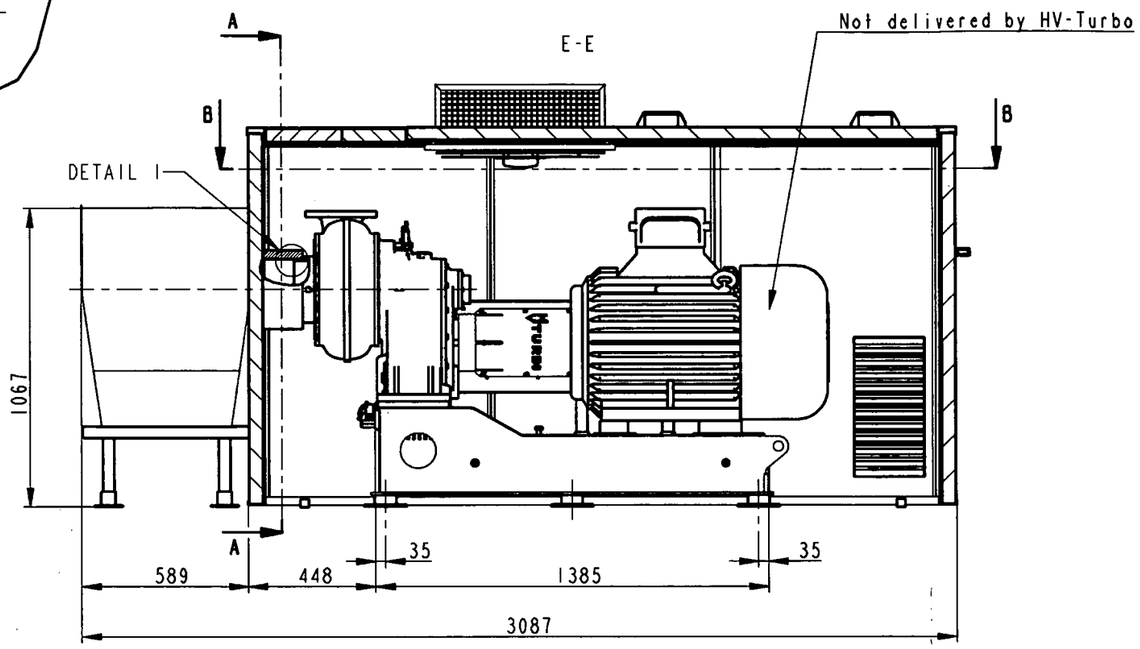
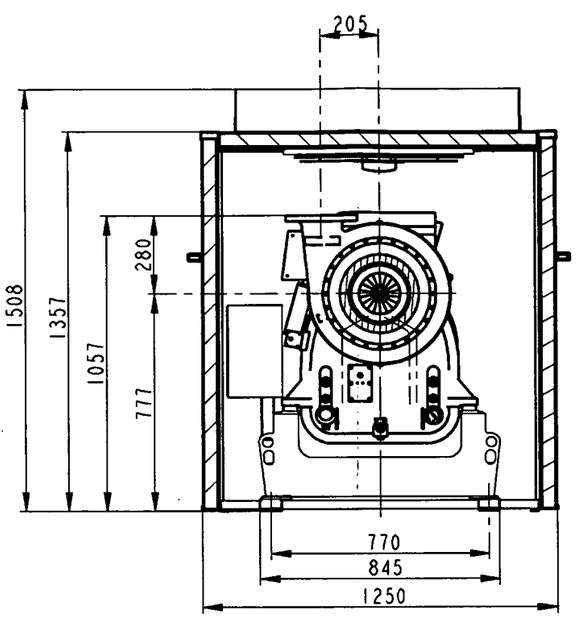
KA2S-GK190
AGGREGATE
A102
E130
E122
A103
S336
E307
D200
E104
E120
:30
E101
A401
E123
F105
A402
A405
F101
A301
A302
G100
F117
A101
F107
K100
S146
A202
E113
S300
E111
A201
A206

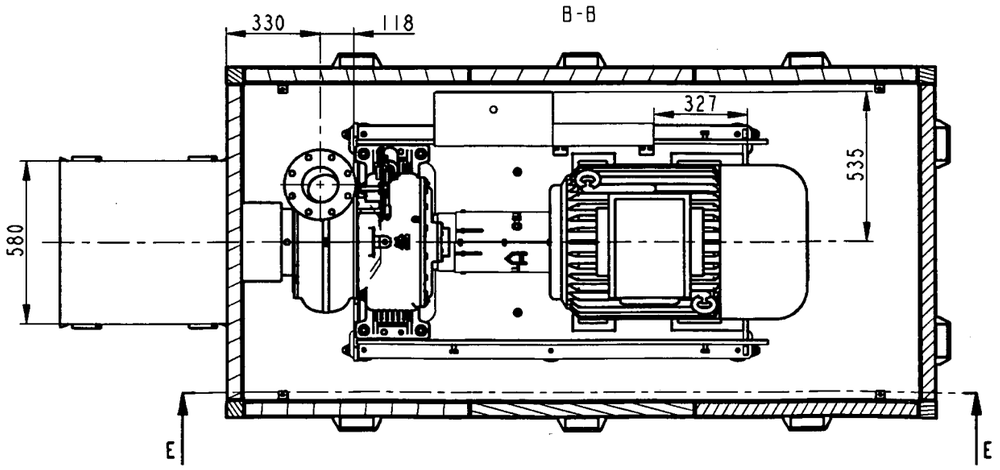
SECTION		TEXT	REV.	DATE	SIGN.
		ACOUSTIC ENCLOSURE ADDED	1	061030	SLa

DETAIL 1
1:2









WEIGHT AGGREGATE
(EXCL. ELECTRIC MOTOR, INLET
SILENCER AND ACOUSTIC ENCLOSURE): 800KG
WEIGHT ELECTRIC MOTOR: 625KG
WEIGHT ACOUSTIC ENCLOSURE: 250KG
WEIGHT INLET SILENCER: 80KG

ELECTRIC MOTOR: ABB M3BP280SMA, 75kW, IP55

TURBO	DK	UK X	PREPARED	SLa	DRWG. NO. 12950
	DE	FR	DATE	061013	
			APPROVED	HER	
KA2S-GK190	3D		A2	SCALE 1:15	
AGGREGAT					
DIMENSION DRAWING	DRWG.NO. 12950			REV. 1	
62007371 Eastern WWC, Ipwich II					

JB-1D
KA2S-GK190

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TURBO

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

Front page
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no. E937.123.291.0.1		
Made by CTN/57	Drawn by SGR/57	Sheet 1
Date 23-10-2006	Rev. 1	Next sheet 10

List of Contents

TURBO

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

List of Contents
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no. E937.123.291.0.1		
Made by CTN/57	Drawn by SGR/57	Sheet 2
Date 23-10-2006	Rev. 1	Next sheet

JB-1D
KA2S-GK190

Junction Box
Order no. 62007371 Compressor no. 7371

Placement codes

+A1 = LCP panel
+A2 = Junction box
+A3 = Compressor
+A4 = Main pipe
+A5 = External component
+A6 = MCP panel

TURBO

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

Technical data
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no. E937.123.291.0.1		
Made by CTN/57	Drawn by SGR/57	Sheet 10
Date 23-10-2006	Rev. 1	Next sheet 11

Circuit		mm2	Colour
Power circuit -	L1 L2 L3 (0-27A)	6	Black
Power circuit -	Neutral (0-27A)	6	Light Blue
Power circuit -	L1 L2 L3 (0-22A)	4	Black
Power circuit -	Neutral (0-22A)	4	Light Blue
Power circuit -	L1 L2 L3 (0-15A)	2,5	Black
Power circuit -	Neutral (0-15A)	2,5	Light Blue
Power circuit - After CB	L1 L2 L3 (0-15A)	2,5	Black
Power circuit - After CB	Neutral (0-15A)	2,5	Light Blue
Power circuit - After CB	L1 L2 L3 (0-10A)	1,5	Black
Power circuit - After CB	Neutral (0-10A)	1,5	Light Blue
Control circuit - 230VAC		1	Red
Control circuit - 24VDC		1	Dark Blue
Control circuit - 0VDC		1	Grey
Control circuit - Volt free signals		1	Orange
Control circuit - RTD / PT 100		1	White
Control circuit - 4-20mA		1	White
Nominel voltage Uo/U : 300/500V			

TURBO

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

Wiring data
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no. E937.123.291.0.1

Made by	Drawn by	Sheet
CTN/57	SGR/57	11
Date	Rev.	Next sheet
23-10-2006	1	12

Code

U = Updated N = New D = Deleted

Revision	Sheet	Plac.	Code
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1	140	-	D

Revision	Sheet	Plac.	Code

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

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Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
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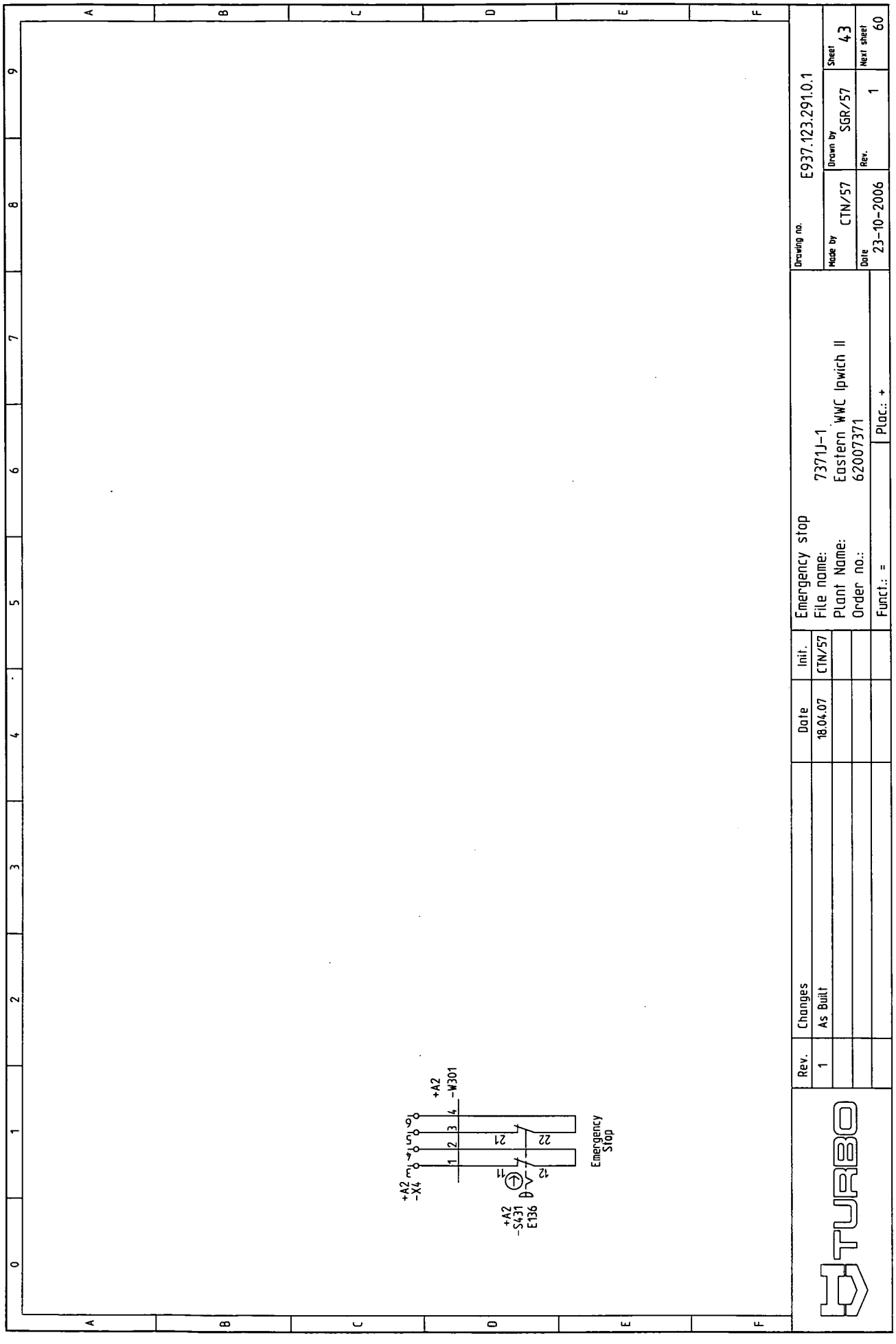
Date 23-10-2006	Rev. 1	Next sheet 43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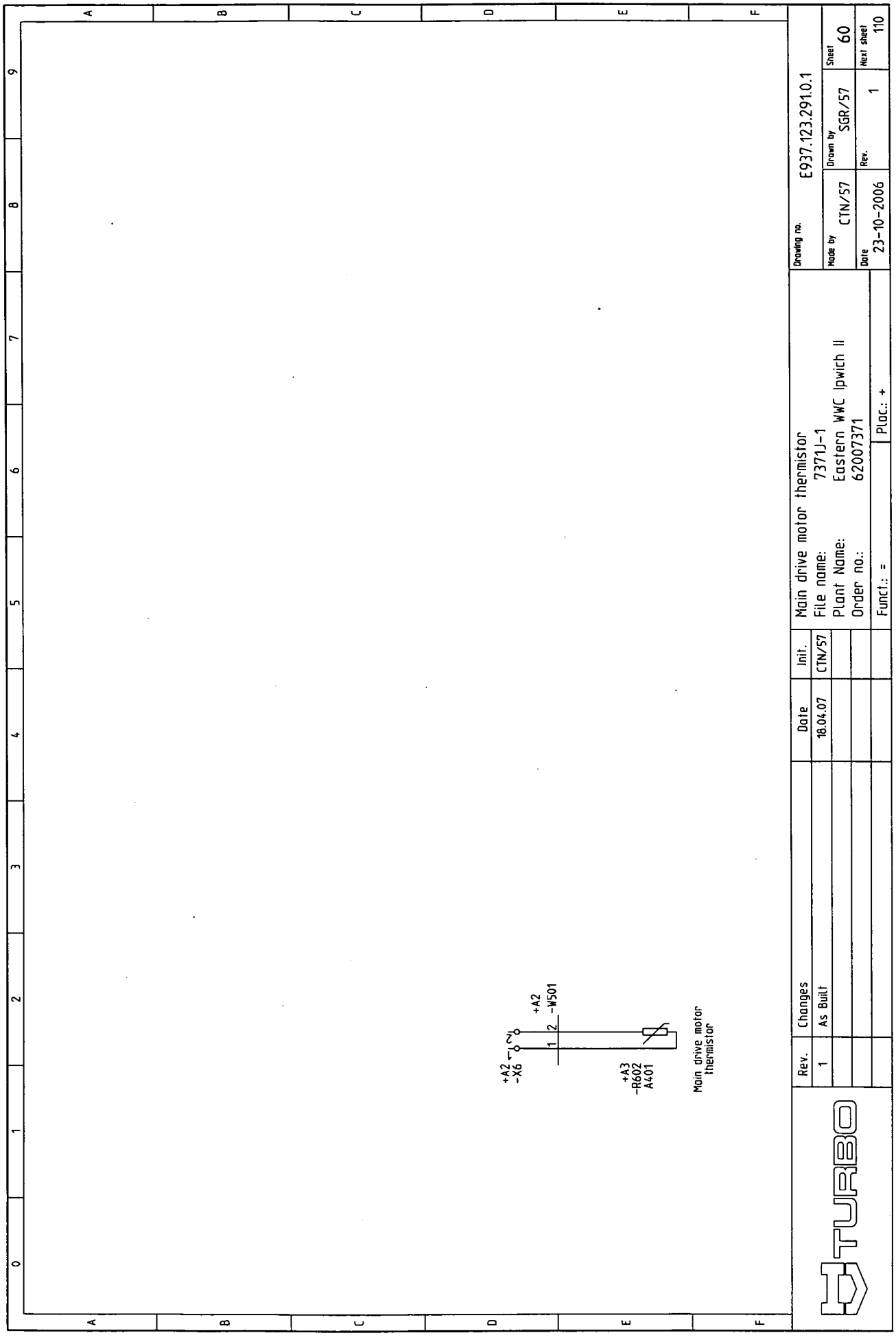
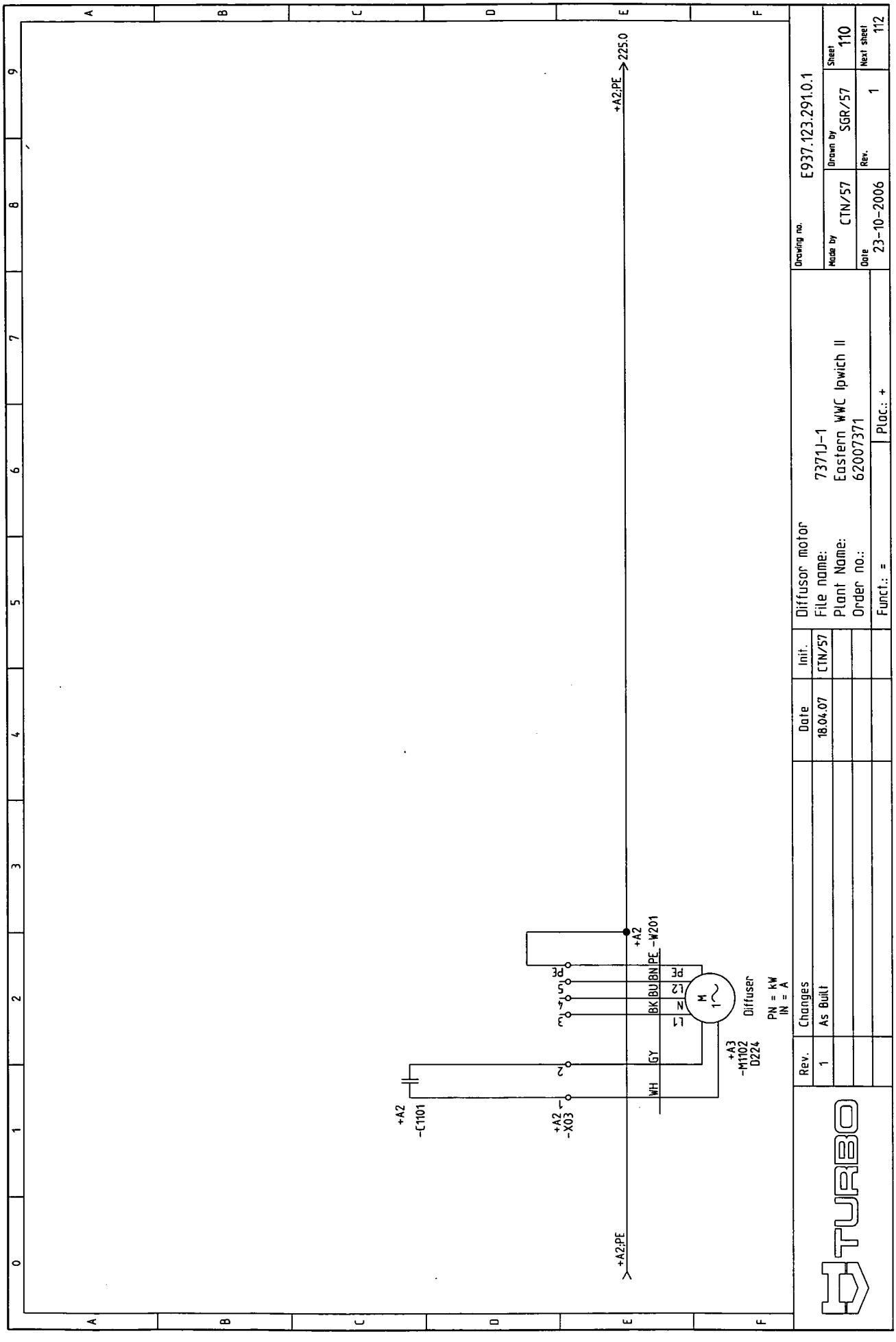
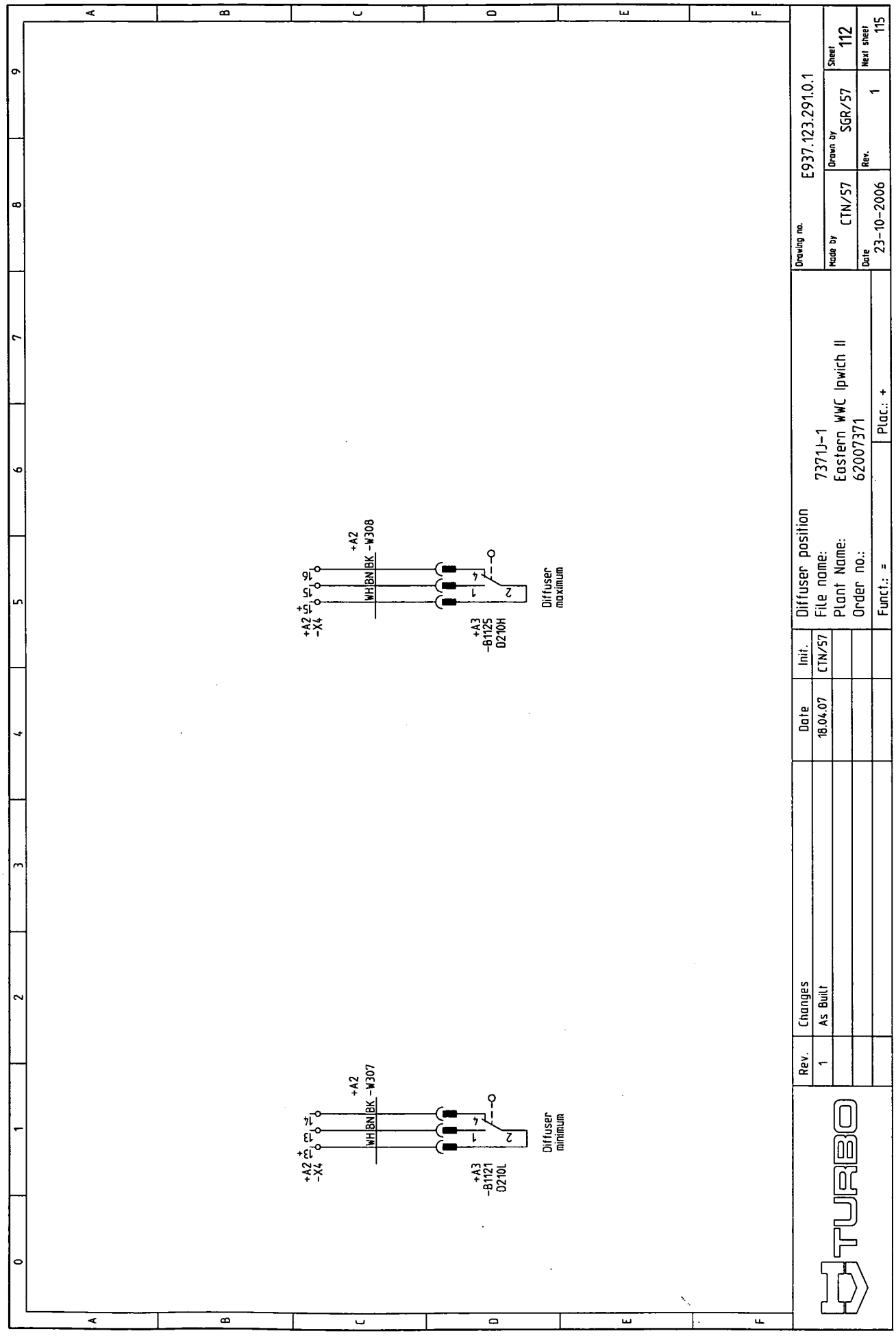
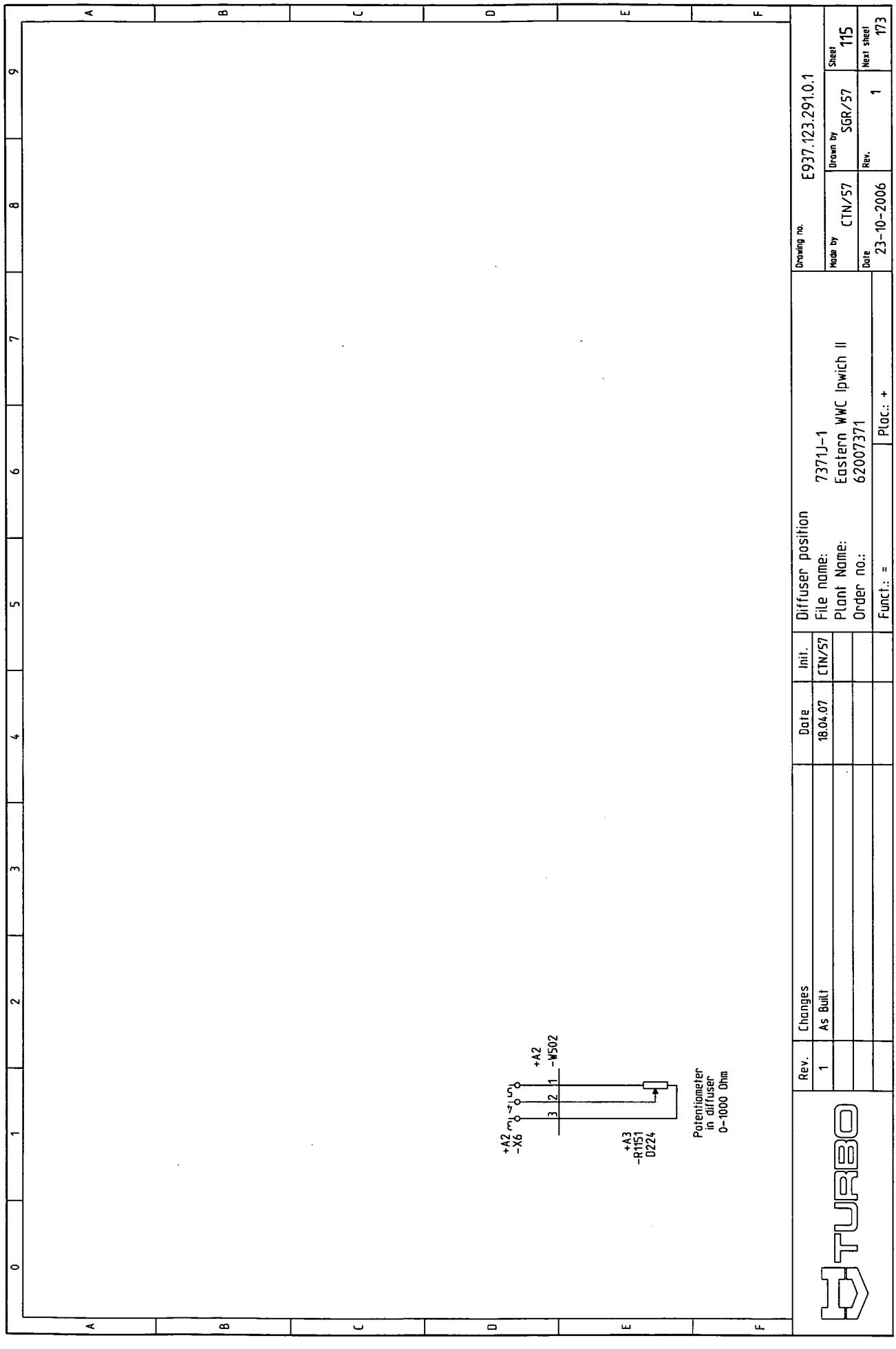
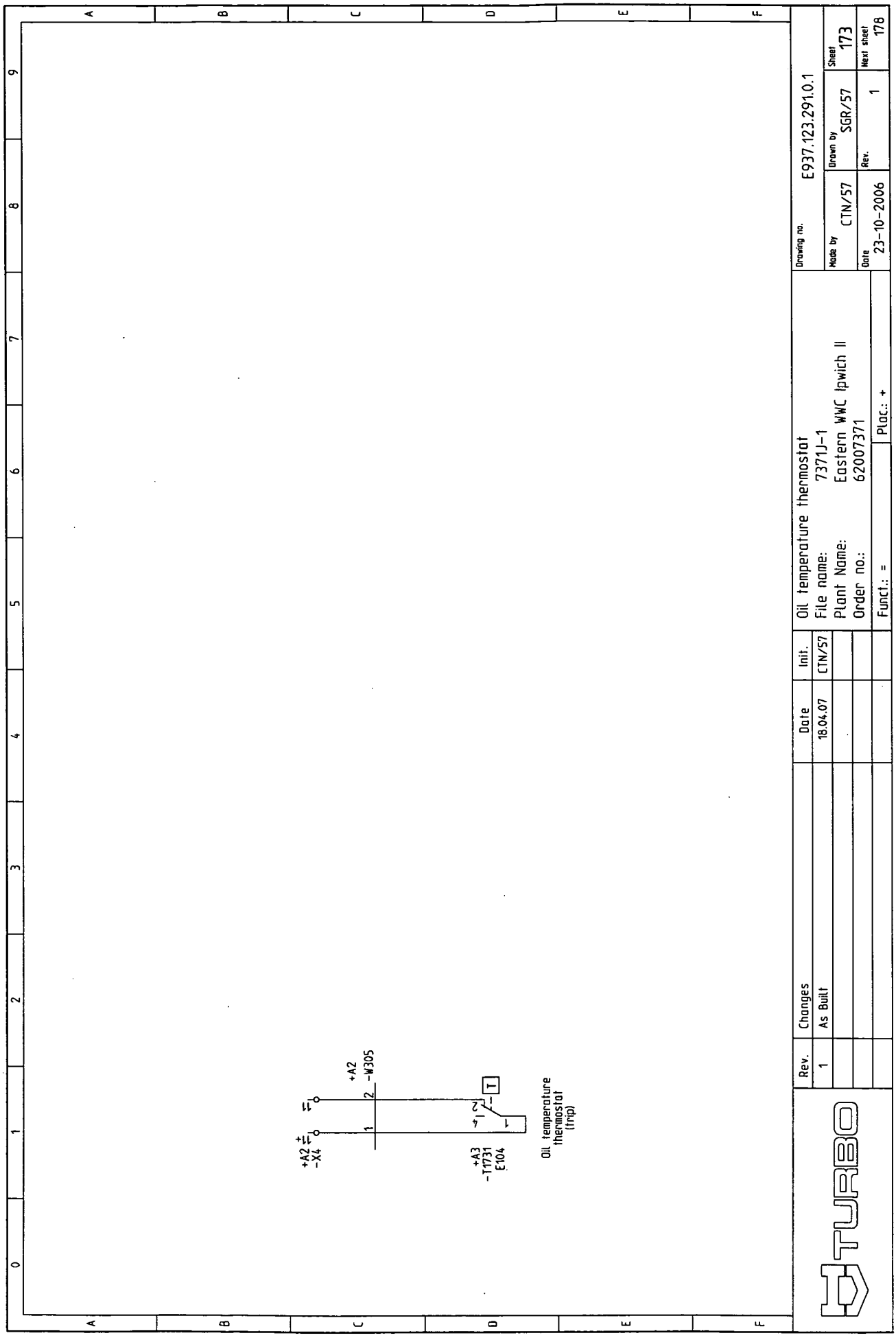
-W301
+A2
-X4
21
22
+A2
-S431
E136
Emergency
Stop
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Emergency stop
File name:
7371J-1
Plant Name:
Eastern WWC Ipwich II
Order no.:
62007371
Funct.: =
Plac.: +
Drawing no.
E937.123.291.0.1
Made by
CTN/57
Drawn by
SGR/57
Sheet
43
Date
23-10-2006
Rev.
1
Next sheet
60
TURBO

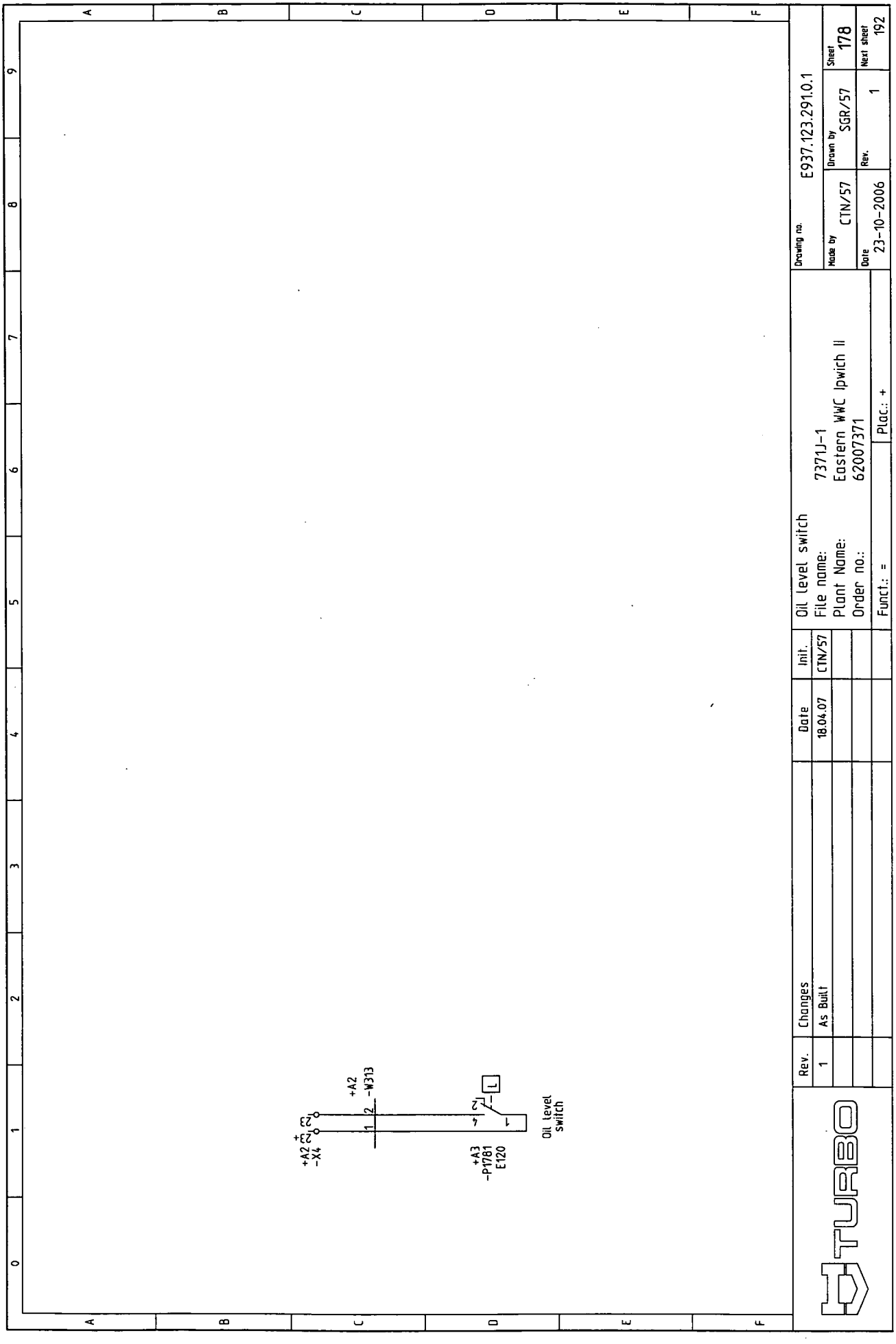

+A2
-W501
1 2
+A2
-X6
+A3
-R602
A401
Main drive motor thermistor
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Main drive motor thermistor
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 60
Date 23-10-2006
Rev. 1
Next sheet 110
TURBO

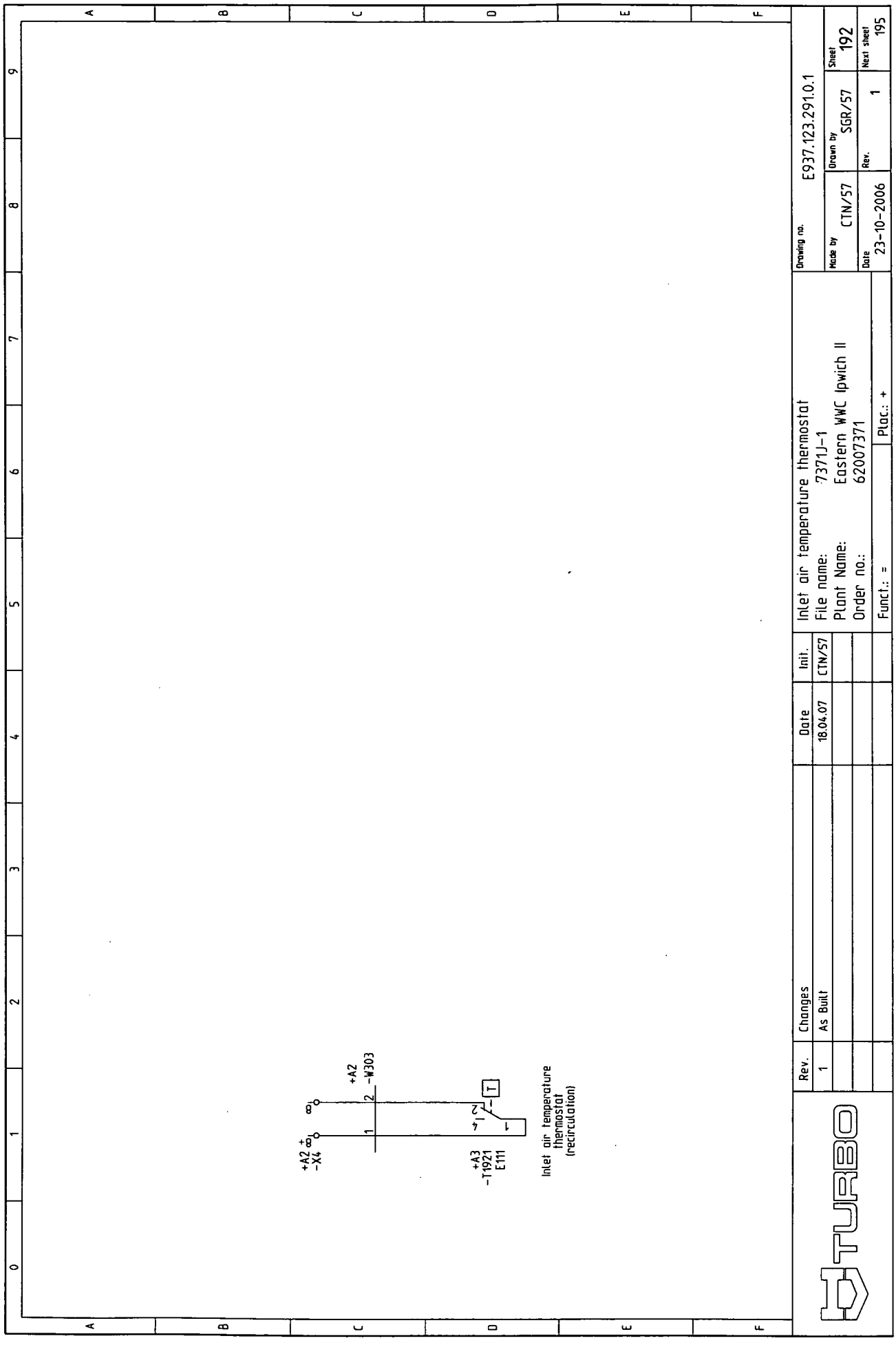

+A2:PE
225.0
+A2
-W201
PE
BN
BU
BK
GY
WH
L1
L2
L3
PE
M
1~
Diffuser
PN = kW
IN = A
+A3
-M1102
D224
+A2
-C1101
+A2
-X03
+A2:PE
Diffusor motor
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 110
Date 23-10-2006
Rev. 1
Next sheet 112
Rev. Changes Date Init.
1 As Built 18.04.07 CTN/57
TURBO

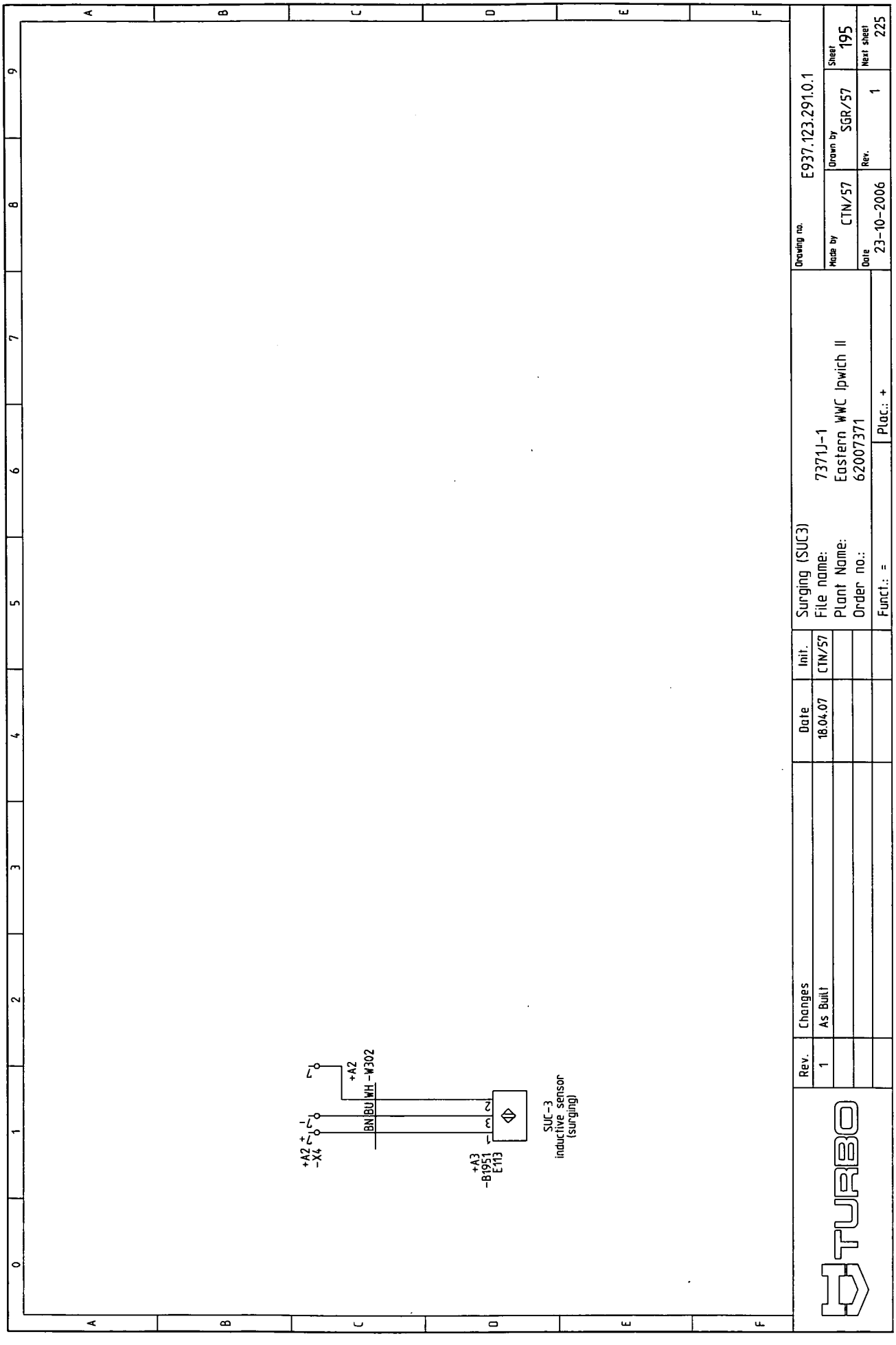

+A2
-X4
+A2
-W308
WH BN BK
+A3
-B1125
D210H
Diffuser maximum
+A2
-X4
+A2
-W307
WH BN BK
+A3
-B1121
D210L
Diffuser minimum
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Diffuser position
File name:
7371J-1
Plant Name:
Eastern WWC Ipwich II
Order no.:
62007371
Funct.: =
Plac.: +
Drawing no.
E937.123.291.0.1
Made by
CTN/57
Drawn by
SGR/57
Sheet
112
Date
23-10-2006
Rev.
1
Next sheet
115
TURBO

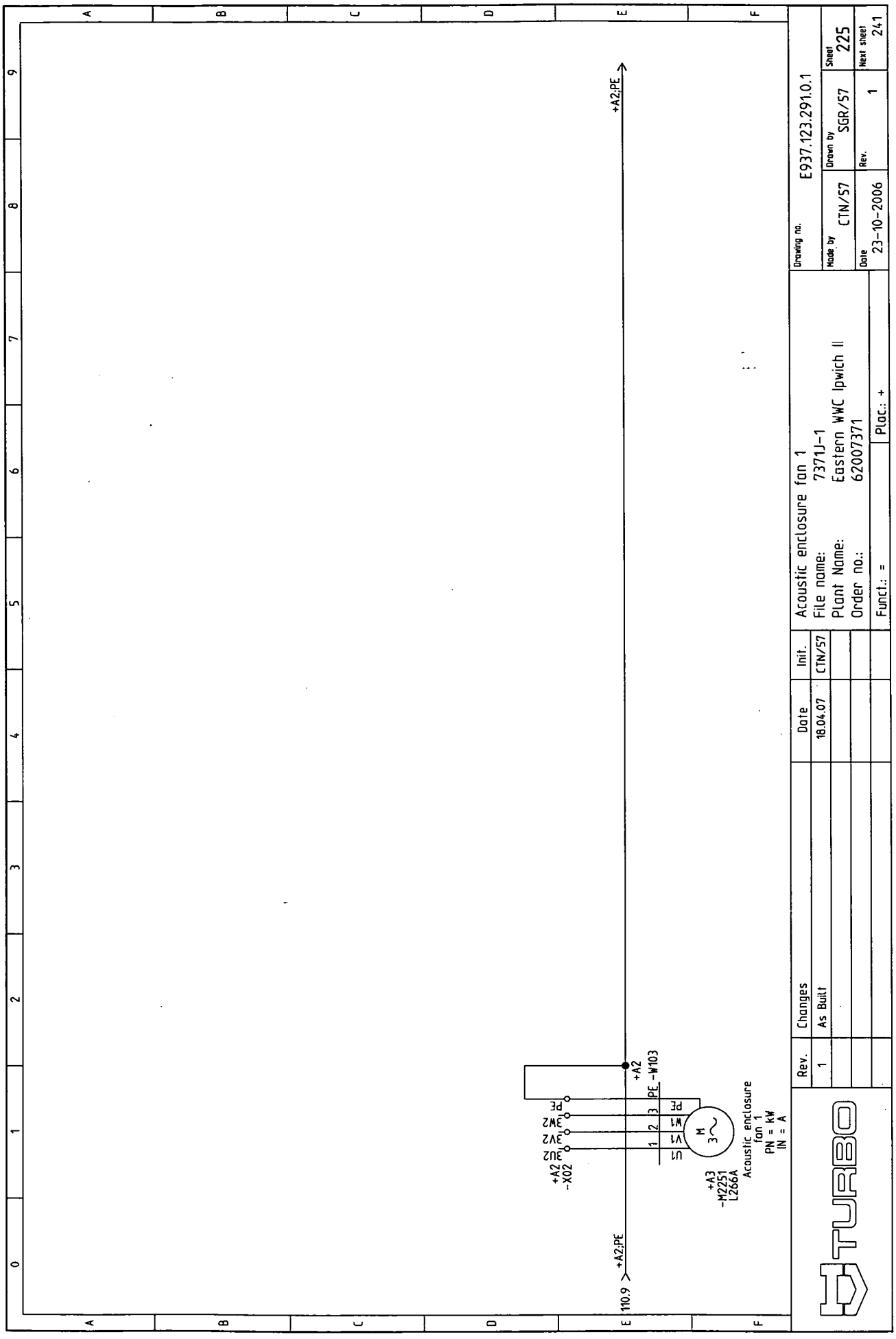

+A2
-W502
+A2
-X6
+A3
-R1151
D224
Potentiometer
in diffuser
0-1000 Ohm
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/S7
Diffuser position
File name:
Plant Name:
Order no.:
7371J-1
Eastern WWC Ipwich II
62007371
Funct.: =
Plac.: +
Drawing no.
E937.123.291.0.1
Made by
CTN/S7
Drawn by
SGR/S7
Sheet
115
Date
23-10-2006
Rev.
1
Next sheet
173
TURBO

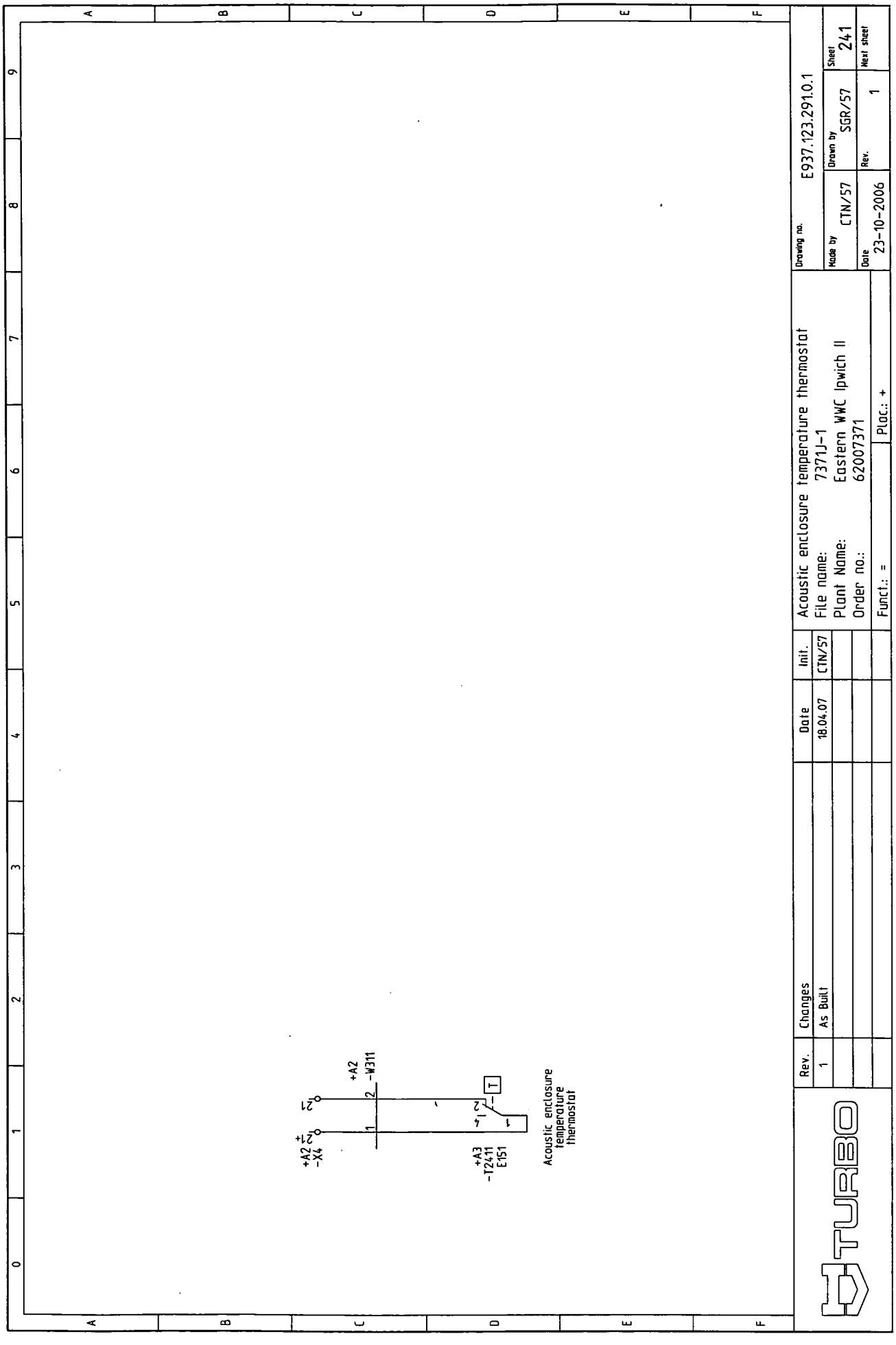

+A2
-W305
+A2
-X4
+A3
-T1731
E104
Oil temperature
thermostat
(trip)
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Oil temperature thermostat
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 173
Date 23-10-2006
Rev. 1
Next sheet 178
TURBO

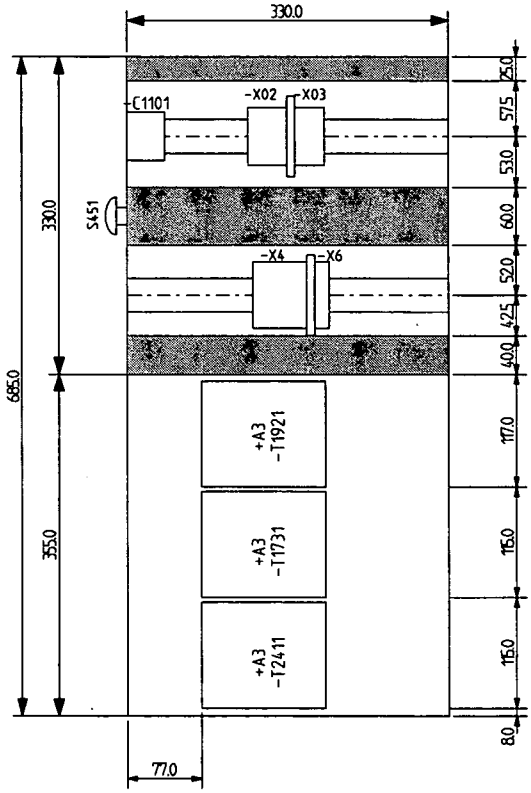

TURBO
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Oil level switch
File name:
7371J-1
Plant Name:
Eastern WWC Ipwich II
Order no.:
62007371
Funct.: =
Plac.: +
Drawing no.
E937.123.291.0.1
Made by
CTN/57
Drawn by
SGR/57
Sheet
178
Date
23-10-2006
Rev.
1
Next sheet
192
+A2
-W313
+A2
-X4
+A3
-P1781
E120
Oil level
Switch


+A2
-W303
+A2
-X4
+A3
-T1921
E111
Inlet air temperature
thermostat
(recirculation)
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/S7
Inlet air temperature thermostat
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +
Drawing no. E937.123.291.0.1
Made by CTN/S7
Drawn by SGR/S7
Sheet 192
Date 23-10-2006
Rev. 1
Next sheet 195
TURBO


+A2
-W302
BN BU WH
+A2
-X4
+A3
-B1951
E113
SUC-3
inductive sensor
(surging)
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Surging (SUC3)
File name:
Plant Name:
Order no.:
7371J-1
Eastern WWC Ipwich II
62007371
Funct.: =
Plac.: +
Drawing no.
E937.123.291.0.1
Made by
CTN/57
Drawn by
SGR/57
Sheet
195
Date
23-10-2006
Rev.
1
Next sheet
225
TURBO


+A2;PE
+A2
-W103
PE
U1
V1
W1
PE
M
3~
+A2
-X02
1U2
1V2
1W2
PE
+A3
-M2251
L266A
Acoustic enclosure
fan 1
PN = kW
IN = A
+A2;PE
E 110.9
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Acoustic enclosure fan 1
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 225
Date 23-10-2006
Rev. 1
Next sheet 241
TURBO


+A2 -X4
21
21
+A2 -W311
2
1
+A3 -T2411 E151
2
1
T
Acoustic enclosure temperature thermostat
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Acoustic enclosure temperature thermostat
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 241
Date 23-10-2006
Rev. 1
Next sheet
TURBO



Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

Junction box Layout
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +A2

Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 641
Date 23-10-2006
Rev. 1
Next sheet

List of Cables

Placement (+)	Cable (-)	Consumer / Component	Type	Remarks	Page
+A2	-W103	Acoustic enclosure fan 1		Customer supply	225

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

List of Cables
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 660
Date 23-10-2006
Rev. 1
Next sheet 661

List of Cables

Placement (+)	Cable (-)	Consumer / Component	Type	Remarks	Page
+A2	-W201	Diffuser		HV-Turbo supply	110
+A2	-W301	Emergency stop		HV-Turbo supply	43
+A2	-W302	Surging (SUC)		HV-Turbo supply	195
+A2	-W303	Inlet air temperature thermostat		HV-Turbo supply	192
+A2	-W305	Oil temperature thermostat		HV-Turbo supply	173
+A2	-W307	Diffuser minimum		HV-Turbo supply	112
+A2	-W308	Diffuser maximum		HV-Turbo supply	112
+A2	-W311	Acoustic enclosure temperature thermostat		HV-Turbo supply	241
+A2	-W313	Oil level switch		HV-Turbo supply	178
+A2	-W501	Main drive motor thermistor		HV-Turbo supply	60
+A2	-W502	Potentiometer in diffuser		HV-Turbo supply	115

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

List of Cables
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no.		
E937.123.291.0.1		
Made by: CTN/57	Drawn by: SGR/57	Sheet: 661
Date: 23-10-2006	Rev.: 1	Next sheet:

List of Items

Pcs.	Type	Description	Article no.	Maker
14.00	WDK 2,5 102150	TERMINAL 2,5 mm2		WEIDMÜLLER
10.00	WDU 2,5 / 102000	TERMINAL 2,5 mm2		WEIDMÜLLER

Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

List of Items
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 775
Date 23-10-2006
Rev. 1
Next sheet

List of Components

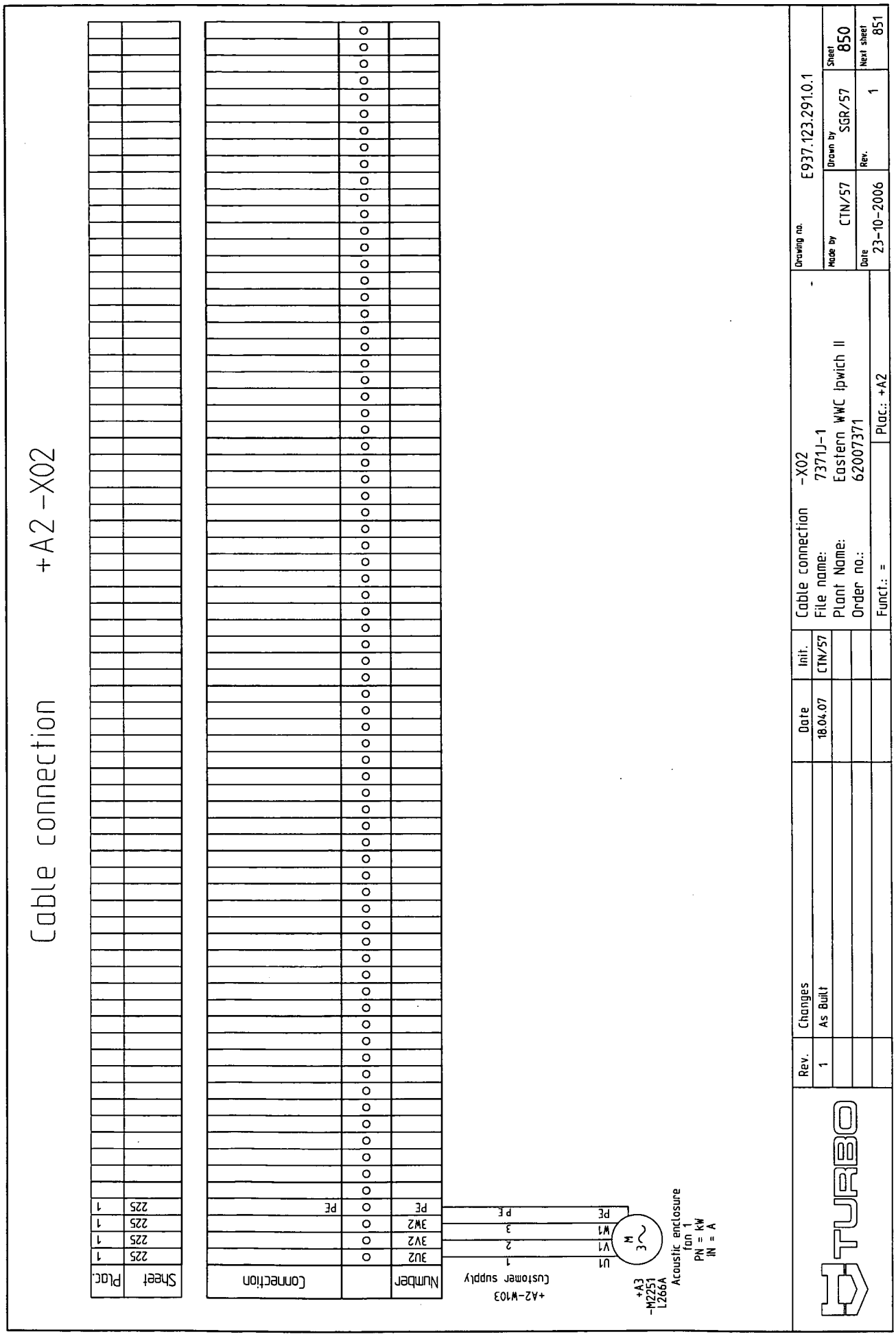
Plac.	Product	Type	Description	Article no.	Maker
+A2	-X02	WDU 2,5 / 102000	TERMINAL 2,5 mm2		WEIDMÜLLER
+A2	-X03	WDU 2,5 / 102000	TERMINAL 2,5 mm2		WEIDMÜLLER
+A2	-X4	WDK 2,5 102150	TERMINAL 2,5 mm2		WEIDMÜLLER
+A2	-X6	WDK 2,5 102150	TERMINAL 2,5 mm2		WEIDMÜLLER

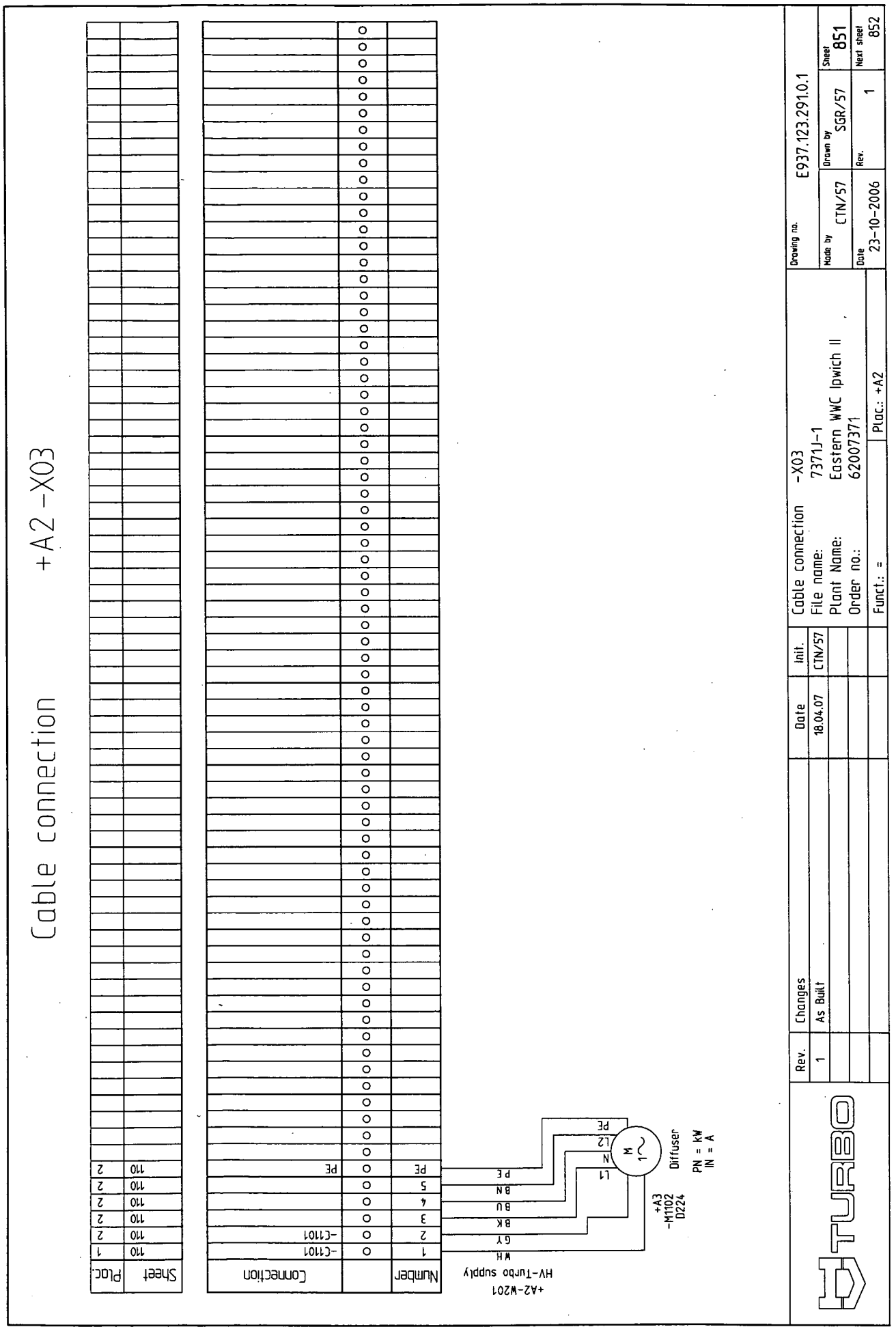
TURBO

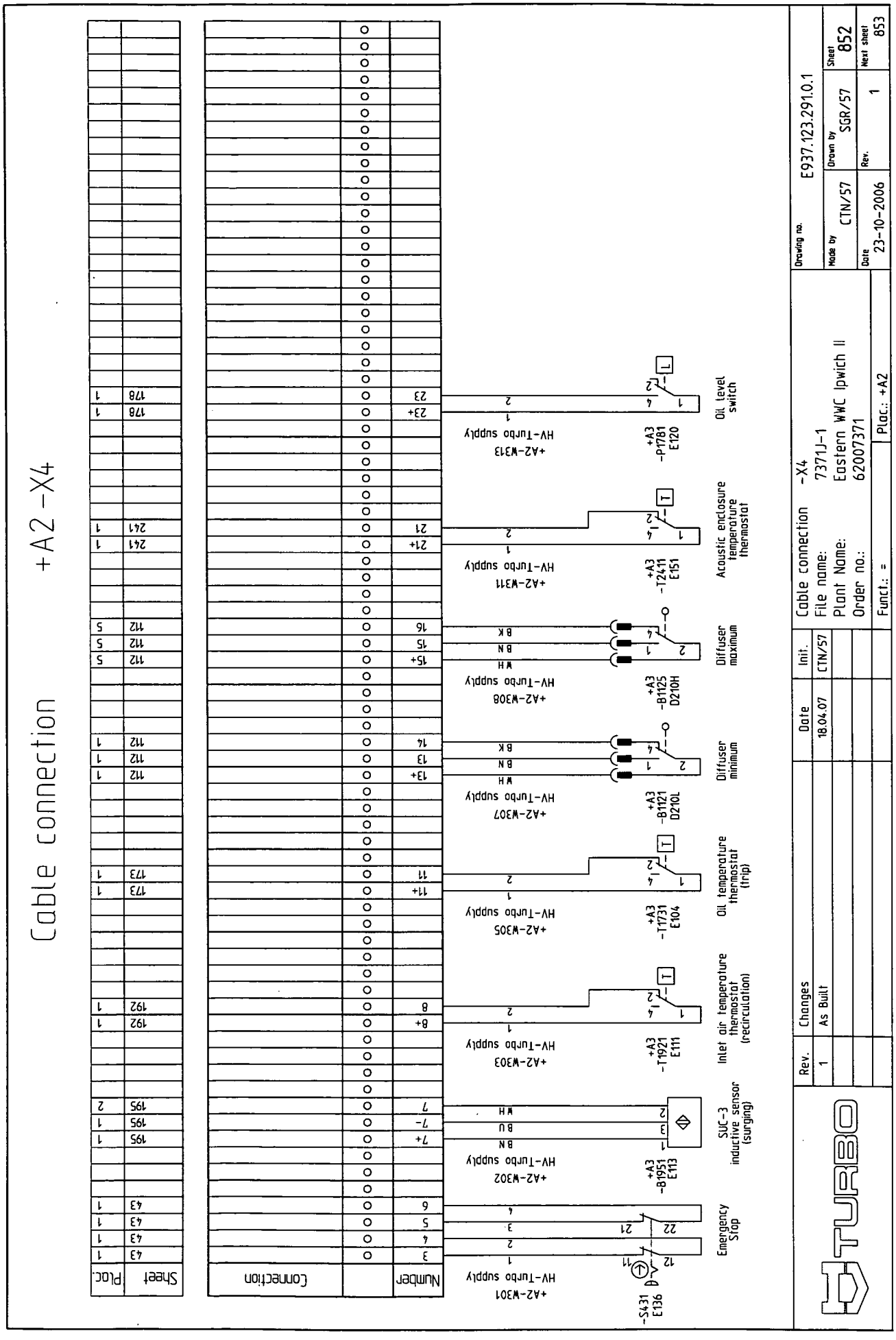
Rev.	Changes	Date	Init.
1	As Built	18.04.07	CTN/57

List of Components
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +

Drawing no.		
E937.123.291.0.1		
Made by: CTN/57	Drawn by: SGR/57	Sheet: 800
Date: 23-10-2006	Rev.: 1	Next sheet:


Cable connection +A2 -X02
Sheet
Plac.
225 1
225 1
225 1
225 1
Connection
PE
Number
3U2
3V2
3W2
PE
+A2-W103
Customer supply
1
2
3
PE
U1
V1
W1
PE
M
3~
+A3
-M2251
L266A
Acoustic enclosure
fan 1
PN = kW
IN = A
TURBO
Rev.
Changes
1
As Built
Date
18.04.07
Init.
CTN/57
Cable connection -X02
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +A2
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 850
Date 23-10-2006
Rev. 1
Next sheet 851


Cable connection
+A2 -X03
Number
Connection
Sheet
Plac.
1
2
3
4
5
PE
-C1101
-C1101
PE
110
110
110
110
110
110
110
2
2
2
2
2
2
2
+A2-W201
HV-Turbo supply
WH
GY
BK
BU
BN
PE
+A3
-M1102
D224
L1
N
L2
PE
M
1~
Diffuser
PN = kW
IN = A
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Cable connection
File name:
Plant Name:
Order no.:
-X03
7371J-1
Eastern WWC Ipwich II
62007371
Funct.: =
Plac.: +A2
Drawing no.
E937.123.291.0.1
Made by
CTN/57
Drawn by
SGR/57
Sheet
851
Date
23-10-2006
Rev.
1
Next sheet
852
TURBO


Cable connection +A2 -X4
Number
Connection
Sheet
Plac.
Emergency Stop
SUC-3 inductive sensor (surging)
Inlet air temperature thermostat (recirculation)
Oil temperature thermostat (trip)
Diffuser minimum
Diffuser maximum
Acoustic enclosure temperature thermostat
Oil level switch
HV-Turbo supply
-S431 E136
-B1951 E113
-T1921 E111
-T1731 E104
-B1121 D210L
-B1125 D210H
-T2411 E151
-P1781 E120
+A2-W301
+A2-W302
+A2-W303
+A2-W305
+A2-W307
+A2-W308
+A2-W311
+A2-W313
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Cable connection -X4
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +A2
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 852
Date 23-10-2006
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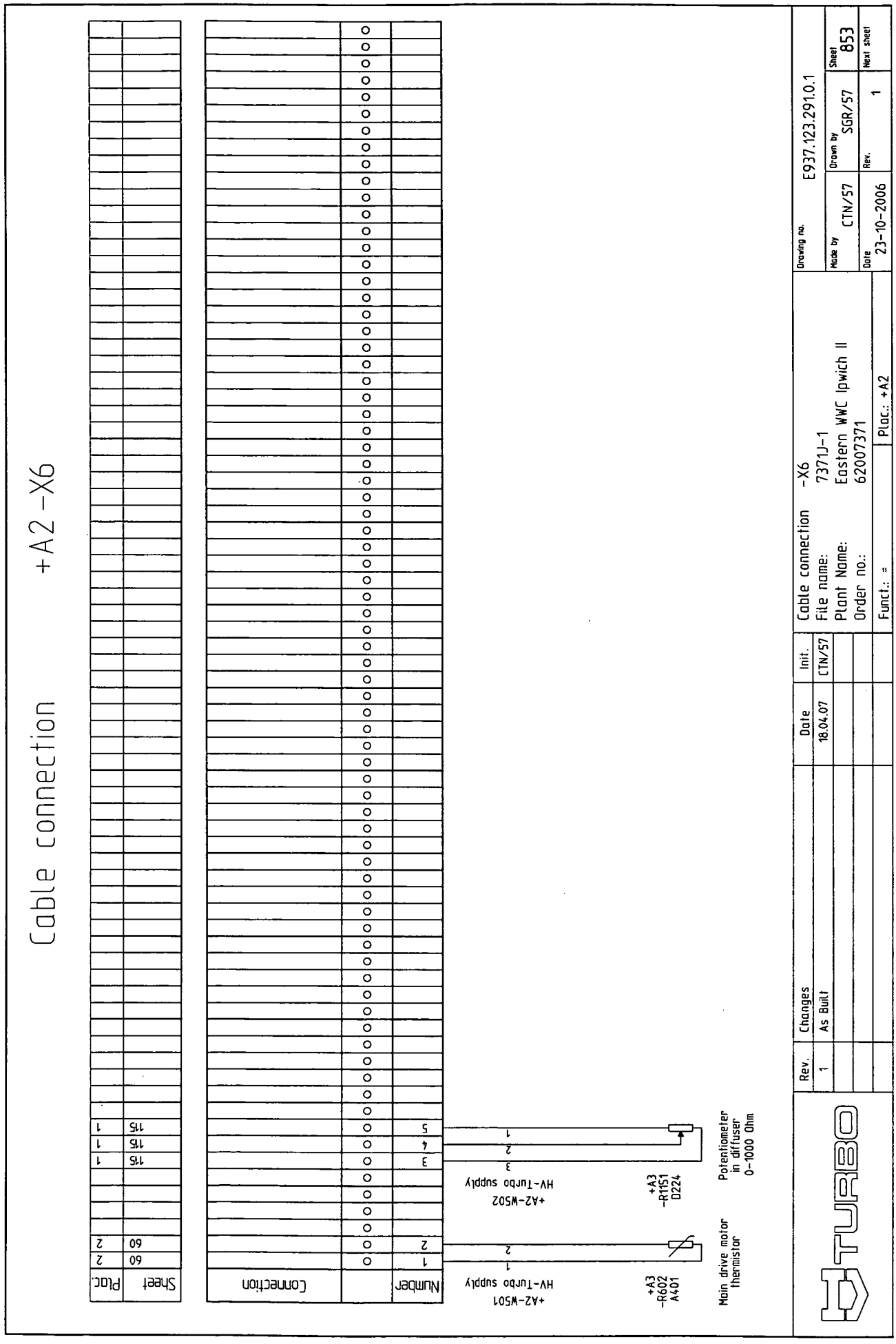
TURBO


Cable connection +A2-X6
Sheet
Plac.
Connection
Number
Main drive motor thermistor
+A2-W501
HV-Turbo supply
+A3
-R602
A401
Potentiometer in diffuser 0-1000 Ohm
+A2-W502
HV-Turbo supply
+A3
-R1151
D224
Rev.
Changes
Date
Init.
1
As Built
18.04.07
CTN/57
Cable connection -X6
File name: 7371J-1
Plant Name: Eastern WWC Ipwich II
Order no.: 62007371
Funct.: =
Plac.: +A2
Drawing no. E937.123.291.0.1
Made by CTN/57
Drawn by SGR/57
Sheet 853
Date 23-10-2006
Rev. 1
Next sheet
TURBO

ACOUSTIC ENCLOSURE KA2

TURBO

Prepared by:	LR	Date: 20.01.1998
Latest revision:	LL	Date: 15.06.2004

MOUNTING INSTRUCTIONS

IMPORTANT: Do not point load the top panel of the acoustic enclosure up to more than 25 kg.

The temperature inside the acoustic enclosure must not exceed 40°C during operation.

After mounting fix the supplied labels, prescribing ear protection, on the side panels of the acoustic enclosure.

Connect the mounted acoustic enclosure to earth.

Pre-assembly Instructions

Check that all items listed on the bill of delivery are supplied and undamaged.
To avoid possible water damage, store the elements indoor prior to mounting.
Before mounting the acoustic enclosure the compressor shall be mounted and fixed to the base plate or to the floor and aligned in relation to the discharge pipe and the inlet duct (if any).
To ensure correct cabling, the electric cables are mounted after the erection of the acoustic enclosure.

The following tools are used for the assembly:

- Impact drilling machine with 8 mm impact drills
- 13 mm open-end wrench
- Level gauge
- Tape measure
- Hammer
- Degreasing agent
- Chalk line

Silicone spray (L289) for greasing the sealing strips is included in the supply.

A thin plastic film protects the surface of the elements against transport and mounting damage. Therefore, remove this film as late as possible during the assembling. When the film has been removed the elements must be treated with the utmost care to avoid damage to the surface.

All item numbers in the mounting instructions, e.g. (L232), are shown on the enclosed drawing and bill of delivery.

Assembly - See Drawing 1

1. Place the floor profiles on the floor in accordance with the distance to the compressor centre line as well as the length measurement (see assembly drawing).
The gable profiles are placed under the side profiles.
Parallelism, right angles and measurements shall be carefully aligned.

2. Keep the profiles in place with available heavy objects to avoid dislocation during drilling. Drill the ∅ 8 mm holes for Simplex expansion bolts (L275) through the holes in the floor profiles down to a depth of 55 mm resp. 65 mm.

   With a view to possible later adjustment, be careful to drill in the centre of the holes as embedded reinforcement irons in the floor may cause problems when positioning.

3. Put floor profiles aside and clean the boreholes of drill cuttings. Engage the expansion bolts (L275) until the top of the bolts are approximately 40 mm above floor level.

4. Clean the underside of the floor profiles thoroughly with a degreasing agent. Fasten sealing strips (L283) as shown on the assembly drawing. Make sure that all slits are sealed to avoid the passage of sound.

NB! Even small openings will considerably reduce the damping effect of the acoustic enclosure.

5. Place the posts as indicated on the assembly drawing. Press the posts firmly against the inner edge of the floor profile and tighten nuts lightly.

6. **See Drawing 2**
   Follow the assembly drawing closely when mounting the top profiles. Put them up and fasten them to the posts with screws (L270) and washers (L278). The side top profiles are placed under the gable top profiles.

7. Now tighten up on the expansion bolt nuts (L275), and check that all posts are erect (vertical), and that the angles are correct. Any slant and off-centre shall be corrected.

8. As a safety measure all panels are shipped without mounted handles (L287). Mount the handles on the panels with Insex screws M6×20 (L288). The panels are prepared for handles.

9. **See Drawing 2**
   A roll of a special sealing strip (L284) is supplied to silence the sound passage. Press the strip tightly against the panel edge of posts and profiles. The sealing strip is mounted in an unbroken line.

   When mounting the sealing strip, start at the bottom in the middle of the opening. Use a hammer to fix the strip to the panel edge all the way around the opening. Pay special attention to the corners.

10. Spray all sealing strips (L284) with silicone (L289) (supplied). Then mount the side and gable panels. Tilt the panel slightly and lift it up into the top profile, slide it over the outer edge of the floor profile and lower it into the floor profile.

    When all panels are mounted, check that the rubber sealing strips (L284) make full contact with the panels. If not, adjust the posts against the outer edge of the floor profile.

11. Sealing between the inlet silencer and the acoustic enclosure is made with Ikalon sealing strip (L282) 30×50 mm. Degrease the surfaces before mounting the sealing strip.

12. The baffle plate (L262) is mounted inside the acoustic enclosure and kept in place by the top panel. Remove wall and top panel to mount the baffle plate (see assembly drawing). Replace the panels after mounting.

13. Use sealing strip (L282) to silence the opening in the top panel around the cone diffuser.

14. The vent duct (L261) is mounted with self-cutting screws (L272) on the ventilator top panel. Check the ventilator blow direction (see assembly drawing).

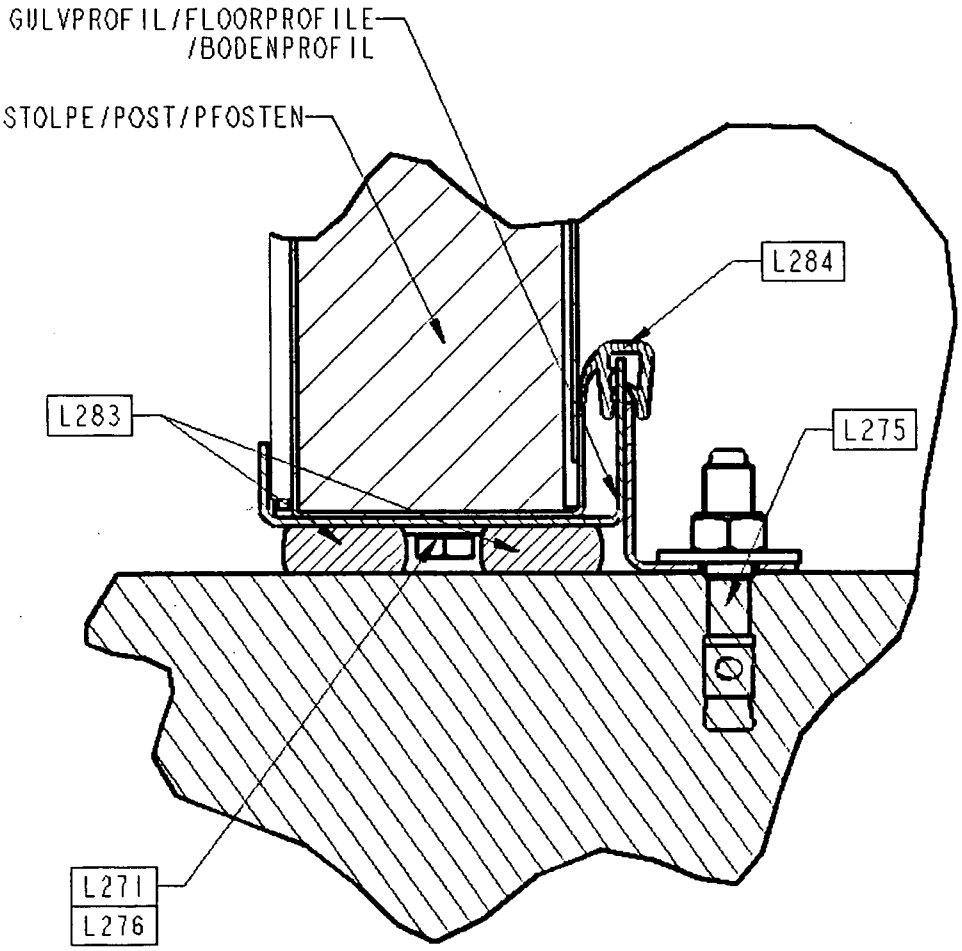
Removal of acoustic enclosure refuse

Refuse, such as mineral and/or glass wool, sealing strips etc., also in wet condition, can be taken to a refuse dump.

The iron is sold as scrap iron.

ACOUSTIC ENCLOSURE
KA2

FELT	TEKST	REV.	DATO	SIGN.

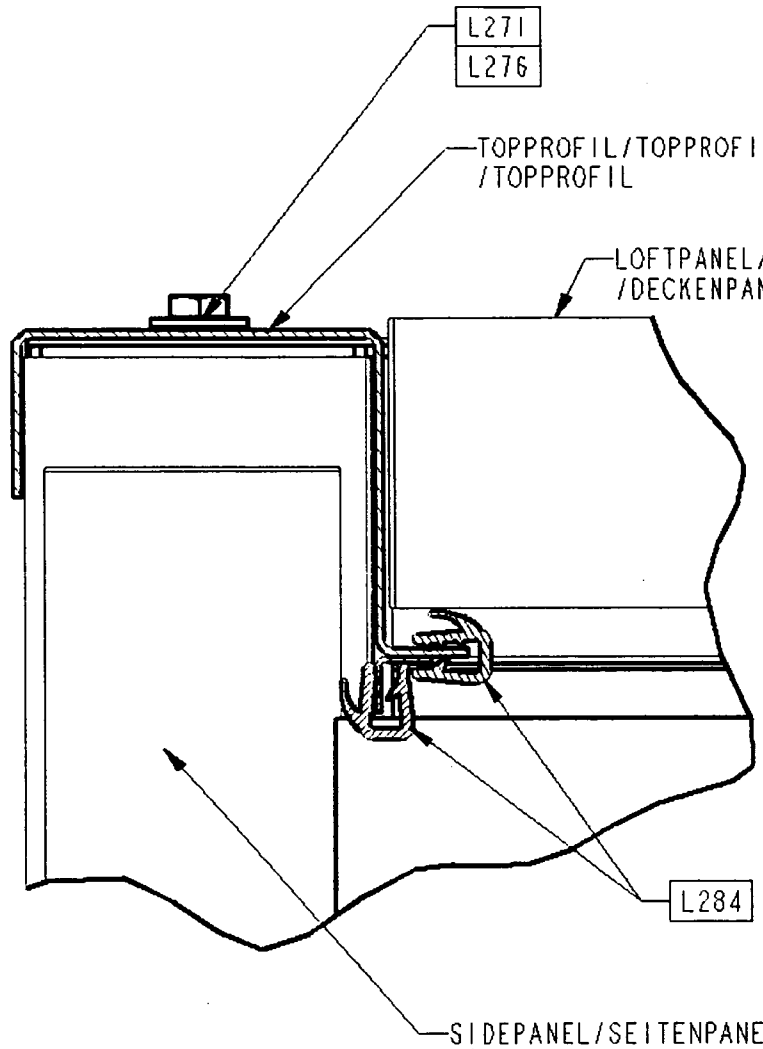


C-C

TURBO	DK	UK X	UDFØRT	LL	TEGN.NR. KA2_MANUAL_01
	DE	FR	DATO	16/2-04	
			GODKENDT	LL	
KA2	3D		A4	SKALA 1:1	
	TEGN.NR. KA2_MANUAL_01			REV. 0	

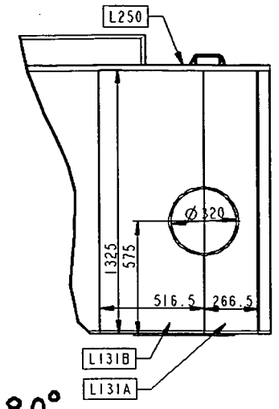
ACOUSTIC ENCLOSURE
KA2

FELT	TEKST	REV.	DATO	SIGN.



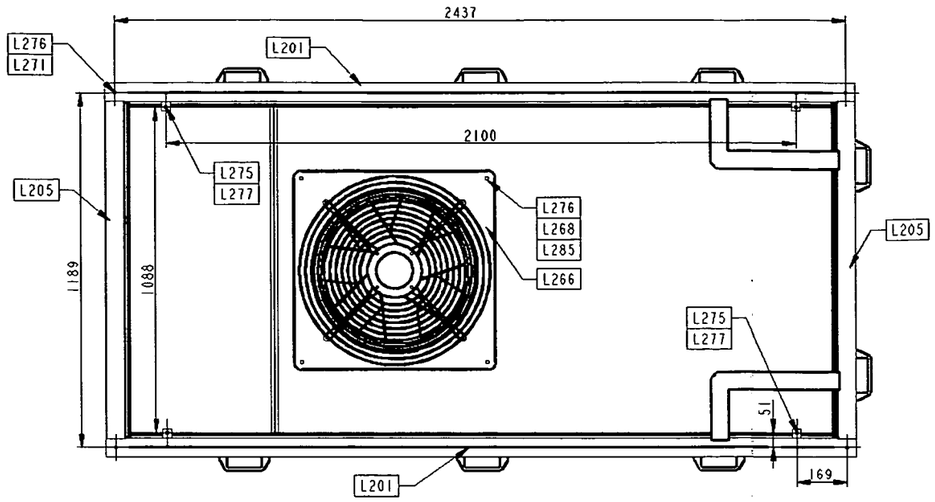
TURBO	DK	UK X	UDFØRT	LL
	DE	FR	DATO	16/2-04
			GODKENDT	LL
KA2	3D	A4	SKALA 1:1	TEGN.NR. KA2_MANUAL_02
	TEGN.NR. KA2_MANUAL_02		REV. 0	

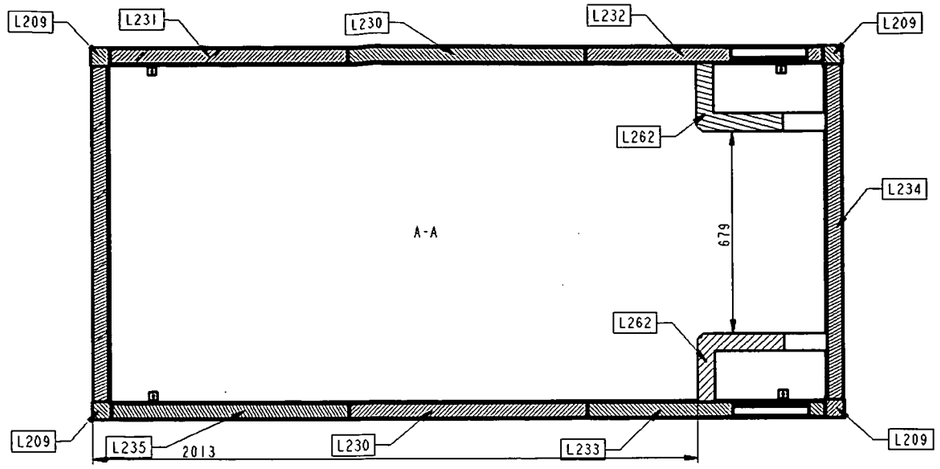
SECTION	TEXT	REV.	DATE	SIGN.

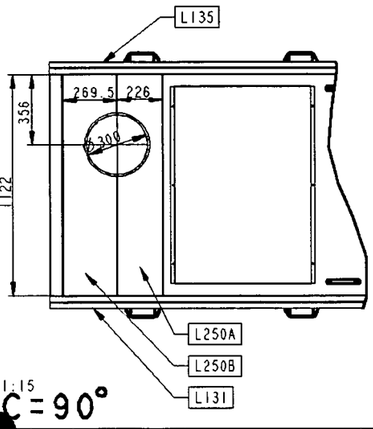


1:15
C=180°

L250	1		9330870600
L235	1		9330850440
L231B	1		9330850580
L231A	1		9330850570







1:15
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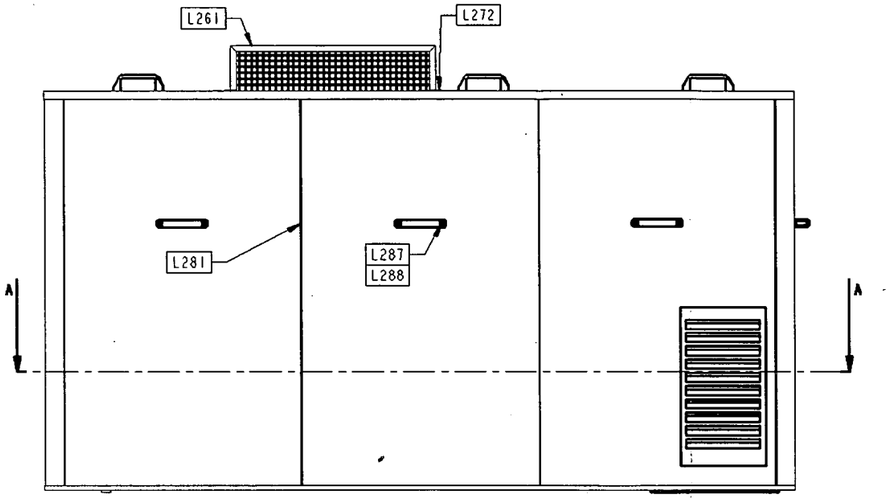
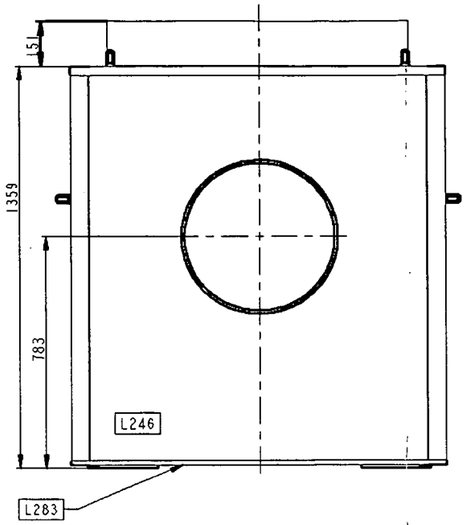
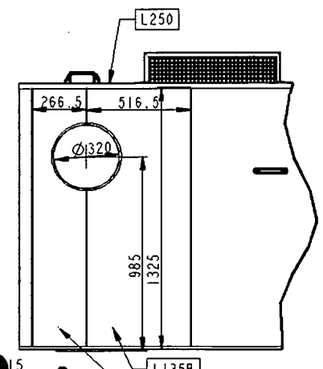
L250A	1		9330870590
L235	1		9330850440
L231	1		9330850440





L289	1	SILICONE SPRAY	9330791010
L288	28	UNBRACO SCREW M6 X 20 MM	N61TR06020
L287	14	HANDLE	9330790529
L285	4	NUT, M8	N91G08
L284	30M	SEALING STRIP	9330890640
L283	20M	SEALING STRIP 20 X 10 MM	89413066
L281	8M	SEALING STRIP, 30 X 5 MM	89413074
L280	5	LABELS FOR HEARING PROTECTION	9332264910
L277	36	WASHER Ø11/52 X 1,25 MM	9330790180
L276	16	WASHER Ø8,4	N64G08,4
L275	4	EXPANSION BOLT M8 X 50 MM	N68B08050
L272	12	SELFDRILLING SCREW B14 X 20 MM	89411755
L271	8	SCREW M8 X 16 MM	N61G08016
L268	4	SCREW M8 X 80 MM	N61GG08080
L266	1	FAN FC50	9330001680
L262	2	BAFFELPLATE	9330890870
L261	1	VENTILATION CANAL	9330796510
L251	1	CEILINGPANEL FOR FAN L266	9330870570
L250	1	TJECK TABLES FOR DIRECTION AF DISCHARGE	
L246	1	GABLE PANEL	9330860500
L235	1	TJECK TABLES FOR DIRECTION AF DISCHARGE	
L234	1	WALL PANEL, GABLE	9330860450
L233	1	WALL PANEL WITH LOUVRE BOARDS II	9330850460
L232	1	WALL PANEL WITH LOUVRE BOARDS I	9330850430
L231	1	TJECK TABLES FOR DIRECTION AF DISCHARGE	
L230	2	WALL PANEL	9330850440
L225	2	TOP PROFILE, GABLE	9330830340
L221	2	TOP PROFILE	9330830360
L209	4	CORNER POST	9330820180
L205	2	FLOOR PROFILE, GABLE	9330810500
L201	2	FLOOR PROFILE	9330810540
POS.	QTY.	PART NAME	PART NO.



1:5
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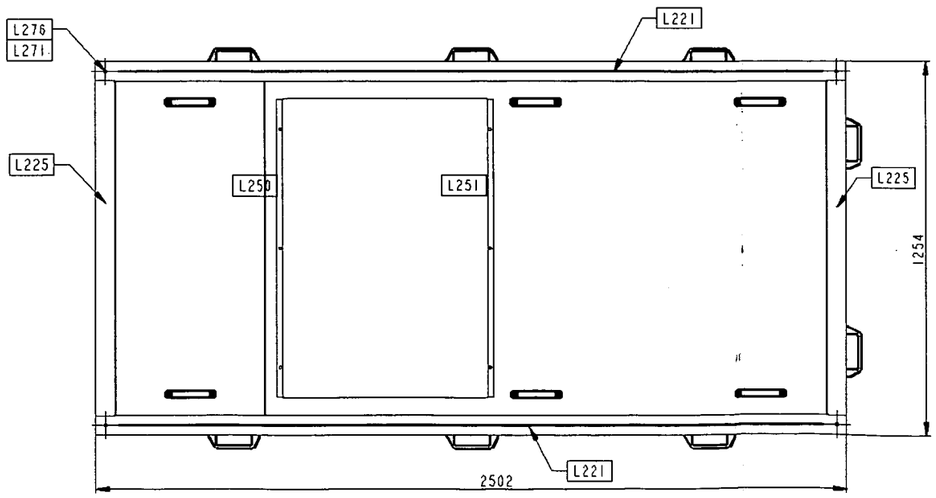
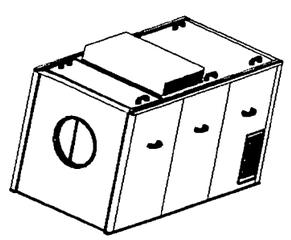
L235B	1		9330850560
L235A	1		9330850550
L231	1		9330850440





1:30

TURBO	DK	UK X	PREPARED LL
	DE	FR	DATE 16/2-04
			APPROVED LL
KA2-GK190	3D		A1 SCALE 1:10
ACOUSTIC ENCLOSURE			
ASSEMBLY DRAWING L200	DRWG.NO. 9330800570		REV. 0
C=0, C=90, C=180, C=270			

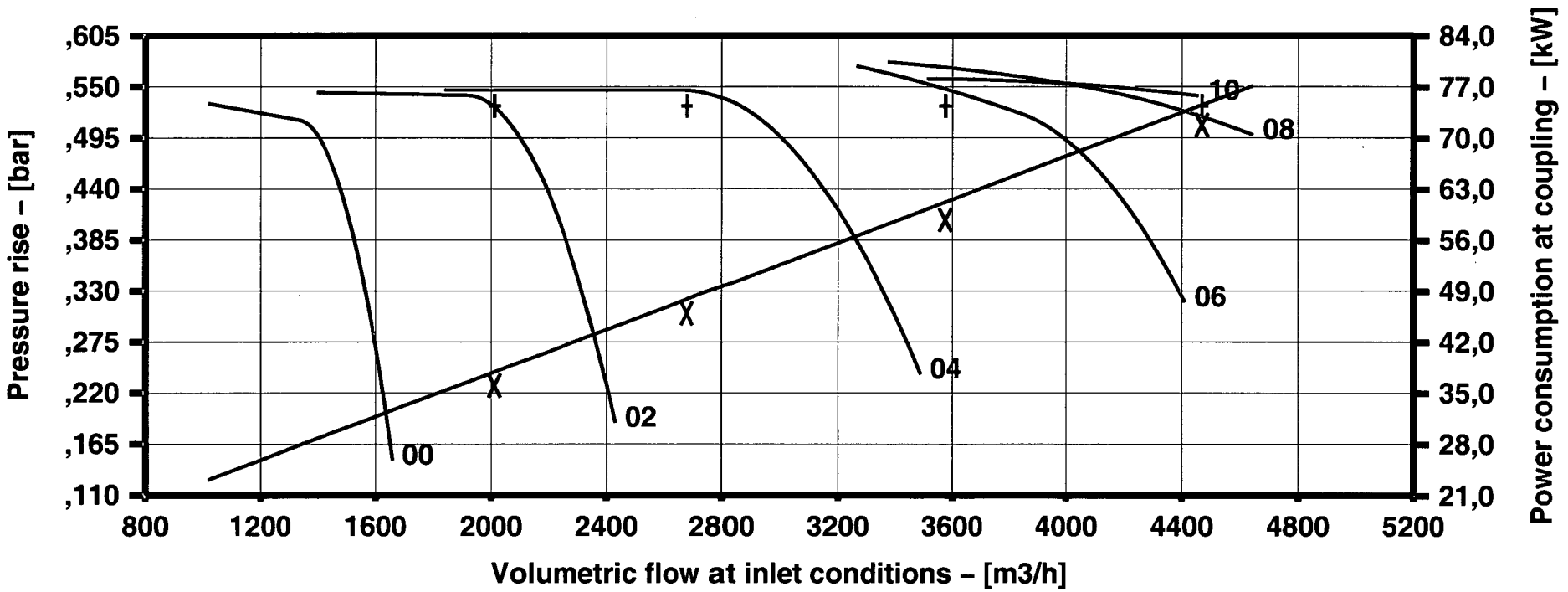
DRWG.NO. 9330800570

Performance Certificate for KA–Compressor

Compressor model:	**KA2–S–GK190**
Build number:	**7371**
Order Number:	**62007371**
Order Name:	**Eastern WWTP Ipwich II**
Testmotor:	**ABB**
Type of test motor:	**M3BP280SMA2B3**
Serial number of test motor:	**0649–010472331**

Curves valid for nominel conditions:

Inlet Pressure:	0,99400 [bar]
Inlet Temperature:	318,00 [K]
Relative Humidity:	60,0 [%]
Motor Speed:	2980, [1/min]



Average test condition

Inlet Pressure:	1,02274 [bar]
Inlet Temperature:	298,58 [K]
Relative Humidity:	17,7 [%]
Motor Speed:	2973, [1/min]

Used evaluation standards for Compressor:

ISO5389/VDI2045

Used evaluation standards for Volumeflow:

ISO 5167–1:1991/Amd.1:1998(E)

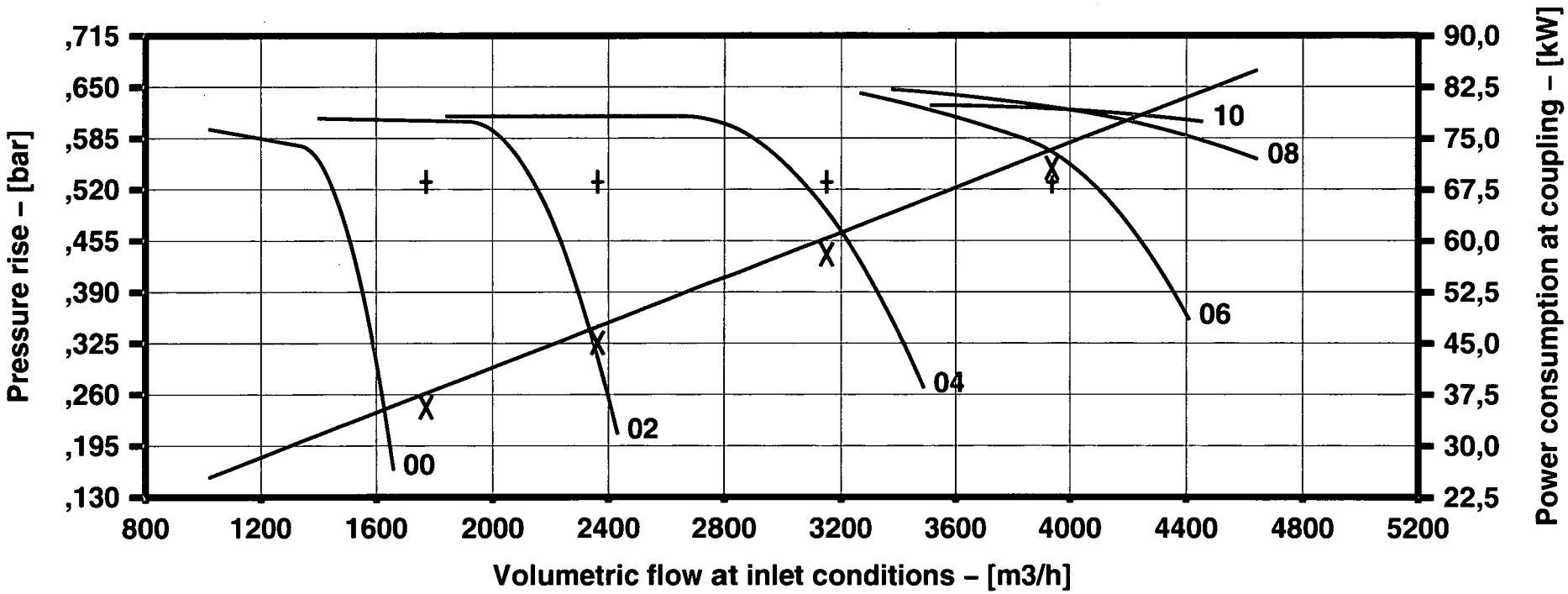
Accepted by:	**BPH**
Test day:	**28–03–2007**

Performance Certificate for KA-Compressor

Compressor model:	**KA2-S-GK190**
Build number:	**7371**
Order Number:	**62007371**
Order Name:	**Eastern WWTP Ipwich II**
Testmotor:	**ABB**
Type of test motor:	**M3BP280SMA2B3**
Serial number of test motor:	**0649-010472331**

Curves valid for nominel conditions:

Inlet Pressure:	0,99400 [bar]
Inlet Temperature:	293,00 [K]
Relative Humidity:	60,0 [%]
Motor Speed:	2980, [1/min]



Average test condition

Inlet Pressure:	1,02274 [bar]
Inlet Temperature:	298,58 [K]
Relative Humidity:	17,7 [%]
Motor Speed:	2973, [1/min]

Used evaluation standards for Compressor:

ISO5389/VDI2045

Used evaluation standards for Volumeflow:

ISO 5167-1:1991/Amd.1:1998(E)

Accepted by: **BPH**

Test day: **28-03-2007**

Accessories

For Compressor KA2S-GK190

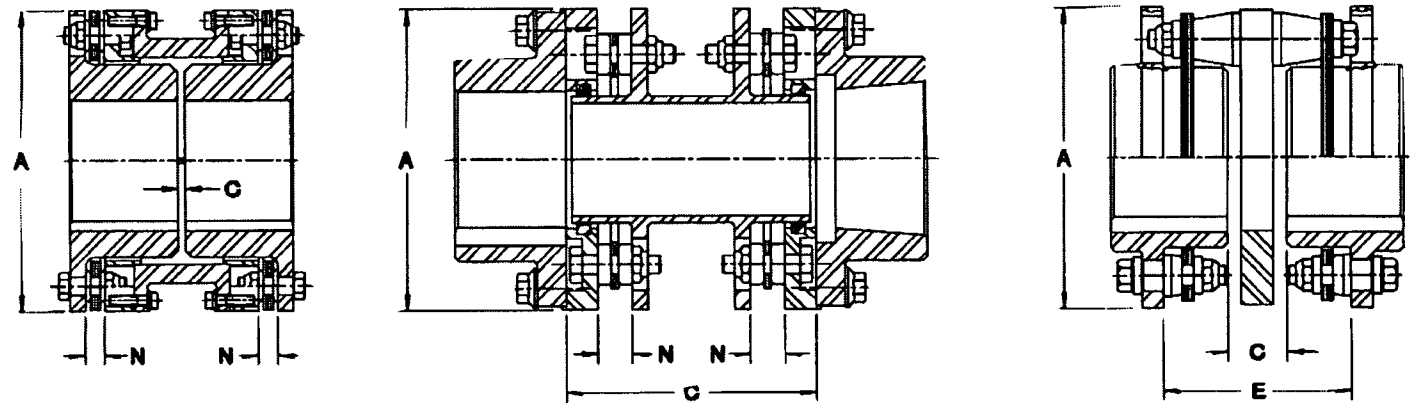
Suppliers Instructions

In order as listed in the Technical Specification

MONITORING AND INSPECTION

Thomas®

Installation Instructions



I. PURPOSE

Monitoring and inspection of the Thomas disc pack in the field.

II. GENERAL INFORMATION

The flexible disc-type coupling is designed for long life when operated within the torque and alignment limits as outlined in the Catalog – Bulletin No. 2000 5/93. The information provided here may also be used for visual determination of the condition of the disc packs.

A well chosen flexible disc coupling operates indefinitely with low cross loading of the connected shafts, has low power absorption, and induces no vibrations or resonances into the system.

The installation of a flexible disc coupling is critical. Various problems could arise during mounting of the hubs and the coupling assembly process. Burrs, dirt and grit on either the shaft or in the bores can cause the hubs to gall during mounting. Poorly-fitted keys can also gall and not seat correctly.

Concentrated heat on the hubs will cause distortion. The coupling must be properly assembled and the locknuts tightened in accordance with the installation instructions. Loose bolts will cause elongation of the disc bolt holes and eventual failure.

The most common forms of failure in disc fatigue due to excessive flexure. This is usually caused by poor initial alignment of the connected machines. It also can be brought about by operational conditions. The following gives some ideas to assure the coupling is operating satisfactorily.

III. DETECTION

The Thomas disc coupling is easily inspected. Visual analysis may point to possible drive system problems. Proper evaluation of the disc packs and connecting parts may save considerable maintenance costs and downtime. When a disc coupling starts to fail, it is usually from the outer disc of the laminated pack and progresses towards the center of the pack. See figure 1.

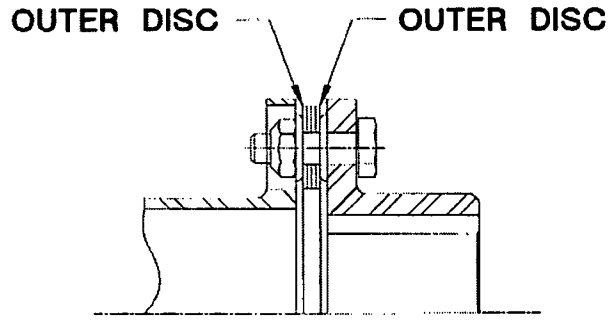


FIGURE 1

Because of this progression, the deterioration of the coupling disc pack may be detected before ultimate failure.

A. Detection of trouble with the equipment in operation.

1. **Monitored Equipment.** Most equipment of this type is continuously monitored with vibration sensors. As a coupling disc pack deteriorates, it loses some pieces of the disc pack which causes unbalance. This unbalance can be detected by the vibration monitoring equipment. This piece-by-piece deterioration allows controlled shut-down before ultimate disc pack failure.

2. **Unmonitored Equipment.** Couplings using a guard with either an open bottom ("U" Type) or open mesh can give early visual warnings. Pieces of the disc pack found under the open "U" guard or seen lying inside the expanded metal guard are a good reason to shut the unit down. Now inspect the coupling, replace the disc packs, and realign the equipment.

B. Detection of trouble with equipment out of service and guard removed:

Here are some of the more evident visual inspection criteria and recommended corrective procedures.

1. Reddish brown color bleeding out between disc laminations at the O.D. of the pack. This is an indication of fretting and/or chemical attack of the disc material. See Figure 2.

2. Fine line crack starting in the outer disc, tangent to the washer O.D. This is an indication of misalignment and can be seen by looking at the outside edge of the disc pack. See Figures 2, 8 and 9.

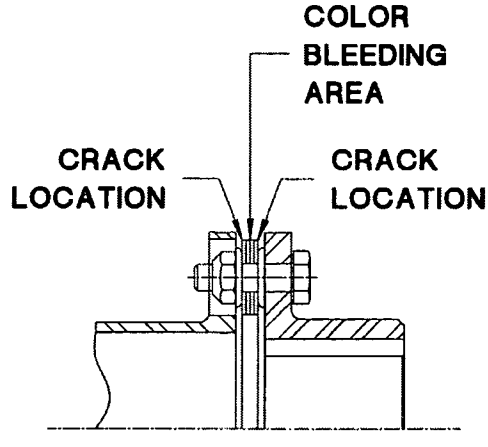
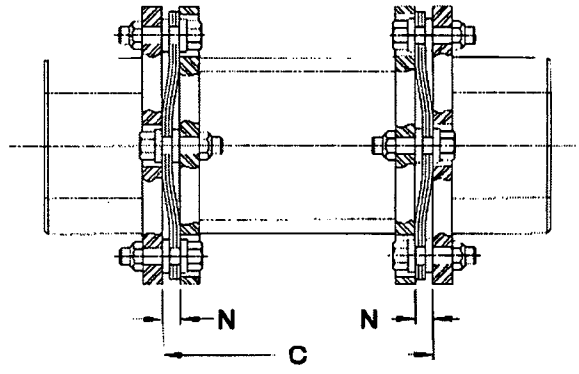


FIGURE 2

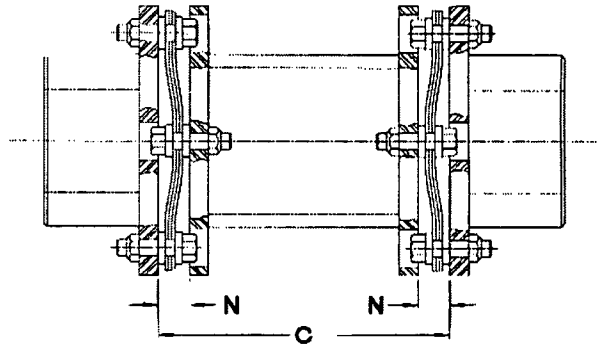
3. Disc pack is wavy and dimension between flange faces "N" is smaller than indicated in the installation instructions or applicable assembly drawing. See Figure 3. This indicates that the coupling has been installed in a compressed condition or equipment has shifted axially during operation. Check for shaft thermal growth conditions. Realign axial position of equipment so the coupling operates with a neutral, flat disc pack.



COMPRESSION

FIGURE 3

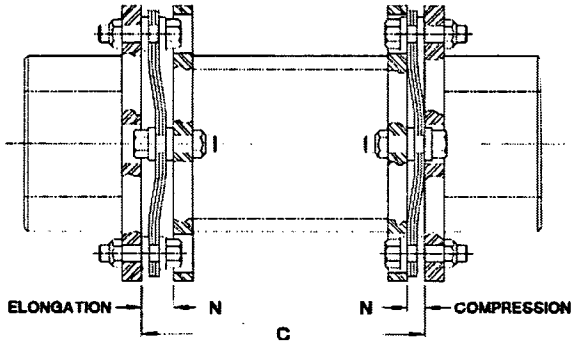
4. Disc pack is wavy and dimension between flange faces "N" is larger than specified on installation instructions or applicable assembly drawing. See Figure 4. This indicates that the coupling has been installed in an elongated position or equipment has shifted axially during operation. Realign axial position of equipment so coupling operates with a neutral, flat disc pack.



ELONGATION

FIGURE 4

5. Disc packs (both ends) are wavy. One end is compressed, and the other end is elongated. (See Figure 5). The conditions can be reversed by moving the center member towards the elongated end. This is called "oil canned" disc packs. The disc pack has no neutral center where it remains flat and parallel with the end flanges.



OIL CAN

FIGURE 5

This condition can be the result of:

1) Tightening the disc pack locknuts while the disc packs are in the compressed or elongated coupling position. See Figure 3 and/or 4.

2) Tightening of disc pack locknuts while coupling is misaligned or other end of spool is hanging unsupported.

3) Bound up bolt(s) in the bolt hole(s).

4) Damaged discs which could be caused by abnormal running conditions, misuse, or loose bolts.

To correct "oil canned" disc pack:

1) Loosen all the disc pack locknuts. Correct the axial spacing of the coupling as necessary with the coupling aligned and spacer fully supported. If "oil canned" conditions disappears, retorque locknut while coupling is in its neutral position.

2) If (1) above is not successful, determine that all bolts, with locknuts loose, can be turned by hand. If any bolts are tight, the bolt holes should be cleaned out by lightly reaming the flange so that the bolt turns by hand in the hole. Reassemble and torque the locknuts while coupling is in its neutral position.

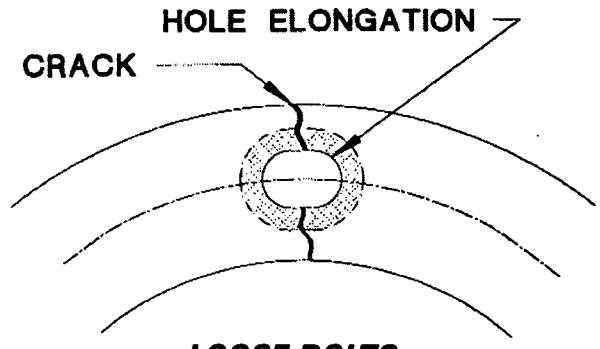
3) If the discs in the pack are permanently deformed, replace the disc pack with a new one and reassemble the coupling.This permanent deformation could be caused by a severe torque overload, abnormal axial loads, or even loose bolts. The cause of the deformation must be corrected before restart.

The coupling, as finally assembled, should have a neutral center where the center member is free to float axially with out snapping from one end to the other when moved by hand.

IV. ANALYSIS OF FAILED DISC COUPLINGS

In the event of a coupling failure, a thorough investigation should be made to determine the cause. The most common causes of failure are improper coupling selection, improper assembly, excessive misalignment, and corrosive attack.

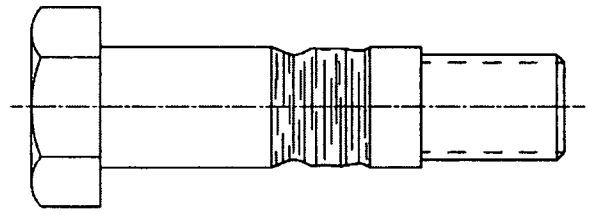
1. Disc broken through the bolt hole indicates loose coupling bolts. See Figure 5. Replace disc pack and tighten locknuts to specified torque value.



LOOSE BOLTS

FIGURE 6

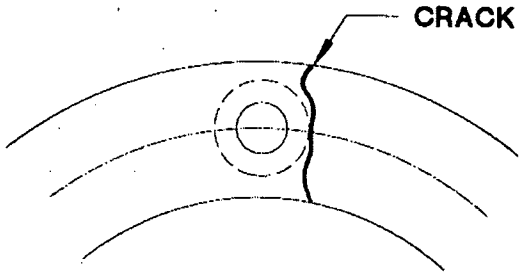
2. Discs embedded into bolt body are usually the result of a loose bolt or a severe torque overload. See Figure 7. Replace bolt and disc pack. Tighten locknut to proper torque. Do not torque the bolt as insufficient bolt stretch may occur.



LOOSE BOLTS

FIGURE 7

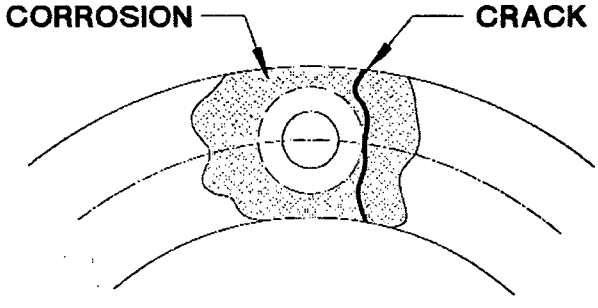
3. Disc broken adjacent to washer face usually indicates excessive shaft misalignment during operation. See Figures 1 & 8. This type of disc failure usually starts with outer disc and progresses through the disc pack. Realign equipment and replace both disc packs. Make hot check of alignment to assure it is within coupling misalignment capacity.



EXCESSIVE MISALIGNMENT

FIGURE 8

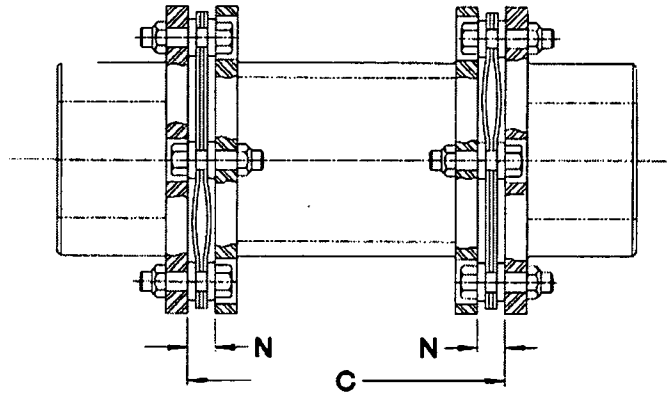
4. Disc broken adjacent to washer face with fretting corrosion present in the area of crack usually indicates excessive shaft misalignment during operation. Also, iron oxide will most likely be evident on outside of disc pack. See Figures 2 & 9. This is sometimes associated with a coupling that has been in service for several years and/or operating in a corrosive atmosphere. Breaks will first appear in outer discs and progress through the disc pack. Replace both disc packs and realign the equipment. Different disc pack material may also be considered.



EXCESSIVE MISALIGNMENT WITH CORROSION

FIGURE 9

5. The disc pack has a bulge near the center or is bowed toward one flange in alternate chordal sections. See Figure 10. This condition is a result of a large torque overload, induced into the system, beyond the peak overload capacity of the coupling. The remaining disc pack chordal sections will be straight and tight. This indicates improper coupling selection or a momentary system torque overload. If bulged or bowed conditions appears in one chordal section only, there may be a loose bolt on one side of the distortion. Loosen all coupling locknuts and unseat the bolts. The bulge should release and flatten out. Retorque locknuts. If distortion does not disappear, replace disc pack and retorque locknuts.



TORQUE OVERLOAD

FIGURE 10

SUMMARY

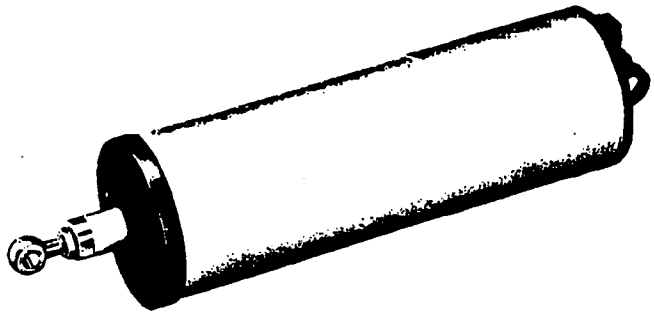
Thomas disc couplings are designed for infinite life. They must be properly selected, installed and aligned to assure reliable service. Because of the design principles, catastrophic failures are very rare. Sufficient time usually exists to repair or correct a deteriorating situation before ultimate failure.

Rexnord

For further assistance, call Rexnord Corp. Coupling Operation
Warren, PA – **814-723-6600**, Fax - 814-726-1740

Translation

magnetic Danmark A/S



Actuators MAGPUSH

SEY 10/1-01

Specifications:	Type	SEY 10/1-01
Thrust	N	300
Static load	N	400
Rate of advance	mm/sec	0.625
Length of stroke, adjustable	mm	10-70
Rated tension	V/50 Hz	230
Power consumption	W	5
Current drain	A	0.02
Operating time (SD 10 min)	%	100
Ambient temperature	°C	-20/+50
Protection class		I
Insulation		E
Type of protection	IP	41
Weight	kgs	0.65

Description

These MAGPUSH actuators are provided with a synchronous motor with a built-in spur gearing. The standard reduction is 1:10.
The actuator has a smoothly sliding special nut and sufficient lubricant reserve and consequently it is maintenance-free.
The thrust tube is provided with a anti-torsion safety device. The operating time stated is based on an ambient temperature of +20°C.

The actuator is surrounded by a plastic tube. The motor is disconnected at the end positions by built-in limit switches. The full length of stroke is adjustable between 10 - 70 mm by means of the front-end adjusting screw.

Power Connection

Connection to electric motor is effected according to the connection diagram overleaf. The connection cable is 4 X 0.5 mm^2 with a length of 1.4 m.

Several motors may not be connected in parallel but only according to a special connection diagram. By simultaneous activation of several motors multipolar switches or relays are necessary.

Installation

The actuator must be installed on the rear fork arm by means of the mounting clamp. Adjustments for mounting differences within an area of +/-5 mm may be made on the eye bolt. Because of the internal anti-torsion safety device the thrust tube may not be exposed to stress. Consequently the lock-nut must be loosened and tightened by means of two fixed spanners SW 10/SW 12.
Where in an end position a closing pressure might occur a spring component must be fitted between the actuator and the load.

Maintenance

Under normal working conditions the lubrication of the work gear spindles and the spur gearing is sufficient for some 100,000 up-and-down strokes. When the stated operating time has been reached we recommend a subsequent lubrication at the factory. Defective motors may only be repaired at the factory.

Accessories

Mounting clamp
- Stock number 9094, 3290

Special Type Actuators

- with signal switches
- with 3 adjustable limit switches
  tensionfree breaking capacity 2 A, 250 V
- with actuator potentiometer 1 k'Ohm
  2 W lifting force, 1% linearity
- tension 1 x 24 v/50 Hz
- tension 1 x 110 v/50 Hz

efector The application sensor

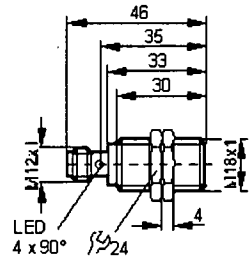
Inductive proximity switches

IGC209

IGB3008BAPKG/M/US
Metal thread M18 x 1
Plug and socket

Increased sensing range
gold-plated contacts

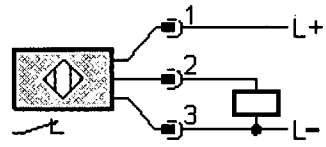
Sensing range 8mm [f]
flush mountable



CE cULus LISTED

Electrical design	**DC PNP**
Output	**normally closed**
Operating voltage [V]	10...36 DC
Current rating [mA]	100
Short-circuit protection	pulsed
Reverse polarity protection	yes
Overload protection	yes
Voltage drop [V]	< 2.5
Current consumption [mA]	< 10
Real sensing range [mm]	8 ± 10 %
Operating distance [mm]	0...6.5
Switch-point drift [% / Sr]	-10...10
Hysteresis [% / Sr]	3...15
Switching frequency [Hz]	400
Correction factors	mild steel = 1 / stainless steel approx. 0.7 / brass approx. 0.5 / Al approx. 0.4 / Cu approx. 0.3
Operating temperature [°C]	-25...70
Protection	IP 68 *) ⧈
EMC	IEC 1000-4-2 / EN 61000-4-2: 4 kV / CD / 8 kV AD IEC 1000-4-3 / EN 61000-4-3: 10 V/m, 80...1000 MHz IEC 1000-4-4 / EN 61000-4-4: 2 kV IEC 1000-4-6 / EN 61000-4-6: 10 V / 0.15...80 MHz EN 55011: class B
Housing material	housing: brass special coated active face: ceramics
Function display Switching status LED	yellow (4 x 90°)
Connection	M12 connector, gold-plated contacts

Wiring



Remarks	*) "Coolant"

Accessories (included)	2 lock nuts

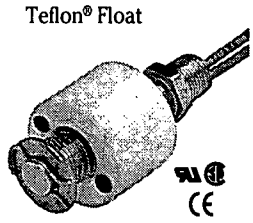
Small Size – Alloys

Rugged Durability, With Broad Heat and Pressure Capabilities, are Hallmarks of These Compact Switches

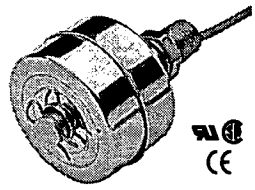
Ideal for shallow tanks or restricted spaces, or for low-cost, high volume use.

LS-1700 Series – Buna N Float

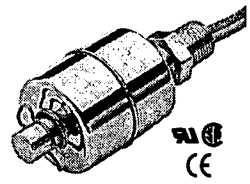
LS-1700 Series – Teflon® Float



LS-1750 Series – All Stainless Steel



LS-1755 Series – All Stainless Steel



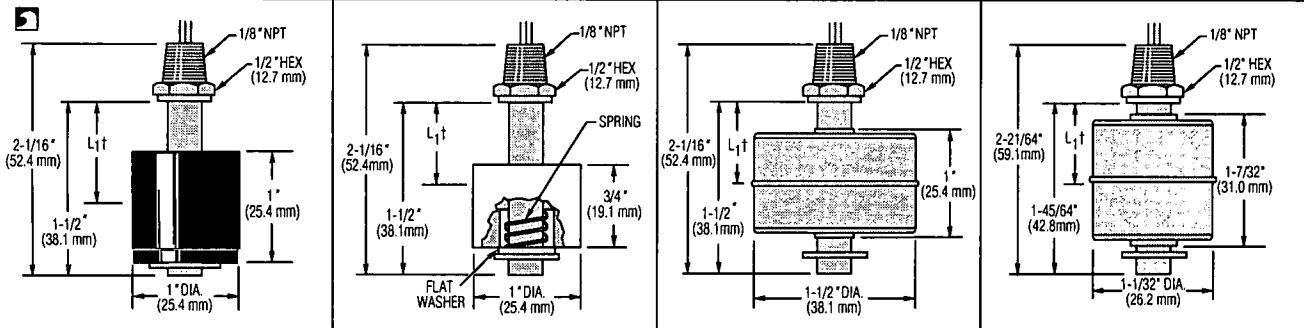
Offer broad chemical compatibility for general purpose use. Also ideal for oils and water.

Rugged construction suitable for most corrosive liquids, and for high temperatures and pressures. Stainless steel is generally recognized as safe (GRAS) with FDA for food contact regulations.

Dimensions

LS-1700 Series | **LS-1750 Series** | **LS-1755 Series**

Buna N Float | Teflon Float | Stainless Steel Float and Stem



L_1= 9/16" (14.2 mm) N.O.; 13/16" (20.6 mm) N.C. | L_1= 1/2" (12.7 mm) N.O. and N.C. | L_1= 5/8" (15.7 mm) N.O.; 3/4" (19.1 mm) N.C. | L_1= 37/64" (14.5 mm) N.O.; 53/64" (20.8 mm) N.C.

†L_1= Switch actuation level, nominal (based on a liquid specific gravity of 1.0).

Common Specifications

Electrical Termination: No. 22 AWG, 24" L., Polymeric Lead Wires, (except Part No. 79990 which has Teflon Lead Wires).

Approvals: Series Nos. LS-1700, LS-1750 and LS-1755 are U.L. Recognized – File No. E45168 and CSA Listed – File No. 30200.

Switch Operation: Units are shipped N.O. unless otherwise specified. Selectable, N.O. or N.C., by inverting float on unit stem (except for LS-1700 Series switches with Teflon® Floats; see selection in "How to Order" table).

How To Order – Select Part Number based on specifications required.

Series Number	Material: Stem and Mounting	Material: Float	Material: Other Wetted	Min. Liquid Sp. Gr.	Operating Temperature	Pressure, PSI, Max.**	Switch* SPST	Part Number
LS-1700	Brass	Buna N	316 S.S., Epoxy	.45	Water: to 180°F (82.2°C) Oil: -40°F to +230°F (-40°C to +110°C)	150	20 VA	**01701**
	316 S.S.						20 VA	**01702**
	316 S.S.	Teflon		.85	-40°F to +250°F (-40°C to +121.1°C)	1000	20 VA, N.O.	**26791**
							20 VA, N.C.	**27980**
LS-1750	316 S.S.	316 S.S.	316 S.S.	.70	-40°F to +300°F (-40°C to +148.9°C)	100	20 VA	**01750**
					-40°F to +480°F (-40°C to +248.9°C)		20 VA	**79990**
LS-1755	316 S.S.	316 S.S.	316 S.S.	.90	-40°F to +300°F (-40°C to +148.9°C)	275	20 VA	**01755**

* See "Electrical Data" on Page X-5 for more information.
** Higher pressures are temperature dependent.

Electrical Data

Standard reed switches in GEMS level switch units are hermetically-sealed, magnetically actuated, make-and-break type. Switches are SPST or SPDT and are rated in Volt-Amps (VA).

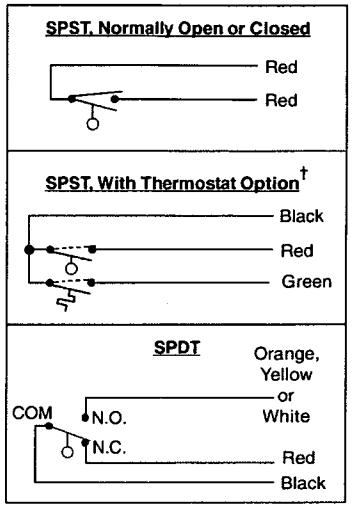
See the chart below for maximum load characteristics of GEMS level switches. CAUTION: Contact protection is required for transient or high in-rush current. Refer to GEMS Bulletin #133702 or call your GEMS representative.

VA	Volts	Amps AC	Amps DC
10 General Use	0-50	.2	.13
	120	.08	N.A.
	100	N.A.	.10
20 Pilot Duty	0-30	.4	.3
	120	.17	.13
	240	.08	.06
50 General Use	0-50	0.5	0.5
	120	.4	.4
	240	.2	.2
100*	120	.8**	N.A.
	240	.4	N.A.

* Not U.L. Recognized ** Limited to 50,000 operations

Typical Wiring Diagrams

(Circuit Condition Dry)



† Thermostat switches open or close when ambient temperature reaches specified setpoint. Thermostat units not CE approved.

European Pressure Directive Addendum

The product is designed and manufactured in accordance with Sound Engineering Practice as defined by the Pressure Equipment Directive 97/23/EC. This product must not be used as a "safety accessory" as defined by the Pressure Equipment Directive, Article 1, Paragraph 2.1.3. The presence of a CE Mark on the unit does not relate to the Pressure Equipment Directive.

CE This product is suitable for Class I and Class II applications only, per the requirements of standard EN60730 and any additional specific requirements for a particular application or medium being sensed. Class I compliance of metal bodied units requires a ground connection between the metal body and the earthing system of the installation. Class I compliance of plastic bodied units in contact with a conductive medium requires that the medium be effectively earthed so as to provide an earthed barrier between the unit and accessible areas. For Class III compliance, a supply at safety extra-low voltage (SELV) must be provided. Please consult the Factory for compliance information on specific part numbers.

Important Points!

Product must be maintained and installed in strict accordance with the National Electrical Code and GEMS product catalog and instruction bulletin. Failure to observe this warning could result in serious injuries or damages.

An appropriate explosion-proof enclosure or intrinsically safe interface device must be used for hazardous area applications involving such things as (but not limited to) ignitable mixtures, combustible dust and flammable materials.

Pressure and temperature limitations shown on individual catalog pages and drawings for the specified level switches must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.

Selection of materials for compatibility with the media is critical to the life and operation of GEMS level switches. Take care in the proper selection of materials of construction; particularly wetted materials.

Life expectancy of switch contacts varies with applications. Contact GEMS if life cycle testing is required.

Ambient temperature changes do affect switch set points, since the specific gravity of a liquid can vary with temperature.

Level switches have been designed to resist shock and vibration; however, shock and vibration should be minimized.

Liquid media containing particulate and/or debris should be filtered to ensure proper operation of GEMS products.

Electrical entries and mounting points may require liquid/vapor sealing if located in an enclosed tank.

Level switches must not be field repaired.

Physical damaged sustained by the product may render it unserviceable.

P/N 72947
Rev. W

Gems Sensors Inc.
One Cowles Road
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06062.1198

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Single-Station Level Switches

Instruction Bulletin No. 72947

Series	Mounting	HEX Size	Float Diameter
LS-1700**	1/8" NPT	1/2"	1" (Slosh Shield Version 1-13/32")
LS-1700TFE*	1/8" NPT	1/2"	1-1/8"
LS-1750**	1/8" NPT	1/2"	1-1/2" (Slosh Shield Version 1-13/16")
LS-1755**	1/8" NPT	1/2"	1-1/32"
LS-1800**	1/8" NPT	1/2"	1-1/4"
LS-1850**	1/2" NPT	3/4" Wrench Flat	3-1/2"
LS-1900**	1/4" NPT	5/8"	1-7/8"
LS-1900TFE*	1/4" NPT	21/32"	2-1/8"
LS-1950**	1/4" NPT	5/8"	2-1/16"
LS-19735*	1/4" NPT	5/8"	1-1/2"
LS-3*	1/8" NPT	1/2"	1"
	3/8" - 16 Str. Thd.	1/2"	1"
	1/8" NPT	1/2"	1-1/4" (Slosh Shield Version)
	1/8" NPT	1/2"	1-7/8" (P/N 76707)
	1/8" NPT	1/2"	3/4" (P/N 201540)
LS-30*	1/4" NPT	5/8"	1-7/8"
LS-38760**	1/4" NPT	9/16" Wrench Flat	1-7/8"
LS-74780*	1/4" NPT	5/8"	1-1/2"
LS-77700**	1/8" NPT	1/2"	1"
	3/8" - 24 Str. Thd.	3/4"	1-1/2"
TH 800-A*** Level Temp	1/4" NPT	5/8"	1-1/4"

*** Plastics** **** Alloys**

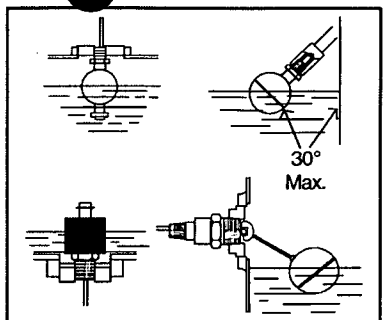
*** **Specialty Switches: Please use caution when handling these units, as shock may damage the thermostat temperature setting. Thermostat units not CE approved.**

Installation

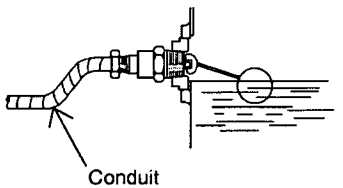
A standard NPT female boss in tank top, bottom or side is all that is required. Units operate in any attitude - from the vertical to a 30° inclination - with lead wires up or down. Standard IPS pipe extends units to any intermediate level in the tank. ***(Figure 1)***

Moisture Protection: When moisture exists in conduit and extension pipes, the potential for this moisture to "wick" down the wire leads and into the switch assembly exists. Should this happen, the switch will appear to be closed due to a high resistance path through the moisture. The following suggestions may help to prevent this from happening:

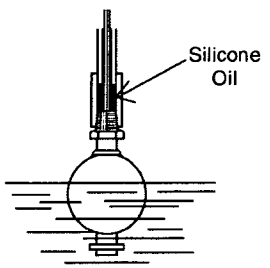
1. Pitch conduit away from the level switch when possible, so that condensation will drip away from the level switch assembly. ***(Figure 2)***
2. When a vertical run of extension pipe is used to extend a level switch down from the top of the tank, a non-conductive silicone oil should be used to fill the vertical run. Alternatively, an appropriate potting may be used to fill the vertical run to occupy the space in which condensation will normally form. ***(Figure 3)***



- Figure 1 -



- Figure 2 -



- Figure 3 -

CAUTION

Most of GEMS level products incorporate a potting cap or are fully potted. Due to the bonding characteristics of the potting to the wire leads, there is no way of assuring a water-tight seal at the potting joint. Our potting cap will resist moisture to some degree, but the precautions mentioned above should be used to assure moisture doesn't enter the switch and cause a short.

Consult your GEMS representative for more suggestions on how to lessen the effects of moisture.

Thread Treatment

1. Sealing: When threading metal threads into a metal coupling, pipe sealant or Teflon® tape is recommended. Due to potential compatibility problems, when sealing plastic threaded units, a compatible pipe sealant such as **No More Leaks**™ from Permatex® is recommended.
2. Tightening: When threading a plastic level switch into a metal coupling, the installer should use a suitable wrench and tighten the threads one to one and one-half additional turns past hand-tight. Over-torquing of the threads will result in damage to the plastic mounting plug.

No More Leaks is a trademark of Permatex® Industrial Corp., a subsidiary of Loctite Corporation. ***Teflon*** is a registered trademark of DuPont Corporation

3. The Effect of Thread Engagement on Actuation Points

The length of mounting threads engaged at installation is important in calculating switch actuation points and the actual length of stem extending into the tank. Use **the chart below** to find the thread engagement length (T) for a given NPT size. Factor the dimension into any calculation of switch actuation levels (L) and overall length (L_0).

NPT	1/8"	1/4"	1/2"	3/4"	1"	1-1/4"	2"	3"
T Dim.	.27"	.39"	.53"	.55"	.68"	.71"	.76"	1.20"

- See Examples Below -

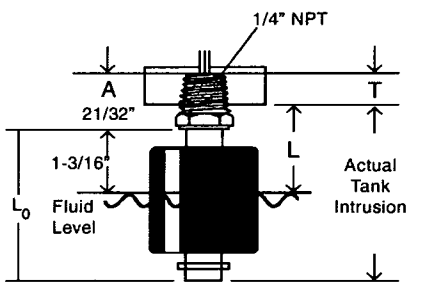
Definition of Variables Used in Examples Below

A = Mounting Length
T = Thread Engagement
P = Distance from coupling (bung) top to inside surface of tank or bracket
L_0 = Overall length from bottom of mounting
L = Switch actuation level as measured from inside surface of tank or bracket to fluid surface
L_1 = Switch actuation level, nominal, as measured from bottom of mounting (based on a liquid specific gravity of 1.0)

Internally Mounted LS-1900
(Standard Length)

LS-1900 Series internally mounted through a 1/4" NPT hole. To calculate "L" dimension:

$L = L_1 + (A-T)$
$L = 1\text{-}3/16" + (21/32" - .39")$
$L = 1.46"$



Internally Mounted LS-1700/1750
(Standard Length)

LS-1700/1750 internally mounted through a 1/8" NPT hole. To calculate "L" dimension:

$L = L_1 + (A-T)$
$L = .63" + (.56" - .27")$
$L = .92"$