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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Compressors for the process industry — Screw and related types — Specifications and data sheets for their design and construction

Compresseurs pour l'industrie de procédé — Types à vis et connexes — Spécifications et feuilles de données pour la conception et la construction

Reference number
ISO 8010 : 1988 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8010 was prepared by Technical Committee ISO/TC 118, *Compressors, pneumatic tools and pneumatic machines*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Contents

Compressors for the process industry — Screw and related types — Specifications and data sheets for their design and construction

0 Introduction

This International Standard contains two annexes in addition to the main text.

Annex A, which contains instructions subject to agreements in the contract, is given for information and guidance only and is not an integral part of this International Standard.

Annex B, which contains the data sheets, is an integral part of this International Standard.

1 Scope

This International Standard specifies the technical requirements for the design and construction of screw and related types of compressors used in the process industry. It also details the documentation requirements.

2 Field of application

This International Standard applies to rotary screw and related types of compressors used in the process industry. It covers the minimum requirements for dry and liquid-injected compressors and vacuum pumps with intermeshing rotors, e.g. Roots blowers.

This International Standard also covers certain requirements for compressor drivers, drive equipment, lubricating systems, controls, instrumentation and auxiliary equipment.

The compressors to which this International Standard applies are not normally used for critical process applications in refineries.

In addition, this International Standard will not normally apply to portable and other air compressors providing air power (for pneumatic tools etc.) nor to standard utility refrigeration compressors.

3 References

ISO 262, *ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts.*

ISO 898-1, *Mechanical properties of fasteners — Part 1: Bolts, screws and studs.*

ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units.*

ISO 1217, *Displacement compressors — Acceptance tests.*

ISO 1219, *Fluid power systems and components — Graphic symbols.*

ISO 1940, *Balance quality of rotating rigid bodies.*

ISO 2441, *Pipeline flanges for general use — Shapes and dimensions of pressure-tight surfaces.*

ISO 3511, *Process measurement control functions and instrumentation — Symbolic representation —*

Part 1: Basic requirements.

Part 2: Extension of basic requirements.

Part 3: Detailed symbols for instrument interconnection diagrams.

ISO 3989, *Acoustics — Measurement of airborne noise emitted by compressor units including prime movers —*

Part 1: Engineering method for determination of sound power levels. [1)]

Part 2: Method for determination of compliance with noise limits. [1)]

ISO 4126, *Safety valves — General requirements.*

ISO 7000, *Graphical symbols for use on equipment — Index and synopsis.*

ISO 7005-1, *Metallic flanges — Part 1: Steel flanges.* [1)]

IEC Publication 79, *Electrical apparatus for explosive gas atmospheres.*

IEC Publication 85, *Thermal evaluation and classification of electrical insulation.*

1) At present at the stage of draft.

4 Unit system

SI units (Système international d'unités) are used throughout this International Standard (see ISO 1000).

However, in addition to SI units, this International Standard also uses some non-SI units accepted by ISO 1000. These units are as follows:

- for pressure: bar (1 bar = 10^5 Pa)
- for volume: litre (1 litre = 10^{-3} m^3)
- for time: minute (1 min = 60 s)
- for time: hour (1 h = $3{,}6 \times 10^3$ s)

5 Definitions

5.1 General

5.1.1 oil-free, dry, compressor: A compressor where the medium being compressed is isolated from the lubricant system. The rotors, synchronized by timing gears, do not touch each other or the casing and therefore require no lubricant in the compression chamber. The air or gas is not contaminated by the lubricant nor any other liquid while passing through the compressor.

5.1.2 oil-free, liquid-injected, compressor: A compressor where the medium being compressed is isolated from the lubricant system but where a liquid is continuously injected into the compression chamber for the purpose of oil-free lubrication, cooling and sealing. Any separation of the liquid from the air or gas is carried out after the gas-liquid mixture leaves the compressor.

5.1.3 oil-flooded compressor: A compressor where oil is continuously injected into the compression chamber. Any separation of the oil from the air or gas is carried out after the gas-oil mixture leaves the compression chamber. Synchronizing gears may not be required.

5.1.4 standard inlet and discharge points: The points at the inlet and discharge flanges of the compressor.

NOTE — When the SUPPLIER provides piping or other parts between the points of demarcation, separate agreement should be made to define the inlet and discharge points.

5.1.5 swept volume for a displacement compressor: The volume swept in one cycle by the compressing element(s) of the compressor first stage.

5.1.6 displacement for a displacement compressor: The volume swept by the compressing element(s) of the compressor first stage per unit of time.

5.2 Pressures

5.2.1 effective (gauge) pressure: The pressure measured with reference to atmospheric pressure.

5.2.2 absolute pressure: The pressure measured with reference to absolute zero, i.e. with reference to an absolute vacuum. It equals the algebraic sum of the atmospheric pressure and the effective pressure (static pressure or total pressure).

5.2.3 static pressure: The pressure measured in a fluid under such conditions that the fluid velocity has no effect on the measurement.

5.2.4 total pressure: The sum of the static and dynamic pressures.

It designates the fluid condition at which the flow energy of the fluid is converted into pressure without any losses in a stationary body of fluid. In a stationary gas, the static pressure and the total pressure are numerically equal.

5.2.5 inlet pressure: The total mean absolute pressure at the standard inlet point.

NOTE — The total absolute pressure may be replaced by the static absolute pressure provided that the gas velocity and density are sufficiently low.

5.2.6 discharge pressure: The total mean absolute pressure at the standard discharge point.

NOTE — The total absolute pressure may be replaced by the static absolute pressure provided that the gas velocity and density are sufficiently low.

5.2.7 rated discharge pressure: The highest discharge pressure required to meet the conditions specified by the USER for the intended service.

5.2.8 design pressure: The maximum pressure which the component is designed to withstand safely.

5.2.9 maximum allowable working pressure: The maximum operating pressure which the SUPPLIER's design permits when handling the specified gas at any service conditions specified for the compressor or any part to which the term is referred, such as an individual stage.

5.2.10 relief valve set pressure: The opening pressure on the inlet side of a relief valve.

NOTE — For a differential-type valve the set pressure is the pressure difference across the valve when opening commences. The downstream pressure is termed the back pressure.

5.3 Temperatures

5.3.1 inlet temperature: The temperature at the standard inlet point of the compressor.

5.3.2 discharge temperature: The temperature at the standard discharge point of the compressor.

5.3.3 rated discharge temperature: The highest predicted operating temperature.

5.3.4 maximum allowable working temperature: The maximum gas temperature which the SUPPLIER or USER permits in the compressor, when handling the specified gas at any service conditions specified.

5.3.5 design temperature: The extreme temperature level(s) which the compressor is designed to withstand safely.

NOTE — This covers gas, coolant and ambient temperatures.

5.3.6 maximum expected discharge temperature: The highest predicted operating temperature resulting from any specified service condition, including part-load operation.

5.3.7 casing design temperature range: The range of temperatures to which the compressor casing may be continuously subjected at the casing design pressure.

5.4 Flow rate

5.4.1 actual volume rate of flow of a compressor (deprecated: "actual capacity"): The actual volume rate of flow of gas compressed and delivered at the standard discharge point referred to conditions of total temperature, total pressure and composition (e.g. humidity) prevailing at the standard inlet point.

5.4.2 standard volume rate of flow (deprecated: "standard capacity"): The actual volume rate of flow of compressed gas as delivered at the standard discharge point, but referred to standard conditions (for temperature and pressure).

5.4.3 inlet mass rate of flow: The mass flow of gas or gas mixture induced by the compressor at the standard inlet point(s).

5.4.4 discharge mass rate of flow: The mass flow of gas mixture delivered by the compressor at its standard discharge point(s).

5.5 Power

5.5.1 theoretical required power: In a compressor without losses, the power which is theoretically required to compress a gas according to the chosen reference process, from a given inlet pressure to a given discharge pressure.

5.5.2 driver coupling power: The maximum power required at the driver shaft, including losses in external transmissions such as gears or belt drives when such transmissions form part of the SUPPLIER's scope of delivery.

5.5.3 shaft input power: The power required at the compressor shaft, excluding losses in external transmissions.

5.6 Specific energy requirement

5.6.1 actual specific energy requirement: The shaft input power per unit of compressor actual volume rate of flow.

5.7 Speed

5.7.1 compressor speed: The rotational speed of the fastest rotor within the compressor stage.

5.7.2 rated compressor speed: The compressor speed necessary to meet the specified service conditions.

5.7.3 minimum allowable compressor speed: The lowest compressor speed at which the compressor may be continuously operated.

5.7.4 maximum allowable compressor speed: The highest compressor speed at which the compressor may be continuously operated.

5.7.5 input drive shaft speed: The rotational speed at the coupling linking the driver and its gearbox to the compressor and its integrated gearbox, if any.

5.8 Operating point

5.8.1 specified operating point: Any point at which the operation of the compressor is specified in the data sheets.

5.8.2 normal operating point: The point at which the usual operation of the compressor is expected.

5.8.3 rating point: The operating point, specified by the USER, at which the performance test data must comply with the specified data.

5.9 Plates

5.9.1 baseplate: A plate or structure supporting one piece of machinery, e.g. compressor, gear or driver.

5.9.2 common baseplate: A plate or structure supporting more than one piece of machinery, e.g. compressor, gear or driver.

5.9.3 soleplate: A plate or structure supporting one or more baseplates.

5.9.4 mounting pad: A plate under an individual support point of a machine.

6 Basic requirements

6.1 General

6.1.1 In the case of conflict between this International Standard and the enquiry or order, the information included in the order shall govern. The completed data sheets form part of the order.

6.1.2 Any documentation pertaining to the enquiry, proposal or order is of a proprietary nature and shall not be divulged to a third party except as may be necessary for the execution of the proposal or the contract.

6.1.3 The approval of documents (drawings) does not constitute permission to deviate from the order requirements unless specifically agreed upon in writing. Any such approval does not release the respective party from his contractual responsibilities.

6.1.4 For budget proposals, the short-form data sheets may be used.

6.2 The enquiry

6.2.1 The USER shall complete the data sheets to the extent possible and specify all process requirements, any known abnormal conditions and also, where this International Standard provides a choice or requires that a decision be made, all other items necessary for the SUPPLIER to make out his proposal.

6.2.2 The USER shall indicate the relevant design and safety codes and the exceptions to, or deviations from, those codes which he wishes the SUPPLIER to comply with.

6.2.3 The USER shall indicate in the data sheets the major spare parts he wishes to be included in the proposal.

6.3 The proposal

6.3.1 The SUPPLIER shall include the data sheets in his proposal, completed as applicable and as indicated by the USER, amplifying these as necessary to describe clearly the nature of his supply.

6.3.2 Unless otherwise specified in the enquiry, the SUPPLIER shall quote only for the instrumentation listed as mandatory in the data sheets and shall supply equipment to his own standard.

6.3.3 The proposal shall state the delivery time as being from the date of receipt of an order, on the basis that the information necessary to proceed with manufacture is received by the SUPPLIER in due time (see A.4.1).

6.3.4 The SUPPLIER shall describe the compressor flow rate control system and shall state the limits of his supply.

6.3.5 The proposal shall include either a specific statement that all equipment is in strict accordance with the USER's specifications or a specific list of deviations therefrom.

Deviations may include alternative designs provided that these are equivalent to, and guaranteed for, the specified duties.

6.4 Rating

6.4.1 Performance rating

The following performance rating shall be given:

a) The flow rate of the compressor shall be within $^{+8}_{0}$ % of the rated flow specified in the data sheets.

NOTE — Larger tolerances may be required for machines with a low flow rate or which handle certain gases (e.g. helium).

b) The specific energy requirement shall not exceed the rated value by more than 6 % at the rating point(s) identified in the data sheets.

Losses in external transmissions, such as gears, shall be stated in the data sheets.

The actual corrected test results shall lie within the rating limits prescribed above, including any measuring tolerances.

6.4.2 Tests

Test procedures shall be in accordance with ISO 1217 (see annex A).

6.5 Noise limitations

6.5.1 The limitations, if any, on airborne noise emission levels of the compressor and its accessories shall be indicated by the USER at the time of enquiry. It shall be the USER's responsibility to consider any noise specifications that may be applicable at the plant site when stating his requirements to the SUPPLIER. The latter shall not be liable for any cost incurred owing to incomplete USER's requirements.

Consideration should be given to part-load as well as full-load operation.

The SUPPLIER's information with regard to noise levels applies only to equipment in his supply.

6.5.2 The maximum permissible A-weighted sound power level in decibels re 10^{-12} W for the relevant octave bands of the noise output of the compressor and its accessories shall be stated by the USER in his enquiry.

The SUPPLIER shall state in his proposal the expected A-weighted sound power level, in decibels, of the main components in his supply.

6.5.3 Methods of measurement and interpretation shall be as stated in ISO 3989.

The responsibility for carrying out noise tests on site shall be agreed between the USER and the SUPPLIER and shall be stated in the data sheets.

NOTE — The sound pressure level in a compressor room depends on the sound power emission from the machines installed and the acoustical properties of the room. It is therefore not possible for the SUPPLIER to predict the final sound pressure levels at the work site.

6.5.4 The SUPPLIER shall quote separately for any noise-abating treatment, other than that normally built into the equipment, if necessary to comply with the noise limitations imposed.

6.5.5 If silencers to comply with these limitations are furnished by the USER, the SUPPLIER shall indicate the respective noise levels at his limits of supply.

6.5.6 Silencers and valves shall be located relative to each other in the piping system in such a way as to avoid any undesirable mutual influence during any operating condition of the compressor. This shall be by mutual agreement between the SUPPLIER and the USER.

6.5.7 Any special noise measurement (e.g. in pipes) shall be performed as agreed between the USER and the SUPPLIER.

7 Compressor

7.1 General

7.1.1 All equipment shall be suitable for the specified operating conditions and shall be designed for continuous full-load duty for at least 2 years of service. Before the USER places the order, the SUPPLIER shall be advised of any special conditions which may render the operation more severe. It is recognized that the above-mentioned operating time is a design criterion and that continuous operation for this period of time involves factors that are beyond the SUPPLIER's control. Therefore, one must differentiate between the design service life and the duration of guarantee.

7.1.2 All equipment shall be suitable for the local and climatic conditions specified by the USER in the data sheets, e.g. for outdoor installation within process plants.

7.1.3 If winter-proof protection is specified, it shall meet the following requirements.

a) During shut-down it shall be possible to drain all parts and piping which may contain water.

b) All equipment which may suffer from frost shall be protected as necessary. The responsibility for this protection shall be agreed between the USER and the SUPPLIER before the order is placed.

7.1.4 The number of individual compressors, the number of compression stages, and the compressor arrangement including the driver shall be agreed upon before the order is placed.

7.1.5 The USER shall provide adequate space for the erection, maintenance and operation of the equipment. The compressor design shall allow adequate and safe access for operation and maintenance. Special demands in the plant arrangement shall be specified by the USER before the order is placed.

7.1.6 Where required by process conditions and specified by the USER, adequate openings shall be provided to drain the process side of the SUPPLIER's supply.

7.1.7 The SUPPLIER may offer a liquid-injection system serving the purpose of lubrication, cooling, sealing or flushing. The liquid to be used shall be agreed with the USER.

7.1.8 Bearing housings and shaft seals shall be designed to minimize the ingress of moisture, dust and other foreign matter during periods of operation and idleness.

7.1.9 All characteristics of the coolant shall be specified by the USER. If no information is given, the coolant system shall be designed for filtered fresh water at a nominal effective pressure of 4,5 bar, and for a maximum pressure drop of 1 bar, at 25 °C and to withstand vacuum. Preferably, the pressure of the coolant should be below that of the lubricant. For a closed liquid system, provision for expansion of the liquid shall be incorporated.

7.1.10 When tools and fixtures, not commercially available, are required to dismantle or assemble the unit, the supply of these shall be the subject of agreement between the USER and the SUPPLIER.

7.2 Materials

7.2.1 The USER shall specify the presence of corrosive agents in the gases handled, in the utilities and in the environment, including constituents which may cause stress corrosion [e.g. hydrogen sulfide (H_2S)].

7.2.2 All materials of construction shall be of the SUPPLIER's standard with the exception that all materials for compressors and auxiliaries in contact with process gases shall be compatible with the gases handled (see also 7.3.3).

If the USER has particular requirements, he shall specify these in the data sheets. The SUPPLIER may suggest more suitable materials, on the basis of his experience.

7.2.3 Steels used for rotors, internal bolting etc. in contact with any gas which contains H_2S in the presence of water, shall not have a hardness exceeding 22 HRC when the tensile strength is equal to or greater than 62 MN/m^2.

7.2.4 Castings subject to pressure shall be sound and free of penetrating shrink or blow holes, scales, blisters or other similar casting defects.

Castings subject to pressure shall not be peened, plugged, burned in or impregnated, except as may be approved by the USER or an appropriate certifying authority. Internal surfaces of castings shall be cleaned by sand- or shot-blasting, pickling or another recognized method.

All mould parting fins and remains of gates and risers shall be chipped, filed or ground flush.

7.2.5 The use of chaplets in castings subject to pressure shall be kept to a minimum. The chaplets shall be clean, rust free (plating is permitted) and compatible with the casting.

Chaplets not completely fused into castings shall be replaced by a weld equivalent in composition to the steel casting or by a screwed plug made of cast iron.

All welded connections (structural welds) on casings, pressure-containing castings, and repair welds shall be undertaken in accordance with the following conditions:

a) the materials shall be suitable for welding and the filler metals shall be compatible with the parent metal;

b) the welding process shall be selected according to the material properties, workpiece thickness and stress on the welded connection;

c) for welds requiring inspection authority approval, welders shall be suitably qualified by an agreed authorizing body (see also 7.2.4);

d) steel castings may be repaired by welding in accordance with the SUPPLIER's national specifications or equivalent for similar material.

7.2.6 Fully enclosed cored voids, including voids closed by plugging, shall not be used.

7.3 Casings

7.3.1 The design pressure of the casings shall be at least the highest pressure which can occur during running or shut-down conditions. Pressures above normal working pressure which can occur during shut-down due to the process shall be stated in the enquiry.

7.3.2 The thicknesses of casings shall include allowance for corrosion caused by the gas handled, the coolant and/or the atmosphere, unless corrosion-resistant materials are used.

7.3.3 The following minimum requirements shall be observed when selecting casing materials, unless otherwise specified by the USER.

a) Cast iron with lamellar graphite (grey cast iron) is acceptable for air and all other gases up to an effective service pressure of 32 bar and at service temperatures between −60 and +260 °C.

b) Nodular cast iron is acceptable for air and all other gases up to an effective service pressure of 64 bar and at service temperatures between −60 and +320 °C.

c) If the gas handled is highly corrosive to cast iron and mild steel, stainless castings shall be used. Corrosion-proofed material may be used if agreed upon between the USER and the SUPPLIER.

d) For higher pressures and temperatures, steel castings shall be used.

e) For gas temperatures below −60 °C, the casing materials shall be agreed upon between the USER and the SUPPLIER.

f) Other materials may be used subject to agreement between the USER and the SUPPLIER.

7.3.4 Lifting lugs, eyebolts, jackscrews or equivalent, as well as dowel pins, shall be provided to facilitate assembly and dismantling. When jackscrews are furnished, provision shall be made to prevent damage to the mating flange.

7.4 External forces and moments

The piping connected to the compressor shall be arranged to eliminate as far as possible forces and moments at the connecting flanges.

The compressor shall be designed to withstand external forces and moments at least equal to a value calculated as follows.

The lateral forces shall be equal to $D \times 50$ N, where D is the nominal bore (in millimetres) of the flange concerned (suction or discharge).

The bending moment shall be equal to $D \times 10$ Nm, where D is as defined above.

7.5 Bolting

7.5.1 All threads shall be metric in accordance with ISO 262 unless otherwise agreed.

7.5.2 Tapped holes for bolting shall be kept to a minimum. Studs are preferred to bolts, except when threaded inserts are used.

A metal thickness of at least half the stud diameter shall be left at the bottom of such holes to prevent leakage in pressure sections and to prevent damage when inserting the threaded components.

7.5.3 Bolts or studs for casing joints shall be designed to withstand the compressor hydraulic test pressure. At temperatures between −60 and +320 °C, they shall meet a minimum property class of 4.6 for cast iron and 5.6 for steel casings according to ISO 898. For higher and lower temperatures, as well as for corrosive media, the materials for fasteners for casing joints shall be selected according to the SUPPLIER's standards.

7.6 Casing connections for piping

7.6.1 Casing connections should be flanged or studded bosses wherever possible. Flanges are mandatory for pipe sizes of 50 mm bore and larger, whilst threaded connections are permitted for smaller sizes. This requirement applies, in particular, to the following secondary connections:

a) lubricant;

b) vents;

c) casing drains;

d) seal gas and seal liquid;

e) pressure equalizing pipes, unless both ends are welded or brazed to the casing;

f) coolant;

g) flushing media;

h) instruments;

i) injection.

7.6.2 All connections to which the USER will connect equipment shall conform to the standards specified in the enquiry or be provided with mating flanges or screwed adaptors.

All flanged connections to which the SUPPLIER's secondary piping will be connected shall conform to ISO 7005-1 (metallic flanges) or as otherwise agreed.

7.6.3 The sealing faces shall conform to ISO 2441.

7.7 Rotors

7.7.1 Rotors with their shafts may be an assembled or a one-piece unit. Cast iron, steel or stainless steel may be used as rotor materials, depending on the operating conditions. Other materials may be agreed upon for special applications.

7.7.2 When timing gears are used, they shall allow adjustment of the relative rotor positions. The locking shall be accessible with the rotors mounted in the casing.

7.8 Bearings and bearing housings

7.8.1 All compressor bearings shall be replaceable.

7.8.2 Thrust bearings shall be designed to accommodate all axial thrust developed during all specified conditions of operation and also to handle reverse thrust, which may develop. Further, these bearings shall be adjustable axially. When thrust collars are used, they shall be replaceable.

7.8.3 Radial bearings and thrust bearings shall be designed for pressure lubrication and arranged to minimize lubricant foaming. Drain openings shall be liberally sized.

NOTE — Straight-lobed (Roots) blowers and light-duty compressors do not always require pressure lubrication.

7.9 Shaft sealing

7.9.1 Gas seals shall be provided to prevent or restrict leakage out of the compression chamber or the ingress of air or foreign matter into the compression chamber during operation and, if necessary, during shut-down periods. Any leakage limitation shall be specified by the USER in his enquiry. Variations in operating conditions that may occur during start-up and shut-down shall be taken into consideration. Shaft seals shall be designed to prevent uncontrolled leakage, in particular of harmful, toxic or flammable gases.

Such gases shall not be allowed to escape freely but shall be discharged from the compressor in a safe manner. Seals using liquid or gas as the sealing medium, or combination seals, may be used for this purpose. In special cases journal bearings may act as shaft seals.

7.9.2 Lubricant seals shall be provided to prevent leakage of lubricant either from the compressor or into the process through the gas shaft seal.

7.10 Balancing

Dry compressor rotors shall be dynamically balanced to balance quality grade 2,5 according to ISO 1940.

7.11 Baseplate

7.11.1 The baseplate, when included in the SUPPLIER's supply, should be sufficiently stiff to maintain alignment after initial installation and alignment. If a pillar-type foundation or other special compressor support is to be used, this shall be specified in the enquiry. The baseplate shall not be used by the USER for fixing other units or piping, unless agreed to by the SUPPLIER.

7.11.2 A foundation supplied by the USER shall be designed to protect the compressor from harmful external vibrations.

7.12 Rating plate and direction of rotation

7.12.1 The rating plate on the compressor shall be made of stainless steel or Monel. The plate shall be fixed at a clearly visible point.

The following minimum data shall be clearly stamped on the rating plate:

a) manufacturer;

b) model designation and serial number;

c) flow rate;

d) input drive shaft speed.

7.12.2 The direction of rotation of the compressor drive shaft shall be clearly shown by an arrow either cast into or permanently attached to the compressor casing.

8 Drivers and drive equipment

8.1 Drivers

8.1.1 General

The type of driver shall be specified by the USER. In the determination of the size of the driver, account shall be taken of the transmission losses (e.g. gear units or hydraulic couplings). The compressor starting torque curve, supplied by the SUPPLIER, shall be considered when selecting the driver.

Anticipated process variations, such as changes in gas composition and inlet or discharge pressures, shall be specified by the USER to permit sizing of the driver. When the USER supplies the driver or the gearbox, he shall specify any lubrication requirements to be met by the SUPPLIER.

The responsibility for drive train components (e.g. couplings) and for the torsional analysis shall be defined prior to the contract.

8.1.2 Electric motor

An electric motor serving as the main driver shall be rated for a continuous output power of at least 115 % of the maximum power required at any specified operating point. Area classification and other design characteristics shall be as specified in the data sheets.

8.1.3 Steam turbine

A steam turbine serving as the main driver shall be rated as follows.

a) It shall be capable of continuously producing a rated power of at least 115 % of the necessary power at each specified operating point and at the speeds specified in the data sheets.

b) It shall be possible to develop this power at the worst combination of steam conditions specified in the data sheets.

8.1.4 Combustion engine or gas turbine

These shall be sized by mutual agreement between the SUPPLIER and the USER.

8.1.5 Reciprocating-type driver

Where the driver is of the reciprocating type, a torsional analysis of the complete system shall be carried out; this analysis shall be the responsibility of the party supplying the driver.

8.1.6 Expander

If an expander is the only driver of the compressor, its rating shall be equal to that for the steam turbine (see 8.1.3).

8.1.7 Other types of driver

In all other cases, the sizing and operation of the drivers shall be agreed upon between the USER and the SUPPLIER.

8.2 Main transmission gear

8.2.1 Main transmission gears shall be according to the SUPPLIER's national standard or as specified by the USER.

8.2.2 Main transmission gears shall be capable of continuously transmitting the rated driver power multiplied by the application factor given in table 1 for various drivers.

Table 1

Driver	Application factor
Steam turbine	1,3
Gas turbine	1,3
Electric motor	1,3
Rotary expander	1,3
Reciprocating engine, 4 to 7 cylinders	1,8
Reciprocating engine, 8 cylinders or more	1,4

8.2.3 The main transmission gear shall be rated to transmit the maximum torque available from the driver under all operating conditions specified, including start-up.

8.2.4 Thrust bearings, if used, shall be sized to absorb axial gearing forces, as well as any axial thrust caused by friction in the couplings.

8.2.5 The rotating parts of the gear of dry compressors shall be dynamically balanced to balance quality grade 2,5 according to ISO 1940.

8.2.6 The directions of rotation of driven and driving shafts shall be clearly indicated by directional arrows either cast into or permanently attached to the gear casing.

8.2.7 The rating plate on a gearbox shall be made of stainless steel or Monel. The plate shall be fixed at a clearly visible point. The following minimum data shall be clearly stamped on the rating plate:

a) manufacturer;

b) model designation and serial number;

c) continuous power rating;

d) rated input/output speed;

e) input/output speed.

8.3 Main shaft couplings

In the connections between driver and compressor allowance shall be made for misalignment between the shafts. If the compressor and gearbox are mounted on a base frame and the driver is mounted separately, a coupling shall be used which takes up any differential expansion and minimizes additional forces on the shafts.

8.3.1 If the maximum peripheral speed of the coupling exceeds 25 m/s the metallic parts of the coupling shall be made of steel.

8.3.2 The coupling shall be capable of continuously transmitting the rated drive power multiplied by the application factor given in 8.2.2.

8.3.3 Couplings shall be rated to transmit the maximum torque available from the driver under start-up and all operating conditions.

8.3.4 Gear-type couplings for shaft speeds above 3 600 r/min shall be provided with through-flow lubrication and care shall be taken to avoid sludge build-up in the coupling. The lubricant filtration shall be agreed with the coupling manufacturer.

8.3.5 Couplings shall be designed to allow uncoupled operation of the driver, where the design of the driver permits such operation. The USER shall specify in the enquiry if it is necessary to remove the coupling with the compressor and driver in position.

Couplings with limited axial float shall be employed where an electric motor is used whose rotor is held axially by the magnetic field only. This shall be made known to the SUPPLIER in the enquiry if the USER is supplying the motor.

8.3.6 The USER and the SUPPLIER shall agree who is to supply the couplings between the driver and the compressor and who is responsible for the balancing and assembly. Coupling bolts shall be selected by mass to permit interchange without affecting the balance.

8.3.7 Coupling halves shall be mounted by cylindrical or conical fits.

8.3.8 Easily removable guards shall be provided on all exposed couplings and shafts. The guards shall be strong enough to prevent any mechanical contact with the coupling or shaft as a result of bodily contact.

9 Auxiliary equipment

9.1 General

9.1.1 All auxiliaries which come within the scope of pressure vessel codes (including gas coolers, silencers, separators and traps) shall be designed, manufactured, inspected and tested in accordance with a recognized code, stated by the SUPPLIER in the data sheets, unless the USER specifically invokes a particular code at the time of enquiry.

All flanges to which auxiliary pipes supplied by the SUPPLIER are connected shall conform to ISO 2441 unless otherwise agreed.

9.1.2 For carbon steel surfaces in gas cooler shells, silencers, separators, traps or other auxiliaries which are not classified as pressure vessels, but which are exposed to water or other corrosive media, a minimum corrosion allowance of 3 mm shall be incorporated, unless alternative methods of protection are agreed. This requirement does not apply to cooler tubes.

9.1.3 All welding of pressure vessels, pressure casings, piping and repairs shall be performed under the following conditions.

a) Materials shall be suitable for welding, and welding materials shall be compatible with the base material according to the SUPPLIER's national standard.

b) The welding method shall be chosen according to the material characteristics and the thickness and stress of the welded joint.

c) Only welders approved by the SUPPLIER's national authority shall be employed.

d) Components which are fabricated by welding shall be stress relieved, if required, so that both the welds and the heat-affected zones meet the yield strength and hardness requirements.

e) Where any pressure casting is repaired by welding, the SUPPLIER shall inform the USER of the details of the repair.

9.1.4 Design pressures of auxiliaries in the process stream shall be at least the highest pressure which can occur during running or shut-down conditions.

9.1.5 Design temperatures of auxiliaries in the process stream shall comply with the definition of the maximum and minimum allowable working temperatures (see 5.3.4).

9.2 Coolers

9.2.1 All characteristics of the coolant shall be specified by the USER. If no information is given, the coolant system shall be designed for filtered fresh water at a nominal effective pressure of 4,5 bar, and for a maximum pressure drop of 1 bar, at 25 °C and to withstand vacuum.

In special applications (e.g. where chlorine is used) it may be desirable to keep the coolant pressure below the gas pressure.

9.2.2 The minimum fouling factors for the water side of coolers shall be as given in table 2.

Table 2

Water	Fouling factor $m^2 \cdot K/W$
Closed circuit (treated)	$0{,}85 \times 10^{-4}$
Normal cooling tower	$1{,}7 \times 10^{-4}$
Brackish	$3{,}4 \times 10^{-4}$

The velocity of the water inside the tubes should be greater than 1,0 m/s to avoid the build-up of silt.

9.2.3 All coolers shall be rated for the most severe operating conditions specified in the data sheets (e.g. coolant temperature, gas density and flow rate).

9.2.4 All flanges to which connections are made by the USER or another furnisher commissioned by him shall be executed in accordance with the standard specified by the USER in the enquiry or, alternatively, the mating flanges shall be provided by the SUPPLIER.

9.2.5 The coolant flow rate, temperature rise and pressure drop shall be stated in the data sheets.

9.3 Silencers

9.3.1 Except for liquid-injected compressors, the SUPPLIER shall supply first-stage inlet and final-stage discharge silencers and when necessary interstage silencers.

9.3.2 The design of the silencers shall take into account the most severe operating conditions (e.g. maximum flow rate, pressure and temperature) and corrosion specified in the data sheets.

9.3.3 All flanges to which connections are made by the USER or another furnisher commissioned by him shall be executed in accordance with the standards specified by the USER in the enquiry or, alternatively, the mating flanges shall be provided by the SUPPLIER.

9.4 Separators and traps

9.4.1 Liquid separators shall be provided downstream of the coolers if specified by the USER or deemed necessary by the SUPPLIER. The USER shall furnish pertinent information to the SUPPLIER.

9.4.2 Unless otherwise specified by the USER, each separator shall be fitted with a drain trap, complete with isolating and blow-down valves.

9.4.3 Manually drained separators shall have a holding volume or separate tank to permit continuous full-duty utilization without drainage for two shifts.

9.5 Pipework (general)

The piping provided by the SUPPLIER for each circuit shall be classified by him according to the following categories.

Category 1: Piping completely fabricated and installed at the SUPPLIER's works but which may be removed for transportation. Any removal shall be carried out in such a way that the piping will merely require assembly at site.

Category 2: Part of piping is fabricated and installed at the SUPPLIER's works (and, as in category 1, may be removed for transportation). The remainder of the SUPPLIER's supply is provided as category 3 or 4, as may be defined by him.

Category 3: Piping fabricated to match the intended site arrangement but supplied with closing lengths for final fabrication at site.

Category 4: Piping supplied as straight lengths (or coils as appropriate) with bends and other fittings necessary for fabrication at site to an agreed arrangement of pipe runs or to an agreed quantity.

9.6 Process gas pipework

9.6.1 The process gas pipework shall be in accordance with a relevant recognized national specification of the SUPPLIER's choice, unless the USER specifically invokes another specification at the time of enquiry.

Such a specification shall be supplemented by 9.6 of this International Standard except where the requirements of the specification and this International Standard are in conflict. In this case, the specification shall govern.

Pipe sizes not preferred in national standards shall be avoided.

9.6.2 The scope of supply of process gas pipework shall be defined in the data sheets.

9.6.3 Terminal point isolating valves shall not form part of the SUPPLIER's normal supply.

9.6.4 The SUPPLIER shall deliver all the jointing and bolting as necessary for the mating connections of his supply, excluding the terminal connections.

9.6.5 On wet-gas service, low-point drains or valves shall be provided in the gas pipework.

9.6.6 The SUPPLIER shall define precisely the location, size and type of his terminal connections.

9.6.7 The design pressure of all gas pipework, flanges and fittings shall be at least the highest pressure which can occur during running or shut-down conditions.

9.6.8 The USER shall state in the enquiry any pipe sizes which are not acceptable at the points to which he has to connect.

9.6.9 The minimum size for process gas pipework shall be 20 mm internal diameter.

9.6.10 Screwed connections sealed by brazing or welding shall not be coated beforehand with thread lubricant or sealing compound. The seal welds shall comprise at least two passes.

9.6.11 All pipes shall be routed to ensure adequate elasticity and access for operation, maintenance and cleaning.

9.6.12 All pipework and associated auxiliaries shall be supported such that the possibility of damage due to vibration, thermal expansion and the mass of the pipework and associated auxiliaries is minimized.

9.6.13 The USER's own piping installation shall not impose loads on the SUPPLIER's equipment except as specified in 7.4.

9.6.14 The use of flexible joints to allow for thermal expansion and to reduce stresses in the piping systems is subject to USER acceptance.

Express attention is drawn to the fact that the furnisher of such joints should be consulted by the SUPPLIER with regard to the necessary procedures to be adopted for installation.

9.7 Non-return and relief valves

9.7.1 A non-return valve shall be used with all screw compressors, whether single- or multi-stage plants.

9.7.2 Relief valves (see ISO 4126) shall be fitted to each separate compressor stage and dimensioned to handle the full compressor flow rate. The set pressure and the full-flow pressure shall be determined by the SUPPLIER to protect the equipment in his supply.

9.7.3 The SUPPLIER shall select the relief valve for the normal back pressure unless the USER specifies in his enquiry that a higher pressure may be developed downstream of the valve under special conditions.

9.8 Auxiliary pipework

9.8.1 The auxiliary systems are as follows:

a) lubrication;
b) venting;
c) drainage;
d) gas and liquid sealing;
e) gas equalization;
f) cooling;
g) flushing;
h) instrumentation;
i) injection;
j) heating;
k) control.

The associated fittings, control devices and measuring devices shall also be subject to the requirements of 9.5.

9.8.2 Except where the gas or lubricant demand special materials, seamless carbon steel pipe shall be used for the gas and lubricant lines. Coolant lines may be made of seam-welded pipe. If it is necessary that parts of the piping are made of corrosion-resistant material, the USER shall specify this in the enquiry.

9.8.3 Fittings and valves in auxiliary systems shall be made of steel with the exception of special valves where an agreement between the USER and the SUPPLIER shall be made.

A nominal effective pressure of 6 bar shall be taken as the minimum pressure rating for all connections.

Copper or plastic pipe is permissible for measuring and control lines with agreement of the USER.

9.8.4 The dimensions of piping shall be in accordance with the relevant International Standards or national standards.

9.8.5 Lubricant return lines shall be dimensioned and arranged so that a satisfactory discharge rate is obtained (allowing for possible foaming). Pipes running "horizontally" should have a constant slope of at least 20 mm per linear metre towards the oil reservoir (i.e. 1 in 50).

9.8.6 Drain lines, other than from instruments or controls, shall be of 20 mm internal diameter as a minimum. The USER shall arrange his drainage system to dispose safely of any process gas which accidentally gains access.

9.8.7 All auxiliary piping provided by the SUPPLIER and which is within the perimeter of the baseplate or part of an auxiliary unit (e.g. oil console or control panel) shall be complete, together with associated control and measuring devices. Interconnecting pipes outside the perimeter of the baseplate but within the SUPPLIER's scope of supply may be fabricated on site.

9.8.8 The pipe systems should preferably be made by bending and welding. Welded fittings and flanges shall be of butt weld, socket weld or slip-on types.

Threaded connections are permissible for pipe sizes up to 50 mm internal diameter and for a nominal effective pressure of 10 bar but they should be limited to a minimum.

9.8.9 Screwed connections sealed by brazing or welding shall not be coated before and with thread lubricant or sealing compound. The seal welds shall comprise at least two passes (see 9.6.10).

9.8.10 Auxiliary lubricant pipes made of carbon steel shall be pickled and passivated after fabrication.

9.8.11 All pipes shall be routed to ensure adequate elasticity and access for operation, maintenance and cleaning (see 9.6.11).

9.8.12 All pipework shall be well secured so that vibration is reduced to a minimum.

10 Lubricant and seal liquid system

10.1 General

10.1.1 A complete pressure lubricating system shall be furnished as applicable with each compressor unit to supply lubricant, at a suitable pressure, to the following:

a) the gearbox and bearings of the compressor;
b) the bearings of the main driver;
c) the couplings;
d) the turbine governor, trip and throttle valve;
e) the shaft seal system;
f) the timing gears.

10.1.2 When specified by the USER, a separate seal liquid system shall be provided by the SUPPLIER.

10.1.3 The SUPPLIER shall coordinate lubricant qualities, pressures and flows for the main driver, gearbox, if any, compressor and seals.

10.1.4 All equipment, including pumps, filters, strainers, coolers, pressure gauges and control valves, shall meet the SUPPLIER's national standard unless otherwise specified. Valved

vent connections and any necessary piping shall be furnished to permit cleaning, filling and draining of idle equipment while the compressor is in operation.

10.1.5 Any grease nipple requiring regular attention shall be easily accessible when the compressor is in operation.

10.1.6 When specified, a replaceable steam heating pipe, or a low watt density (maximum, 25 kW/m^2) thermostatically controlled electric heater, shall be provided for heating the lubricant prior to start-up in cold weather. When steam heating is used it shall be arranged so that a failure of steam heating pipes does not allow steam to enter the compressor lubricant system. A separate vented space filled with heat-transfer fluid may be used between the steam heating pipes and the lubricant reservoir, or the heating pipes may be mounted outside the reservoir. The heating apparatus shall have sufficient power to heat the lubricant in the reservoir from -15 to $+20$ °C in 12 h.

Reservoirs shall be fitted with supports for heat insulation when specified by the USER in the enquiry. The USER shall furnish and install the insulation.

10.1.7 The piping and instrumentation diagram for oil-free compressor lubrication systems shown in the figure is for guidance only and may be modified to suit specific requirements.

10.2 Lubricant reservoirs for lubricant-free compressors

10.2.1 The lubricant reservoir may be separate from the compressor baseplate or may be incorporated into it.

10.2.2 When lubricant reservoirs are separate from the compressor baseplate, the drain pipe shall slope by a minimum of 75 mm per linear metre and shall enter the reservoir above the maximum lubricant level.

10.2.3 The reservoir shall be sealed against dirt, water etc. All cover openings in the top surface shall be sealed using gaskets and shall be raised at least 20 mm above the surface to avoid the entry of solids and water.

10.2.4 Reservoirs shall be designed for complete drainage, preferably by incorporating a sloping bottom with the drain connection at the lowest point. Inspection openings shall be provided to permit inspection and cleaning of the interior.

Pipe connections to the reservoir shall be flanged. The pump suction connection shall be located at the "high end" of the reservoir when a sloping bottom is fitted. The lubrication system shall be designed to avoid lubricant foaming and to avoid generation of static charge.

At the lowest point in the reservoir, a pipe connection with a blank flange of 25 mm size or more shall be provided for drainage or for connection to a centrifuge. The filling connection shall be used as the return connection in the reservoir for the return of the centrifuged lubricant.

10.2.5 A filling connection of at least 50 mm diameter shall be provided and equipped with a strainer. A visible lubricant level indicator, preferably a sight gauge, shall be supplied. The reservoir shall include degassing facilities if necessary, and shall be equipped with a suitably sized vent and breather filter.

10.2.6 The lubricant reservoir shall be sized in accordance with the following requirements.

a) For degassing and contaminant settling-out: the total reservoir lubricant volume below the minimum operating level shall provide a retention time of 4 min, on the basis of the time necessary for the total lubricant return to flow from the machinery to the reservoir at the normal operating point of the compressor.

b) For safety in the event of breakage or leakage: the reservoir lubricant volume between the minimum operating level and the level at which the pump commences to cavitate shall be sufficient for operation for 2 min on the basis of the time necessary for the total lubricant return to flow from the machinery to the reservoir at the normal operating point of the compressor.

The volume of the reservoir shall be sufficient to hold all the lubricant that drains back at shut-down.

10.3 Pumps and drivers

10.3.1 Positive displacement or centrifugal pumps may be positioned below the minimum lubricant level according to the SUPPLIER's standard. Centrifugal pumps shall have submerged suction. Provision shall be made for automatic and manual starting of standby pumps.

10.3.2 When a standby pump is fitted, it shall be controlled automatically to start up to provide pressure and to maintain safe operation on failure of the main pump or on reduction in pressure for other reasons. If necessary, accumulators shall be included to maintain pressure while the standby pump is coming up to pressure.

The lubricant cooler and the lubricant filter shall be rated to take the lubricant flow from one pump only, unless otherwise specified.

When specified by the USER, a test bleeder valve and restriction(s) shall be provided in the connection to the pressure-sensing device to permit checking of the control and operation of the standby pump while the main pump is operating. This device shall be independent of the low lubricant pressure trip and shall have electric contacts when specified.

10.3.3 A means of maintaining lubricant pressure shall be provided. Pressure maintenance devices shall operate smoothly without chattering and shall be located to be accessible for adjustment during running. These devices shall be sized so that the pressure will not rise more than 15 % when both the main and the standby pumps are in operation. Where positive displacement pumps are furnished, pressure relief valves shall be provided and shall discharge excess lubricant to the reservoir.

10.3.4 When more than one pump is fitted in the lubricant system, each pump shall have a non-return valve in its discharge line.

10.3.5 Easily removable guards shall be provided on all exposed rotating parts. The guards shall be strong enough to prevent any contact with the parts as a result of bodily contact (see 8.3.8).

10.4 Lubricant coolers

10.4.1 A single cooler shall be provided unless the USER specifies otherwise. Twin coolers shall be piped in parallel, using continuous-flow change over or individual valves to permit isolation of either cooler. Each cooler shall be sized for the total heat load. When twin coolers are provided, they shall be located and arranged to permit removal of a cooler or tube bundle while the compressor is in operation.

10.4.2 Coolers shall be supplied to the SUPPLIER's national standard unless otherwise specified.

10.4.3 Coolers shall be suitable for a lubricant system pressure not less than the relief valve setting for a positive displacement pump or for the maximum discharge pressure of centrifugal pumps and the specified coolant pressure.

All characteristics of the coolant shall be specified by the USER in the enquiry. If no information is given, the coolant system shall be designed for filtered fresh water at an effective pressure of 4,5 bar, and for a maximum pressure drop of 1 bar, at 25 °C and to withstand vacuum.

Preferably the pressure of the coolant should be less than that of the lubricant.

10.4.4 Filling, draining and venting connections shall be provided on both coolers when twin coolers are used.

10.5 Filters

10.5.1 Twin full-flow lubricant filters capable of removing particles greater than 25 µm in diameter shall be furnished for bearings and seals. Replaceable filter elements shall be used. Bypass valves shall not be used.

10.5.2 Filter casings and filter elements shall be suitable for operation at a pressure not less than the relief valve setting of positive displacement pumps or the maximum discharge pressure of centrifugal pumps. Filter element cartridge materials shall be corrosion resistant to water in the lubricant.

10.5.3 The filter shall be located downstream of the cooler and shall have continuous-flow change over or individual valves to permit changing the filter element while the compressor is in operation.

10.5.4 Filling, draining and venting connections shall be provided on both filters.

10.6 Liquid-injected screw and related compressors

10.6.1 General

A liquid may be injected into the gas being compressed in screw and related compressors, e.g. for the purpose of performance improvement, temperature control, or cleaning of deposits from rotors and casings. The liquid may be passed on with the process gas or may be separated and recycled to the compressor after cooling and filtering as appropriate.

The requirements in 10.1 to 10.5 shall also apply to liquid-injected compressor lubrication systems with the exceptions listed in 10.6.4 and 10.6.5.

10.6.2 Case where injected liquid is not compressor lubricant

Where the injected liquid is not the lubricant of the compressor bearings etc., a separate lubrication system shall be fitted which shall comply with the specifications given in 10.1 to 10.5.

10.6.3 Case where injected liquid is compressor lubricant

Where the injected liquid is also the compressor lubricant, as in the case of oil-flooded compressors, the lubricant system pressure is related to the compressor discharge pressure. The lubricant is also in direct contact with the process gas during the compression cycle. The compressor shaft seals shall be lubricated from the compressor lubrication system, as shall an integral gearbox, if used.

A separate lubrication system shall be provided where necessary for an independent gearbox and main driver and this shall comply with the same requirements as specified for the lubrication system of dry compressors in 10.1 to 10.5.

With this type of compressor, lubricant is injected into the gas during compression. The lubricant-gas mixture is passed to the lubricant tank/separator where the lubricant is removed from the gas. This vessel (or vessels) is (are) therefore at the compressor discharge pressure. Lubricant is fed by pump or discharge pressure through the cooler and filter to the compressor with a pressure relief valve fitted when a positive displacement pump is used.

10.6.4 Reservoir for lubricant-injected compressors

a) The reservoir may be combined with the separator or may be a separate vessel.

b) Reservoirs shall be designed for complete drainage.

c) Pipe connections to the reservoir shall be flanged.

d) A filling connection of at least 50 mm diameter shall be provided. A level indicator shall be supplied.

e) Each reservoir shall have a minimum retention time of 30 s, on the basis of the normal flow rate through the reservoir, unless otherwise specified. Normal flow rate is defined as the amount of lubricant required by bearings, seals, and injection and other equipment being supplied, but does not include any lubricant bypassed directly to the reservoir.

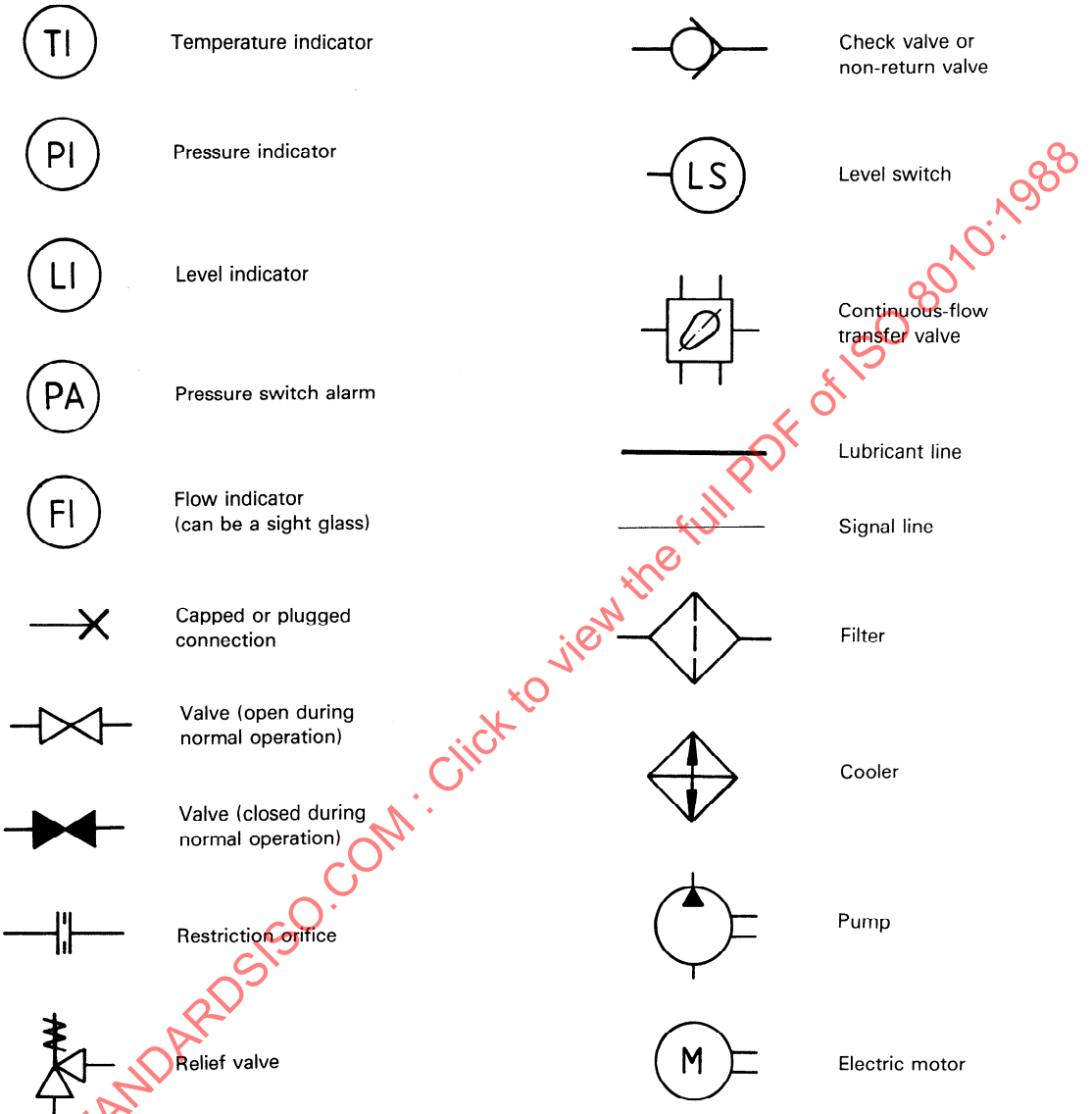
10.6.5 Coolers for liquid-injected screw compressors

The requirements shall be the same as those for dry compressors with the following exception.

Cooler materials shall be selected to suit both the coolant conditions and the liquid-gas mixture. The liquid may carry a quantity of the process gas in solution and this shall be taken into account.

Key to the figure

The use of symbols in this figure is according to ISO 3511-1, ISO 3511-2, ISO 3511-3 and ISO 1219.



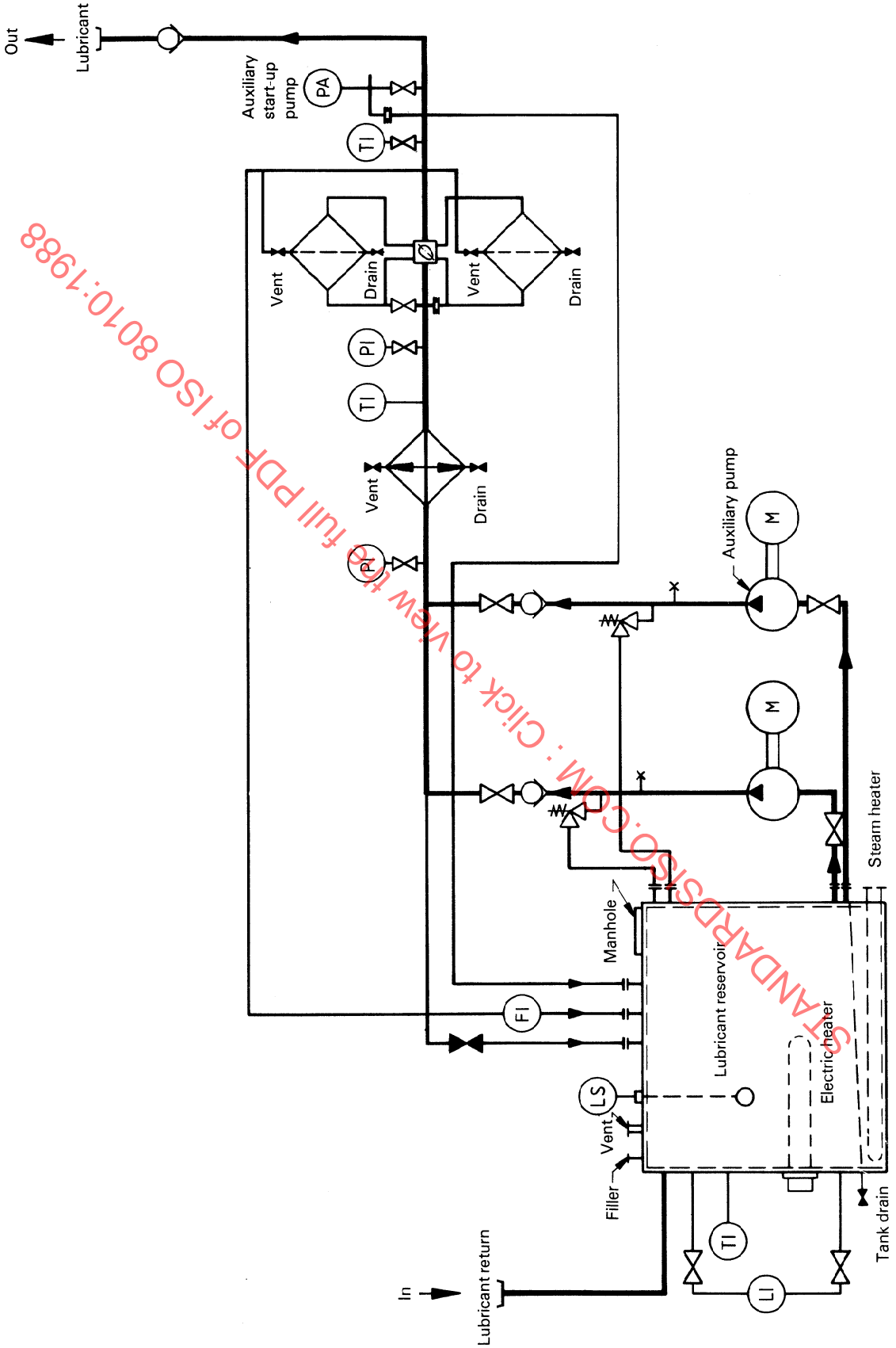


Figure — A typical piping and instrumentation diagram for oil-free compressor lubrication systems

11 Control and instrumentation

11.1 Flow rate control

11.1.1 The USER shall specify his requirements for flow rate control and whether this is to be manual or automatic. If nothing is specified in the enquiry, it shall be understood that flow rate control is not required.

11.1.2 The USER shall specify the parameter on which control is to be based.

11.1.3 If the USER intends to supply any part of the control system, this shall be specified in the enquiry. If not specified, it will be assumed that the SUPPLIER shall supply all the necessary equipment.

11.1.4 The SUPPLIER shall specify if unloading for start-up and shut-down is necessary. If the control devices for unloading are located in the USER's piping, then details of the equipment involved shall be specified in the proposal.

11.2 Instruments

11.2.1 The SUPPLIER shall provide the necessary instruments and trip switches for safe operation of the unit, e.g. appropriate microprocessor-based functions may be used. The instruments shall be supplied in accordance with but not limited to the minimum requirements set out in the data sheets. Any special code or standard for requirements such as flameproofing shall be specified by the USER in the enquiry.

11.2.2 Additional instruments beyond the minimum required by the SUPPLIER shall be specified in the enquiry.

11.2.3 If the USER requires instruments of a particular make, this shall be specified in the enquiry.

11.2.4 The data sheets shall specify which instruments will be mounted on the instrument panel.

11.2.5 The USER shall specify whether the instrument panel is to be mounted outdoors and requires weather protection.

11.2.6 The instrument panel may be mounted on the compressor set or be free-standing. The SUPPLIER shall describe which alternative he is offering. The USER may specify in his enquiry a free-standing or remote panel.

11.2.7 If the instrument panel is to be remote, the USER shall specify in his enquiry the distance from the compressor set to enable the SUPPLIER to select suitable equipment.

11.2.8 The USER shall specify in his enquiry whether the SUPPLIER shall include in the panel any additional equipment, such as electrical relay circuits, to incorporate switches from other plant etc.

11.2.9 All dial-type instruments mounted in the panel shall have a minimum diameter of 100 mm. Non-circular instruments shall have a minimum scale length of 100 mm.

11.2.10 The USER shall inform the SUPPLIER in the enquiry of any special requirements regarding power supply to the instrument panel (e.g. separate emergency power).

11.2.11 Instrument connections shall be the SUPPLIER's national standard unless otherwise specified by the USER.

11.2.12 All trip switches shall have single-pole double-throw contacts.

11.2.13 Instruments with a protective function shall have fail-safe operation, unless otherwise specified in the data sheets. This means that a break in the electric circuit will actuate the protective system.

11.2.14 An indicating device shall be incorporated on the panel face to indicate continuously any fault function.

11.2.15 All instruments, indicating lamps, etc. on the panel shall be labelled to identify their function. When symbols are used they shall conform to ISO 7000.

11.3 Installation

The SUPPLIER shall state in the proposal the extent of piping and wiring in the panel as delivered to the USER. Where the panel is free-standing or remote, the interconnection between the unit and the panel shall be the USER's responsibility.

12 Data sheets

The data sheets given in annex B are an integral part of this International Standard and shall form a part of

a) the enquiry from the USER;

b) the proposal from the SUPPLIER;

c) the contract.

The space in the data sheets for page . . . of . . . is intended to allow a set of sheets for a given data sheet number to be numbered in series so that any one data sheet may be incorporated more than once if there is insufficient space on a single sheet.

Data sheet 102C, Table of contents, has a column down the right-hand side where the number of pages of each data sheet, which has been included in any given project, shall be incorporated.

Items which it is considered must be completed by the USER at the enquiry stage are shown in bold-face type.

Annex A

Instructions subject to agreements in the contract

(This annex does not form an integral part of the standard.)

NOTE — The commercial and contractual requirements concerning claims, covering of expenses and guarantee conditions are normally guided by national laws and practices, or by mutual agreement if the parties concerned happen to belong to different nations.

A.1 Inspection and tests

A.1.1 General

A.1.1.1 During normal working hours and with at least 3 working days notice the SUPPLIER shall allow access to his workshop by the USER's representatives during the period when the manufacture or testing of the equipment is in progress. The SUPPLIER, by agreement with the USER, shall be authorized to limit such access for reasons defined by the SUPPLIER.

The SUPPLIER's proposal shall make clear the proportioning of inspection and testing expenses between the SUPPLIER and the USER.

A.1.1.2 Provided that the contract has stipulated it, the SUPPLIER shall give instructions to his suppliers to allow access as defined in A.1.1.1 to their premises for the purpose of inspection or witnessed testing of subcontracted parts.

A.1.1.3 The USER shall indicate to the SUPPLIER at the time of enquiry all tests required and which tests shall be witnessed by his representatives.

The SUPPLIER shall notify the USER or his representative at least 10 working days in advance of the planned test dates, subject to confirmation at least 3 working days prior to the date of such tests.

An agreement between the USER and the SUPPLIER shall be stated in the contract for cases where the USER's representative is unable to attend a test on the date indicated by the SUPPLIER.

A.1.1.4 Test certificates shall be provided by the SUPPLIER for all tests required by the contract.

A.1.1.5 The USER's representative shall countersign all test certificates provided by the SUPPLIER for witnessed tests. Signature shall not relieve the SUPPLIER of his contractual liability.

A.1.1.6 Auxiliaries shall be inspected and tested in accordance with 9.1.1.

A.1.2 Inspection of material and components

A.1.2.1 If shop inspection is specified, no surfaces or parts shall be painted, except for any anticorrosion coating, until the inspection is completed.

A.1.2.2 Inspection of any item may be waived by the USER, even if shop inspection is specified in the contract.

In this case, written notification shall be furnished, and any required data, including reports of chemical and physical properties, shall be forwarded to the USER if requested, or retained by the SUPPLIER for at least 12 months.

A.1.2.3 Certificates shall be available for the casings and rotor materials. If the USER requires certificates for other components, he shall specify these in the enquiry.

A.1.3 Compressor tests

A.1.3.1 A hydrostatic test of all pressure casings shall be carried out by the SUPPLIER. The test pressure shall be at least 1,5 times the highest pressure which can occur during running or shut-down conditions.

A hydrostatic test shall also be carried out on the cooling jacket of the compressor with a pressure of at least 1,5 times the maximum coolant pressure.

The hydrostatic test pressure shall be maintained for 30 min.

A.1.3.2 Any special tests, e.g. a porosity test, shall be specified by the USER in the enquiry. Test procedures shall be agreed between the SUPPLIER and the USER.

A.1.3.3 A performance test, the purpose of which is to verify that the compressor complies with the rating (see 6.4), shall be carried out according to the following specifications.

a) The performance test shall be carried out at the SUPPLIER's plant without the presence of the USER or his representative, unless otherwise specified in the enquiry.

b) The performance test shall be carried out on air.

c) The SUPPLIER shall provide the air performance equivalent to the USER's contract duty.

d) The test shall be carried out with the SUPPLIER's test equipment and not necessarily with the contract driver or other contract equipment.

e) Each stage of a multi-stage compressor may be tested individually and not as a complete unit.

f) The testing time shall be for not less than 4 h of which 1 h shall be at a condition with

1) the discharge temperature 30 K above the maximum expected discharge temperature in the case of dry compressors, or

2) the discharge temperature 10 K above the maximum expected discharge temperature in the case of liquid-injected compressors.

g) The test shall be carried out at the contract speed if test-bed facilities permit.

h) Where it is not possible to operate the compressor on the test-bed at the actual contract conditions owing to power or other limitations, simulated testing shall be carried out.

i) Testing shall be arranged to obtain the full contract discharge temperature plus overload by suction throttling, recirculation or other means.

j) The test procedure shall be as specified in ISO 1217 unless otherwise agreed.

k) The testing parameters, i.e. the data to be obtained from the compressor test, shall include the following:

1) ambient pressure, temperature and relative vapour pressure;
2) inlet temperature;
3) inlet absolute pressure;
4) discharge temperature;
5) discharge absolute pressure;
6) compressor flow rate;
7) compressor speed;
8) compressor shaft input power;
9) lubricant inlet temperature;
10) lubricant manifold pressure;
11) all lubricant discharge temperatures;
12) jacket coolant inlet temperature;
13) jacket coolant discharge temperature;
14) jacket coolant flow rate.

l) The compressor shall be dismantled after the test only when specified by the USER in the enquiry.

A repeat test shall be required after dismantling and inspection.

A performance test certificate shall be provided by the SUPPLIER.

A.1.4 Warranties

A.1.4.1 All equipment, components and spare parts supplied with the compressor shall be guaranteed by the SUPPLIER against defects which, under proper use, appear therein and arise from fault in design, faulty workmanship or defect in materials.

A.1.4.2 The guarantee period starts at the time when the compressor is handed over to the USER for operation and expires 12 months from that date, but not later than 18 months after the compressor is ready for shipment.

A.1.4.3 The guarantee period for spare parts supplied with the compressor shall be as stated in A.1.4.2.

A.2 Preparation for shipment

A.2.1 Preservation

A.2.1.1 All equipment supplied shall be protected by the SUPPLIER against deterioration during transport and storage, as mutually agreed with the USER. For the purpose of establishing appropriate protection, the USER shall specify in the data sheets the modes of transportation anticipated, the final destination and the duration and nature of storage.

When not otherwise specified, the inhibiting oil and packing shall be such as to provide adequate protection against deterioration when the equipment is stored inside a proper storage building for a period of 6 months in a temperate climate.

A.2.1.2 In all cases, machined external surfaces liable to corrosion shall have a protective coating applied by the SUPPLIER.

A.2.1.3 Equipment shall be secured in such a way as to protect it against injurious damage from vibration associated with the modes of transport. A clearly visible warning label shall be affixed to the equipment to indicate any securing devices which must be removed before commissioning.

A.2.1.4 All openings, including auxiliary pipes, shall be covered before dispatch in accordance with the USER's specification. Wooden plugs shall not be used for threaded openings.

A.2.1.5 All internal non-painted surfaces such as compressor and gearbox internals, lubricant pumps, lubricant pipes and gas pipes shall be coated with inhibiting oil before shipment.

Where compressor internals must remain oil-free because of the contract gas to be handled, the USER shall state this so that alternative corrosion protection can be applied. In this case, the compressor shall be fitted with sealed flanges and with desiccant bags placed inside to absorb atmospheric moisture.

A.2.2 Identification

A.2.2.1 All parts of the equipment sent separately shall be suitably marked for identification, as indicated by the USER.

A.2.2.2 All packing cases shall have the USER's contract number clearly marked on the exterior, including the item number of the particular contents.

Documents identifying the contents and the names of the USER and the SUPPLIER shall also be included inside the packing case in the event that the outside markings become obliterated during shipment.

A.2.3 Transportation and handling

A.2.3.1 To ensure that proper provision is made by the SUPPLIER and the USER for transportation of material to site and storage and handling of the material when received at site, the SUPPLIER and the USER shall jointly agree the modes of transportation, the site facilities, including the storage conditions, and the means of handling available for off-loading and positioning of all equipment. The USER shall indicate at the time of enquiry any size and weight limitations.

For transport by sea, the packing shall be lined with waterproof material and desiccant material shall be placed in the packing case.

A.2.3.2 Weights and lifting points shall be clearly indicated on the packing cases.

A.3 Erection and commissioning

A.3.1 Site preparation

A.3.1.1 Where the SUPPLIER is responsible for erection at site, the USER shall notify the SUPPLIER of the date when the site will be ready for erection to commence. The SUPPLIER shall have the right to check before the arrival of the material or the actual commencement of erection, whichever is appropriate, that the foundations and facilities required for erection are available and in good order.

The USER shall carry out the transport of the SUPPLIER's supply up to the foundation or the corresponding hoisting device unless otherwise agreed between the USER and the SUPPLIER.

This does not relieve the USER of his responsibility to provide a foundation of adequate quality.

A.3.1.2 The USER shall make available all site services and facilities to allow the SUPPLIER to erect properly, test and commission the SUPPLIER's supply as agreed with the SUPPLIER.

A.3.1.3 The USER shall notify the SUPPLIER at the time of the contract of any regulations concerning the conditions of work at the site. The USER shall inform the SUPPLIER of his official responsible for safety matters. The responsibility for meeting the local safety regulations lies with the USER.

A.3.1.4 The USER shall ensure that the SUPPLIER's personnel will find adequate accommodation, boarding and health care for the duration of erection and commissioning.

A.3.2 Erection on site

A.3.2.1 The erector in charge of the compressor unit, who shall be defined in the erection contract, is responsible for the proper handling, installation, assembly and cleaning of the compressor and its auxiliaries, as well as for proper connections at the terminal points.

A.3.2.2 The pressure testing of the erected pipework system shall be the responsibility of the USER or the SUPPLIER, whichever party carried out the erection. The compressor shall be isolated from the pipework during any such test.

A.3.2.3 If a long period of standby or shut-down is anticipated, the USER shall consult the SUPPLIER regarding the appropriate protection.

A.3.2.4 Special attention shall be devoted to the flushing of seal liquid lines for compressors with contact or liquid ring seals.

A.3.2.5 Any construction work shall be carried out by the USER. Activities performed by the USER which contractually are to the account of the SUPPLIER shall be ratified by the SUPPLIER's representative.

A.3.2.6 Unless otherwise agreed between the USER and the SUPPLIER, electrical installation work shall be carried out by the USER.

A.3.2.7 Electric welding of external components shall be carried out with the compressor unit electrically insulated from the components.

A.3.3 Training of staff and commissioning

A.3.3.1 It is recommended that the USER's staff who will operate the equipment are present during commissioning for training purposes.

The handing-over procedure shall comprise the commissioning of the SUPPLIER's supply demonstrating satisfactory completion and proper function, and acceptance by the USER.

A.3.3.2 The USER is responsible for ensuring that process gas conditions and utilities are according to those specified in the contract.

A.3.3.3 Any additional requirement for commissioning shall be agreed between the USER and the SUPPLIER.

A.3.3.4 When the USER carries out both erection and commissioning, he shall be responsible for any irregularity which may occur.

A.3.3.5 If an approval of any part of the SUPPLIER's supply by the national authority competent for the site is required, it shall be to the USER's account and he shall specify the necessary documents in the enquiry.

A.3.3.6 The USER shall notify the SUPPLIER of the date when the plant is ready for commissioning, giving sufficient time for all travel arrangements.

A.3.3.7 The USER shall take care that no damage to the SUPPLIER's supply can occur owing to foreign matter in upstream pipework, e.g. water or dirt.

A.3.3.8 When process start-up is delayed for reasons outside the SUPPLIER's control, the USER shall be responsible for the proper protection of the compressor unit with auxiliaries, according to the SUPPLIER's recommendations.

A.4 Documentation

A.4.1 General

The USER and SUPPLIER shall agree on the documents to be provided as a part of the scope of supply. These documents are listed and should be marked with an X on data sheet 1101C.

A.4.1.1 At the time of enquiry the USER shall provide the SUPPLIER with all the information necessary to prepare a proposal, using the data sheets in this International Standard.

A.4.1.2 Together with his proposal, the SUPPLIER shall provide the USER with the data sheets complete with all the information necessary to evaluate properly the proposal.

A.4.1.3 At the time of contract, the data sheets shall be updated by agreement and shall form part of the contract.

A.4.1.4 After award of the contract, the SUPPLIER shall provide the USER with the documentation consisting of the drawings and data required for the installation, operation and maintenance study of the machinery supplied and the identification of the spare parts.

Likewise the USER shall send to the SUPPLIER the documentation required for the set design.

At the time of the contract signature, agreement shall be reached between the SUPPLIER and the USER, establishing for each document its applicability and dates of submission. Data sheet 1101C shall be completed with the agreed decisions.

A.4.1.5 Only documents specific to the contract need bear the USER's and the SUPPLIER's contract reference numbers.

A.4.1.6 The language of documentation shall be as agreed between the USER and the SUPPLIER and shall be indicated on the data sheets.

A.4.1.7 Requests for changes or modifications to any document or drawing shall be in the contract language. All requests for changes to drawings shall be legible (typed or block letters).

A.4.1.8 The SUPPLIER may combine drawings and data specified in accordance with his normal practice.

A.4.1.9 If certified drawings will not be available within the time specified by the USER, the SUPPLIER shall provide typical preliminary drawings, to assist the USER.

A.4.1.10 For the proposal, the SUPPLIER shall estimate the delivery time on the basis that approval of drawings will be given within 4 working weeks of their submission to the USER.

A.4.1.11 Approval of the SUPPLIER's drawings by the USER shall be made, after receipt by the USER, on the basis of the agreed schedule to maintain the final delivery date.

A.4.1.12 After the drawings have been approved, the SUPPLIER shall furnish certified copies of these as specified in data sheet 1101C.

A.4.1.13 Modifications to approved or final drawings require the USER's consent and shall be identifiable.

A.4.2 Remarks and comments on documents listed in data sheet 1101C

A.4.2.1 **Preliminary documents** shall contain sufficient information to allow preliminary discussions between the SUPPLIER and the USER.

A.4.2.2 The **documents for approval** are the documents submitted to the counter-party during the contract stage for the study of the whole supply.

Since the date of approval affects the time of delivery, the date of submission and that of approval shall be defined by mutual agreement. If approval is delayed for reasons beyond the SUPPLIER's control, delivery may be delayed accordingly.

The interval between the date of submission and the date of approval shall be agreed if it exceeds the 4 working weeks specified in A.4.1.10.

A.4.2.3 The **final documents** are those certified as correct for the installation.

A.4.2.4 **Schematics** (piping and instrumentation diagrams) for process gas, cooling system, lubricating system, control and instrumentation, seal, vent, purge and drain shall be complete with legends, shall show the functioning of these systems and shall show the limits of supply.

A.4.2.5 The **geometrical site data** shall allow the SUPPLIER to study the best disposition of his supply within the available space.

A.4.2.6 The **outline drawing of the compressor set** shall include:

a) overall outlines in at least two views;

b) dimensions to show overall sizes and centre lines;

c) maintenance withdrawal spaces where these project outside the outline;

d) lifting points;

e) the direction of rotation of drive shafts;

f) the function, position and nature of terminal points for USER connections;

g) support positions and dimensions;

h) the heaviest mass for normal maintenance.

A.4.2.7 The **coupling drawings** shall give all dimensions necessary for the detailed design of the connections between shafts, including space requirements for assembly and dismantling.

A.4.2.8 The **pressure vessel drawings** shall show all the elements necessary to receive the approval in accordance with the code or standard indicated in the order.

A.4.2.9 The **layout drawing** of the set, showing the position of the main components of the SUPPLIER's supply, shall allow the USER to study the design and disposition of the main elements of the USER's supply including those necessary for maintenance of the SUPPLIER's equipment.

A.4.2.10 The **installation drawing** of the set, showing the disposition of the whole supply including the route of interconnecting piping, shall allow the USER to determine the proper connection of his equipment to the SUPPLIER's supply without interference and taking into account the maximum allowable forces and moments on piping ends and the clearance necessary for dismantling and maintenance purposes.

A.4.2.11 The **foundation drawing** shall provide data for the dimensioning and design of the civil work. The foundation drawings prepared by the SUPPLIER are certified only in respect of the installation dimensions and loads of the compressor, driver and auxiliaries. The following information shall be included:

a) position of openings and anchor bolts;

b) values and direction of static and dynamic loads at points of supports and at pipe connections.

A.4.2.12 The **list of recommended spare parts** shall inform the USER of those spare parts suggested for the equipment for 2 years operation.

A.4.2.13 The **list of instruments** is a summary of all instrumentation included in the supply. The following information shall be given:

a) identification mark;

b) service;

c) manufacturer;

d) type;

e) range;

f) connection size;

g) setting values.

A.4.2.14 The **instrument and control terminal interconnection identification** shall allow the USER to connect properly his electric cables and pneumatic and hydraulic pipes to those supplied by the SUPPLIER.

A.4.2.15 The **instruction manual** shall be supplied by the SUPPLIER and furnished by the date listed on data sheet 1101C but not later than the date of shipment. The manual shall reflect the specific characteristics of the application, describing the installation, operation and maintenance procedures for the compressor and principal components of the supply. It shall

a) be indexed;

b) describe the compressor constructional features and the functioning of component parts or systems (including control and safety devices) in writing, by outline and sectional drawings, and by schematic and illustrative sketches in sufficient detail to identify all principal parts (including spares);

c) give adequate instructions for dismantling and reassembly of the compressor and auxiliaries for maintenance purposes;

d) describe the operating procedure (starting, operating, normal and emergency shut-down) of the set;

e) state the maximum and minimum allowable speeds;

f) give the maintenance schedule for the compressor and auxiliaries, including advice on the procedure during prolonged shut-downs;

g) include final copies of all relevant data sheets, performance curves and other documents describing the performance of the machine;

h) give a recommended spare parts list;

i) give normal and allowable clearances between fixed and moving parts.

A.4.2.16 **Lubricant specifications** shall be provided by the SUPPLIER for all appropriate items of his supply and shall constitute his recommendation to the USER for reliable operation.

For lubricants in contact with the process gas, the specifications shall be agreed between the SUPPLIER and the USER after account has been taken of the gas properties and the machine duties.

A.4.2.17 The **shipping instructions** supplied by the USER and the **shipping data** supplied by the SUPPLIER shall include markings, dimensions, masses, packing methods and inspection requirements (see A.2).

A.4.2.18 The **performance test certificate**, as specified in A.1.3.3, shall allow the USER to check that the performance of the compressor meets the contract requirements.

A.4.2.19 **Material, inspection and shop test certificates** shall allow the USER to check that the materials and components supplied correspond to the contract specifications.

Annex B

Data sheets

(This annex forms an integral part of the standard.)

The short-form data sheets may be used instead of the regular data sheets contained in this International Standard for budget proposals and where the information supplied on them is sufficient for the particular application (see data sheets S1C and S2C).

Re-vision	Info.	COMPRESSOR DATA SHEET No.		
				Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

User to mark X in Info. column where data required in supplier's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 101		
		MAIN REFERENCES AND REVISIONS		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	SCREW COMPRESSOR DATA SHEET No. 102C		
		TABLE OF CONTENTS		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

	Data sheet [1]	Subject	No. of pages
	101	Main references and revisions	
	102C	Table of contents	
	201C	Conditions of service	
	202	Gas composition	
	203	Site conditions, arrangement	
	204	Utilities 1 (electric power, fluids)	
	205	Utilities 2 (cooling water)	
	206	Machine mounting	
	207	Miscellaneous (applicable standards; mandatory sub-suppliers;	
		prohibited sizes, ratings or materials; exceptions; special cleaning	
		requirements; major spare parts; etc.)	
	208	Vibration and noise limitations	
	301C	Compressor design	
	401	Couplings	
	403	Gears	
	404	Electric motor for compressor drive	
	405C	Steam turbine and other drivers	
	501C	Pipework	
	502	Gas coolers	
	503	Separators and drainage	
	504	Pressure vessels	
	505	Silencers and gas filters	
	506	Valves	
	601C	Lubrication system	
	701	Controls and instrumentation (general)	
	702C	Flow rate control and start unloading	
	703C	Instrumentation	
	801C	Inspection and quality control 1 (compressor)	
	802	Inspection and quality control 2 (pipework, vessels)	
	901	Shipment and preservation	
	1101C	Documentation	
	S1C	Screw compressor short-form data sheet	
	S2C	Screw compressor short-form data sheet	

1) C for screw compressors only

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	SCREW COMPRESSOR DATA SHEET No. 201C					
		CONDITIONS OF SERVICE				Page of	
		USER:	**PROJECT:**			**SUPPLIER:**	
		Ref. No.	Ref. No.			Ref. No.	
		Operating point ☒ = normal operating point	☐	☐	☐	☐	
		Process stage					
		Model designation					
		Gas designation (see data sheet 202)					
		Designation of operating point					
		Rating point	☐	☐	☐	☐	
		No. of units for service					
		No. of standby units					
		Inlet mass rate of flow ☐ kg/s ☐ kg/h ☐ wet ☐ dry					
		Discharge mass rate of flow					
		☐ kg/s ☐ kg/h					
		Mass rate of flow tolerance (%)					
		Inlet volume rate of flow ☐ m^3/s ☐ m^3/h ☐ wet ☐ dry					
		Inlet volume rate of flow tolerance (%)					
		Inlet absolute pressure (bar)					
		Inlet temperature (°C)					
		γ ($= \kappa = c_p/c_V$ for ideal gases only) [1]					
		Compressibility factor Z ($= pV/RT$)					
		Discharge absolute pressure (bar)					
		Discharge temperature (°C)					
		γ ($= \kappa = c_p/c_V$ for ideal gases only) [1]					
		Compressibility factor Z ($= pV/RT$)					
		Absolute backpressure on relief valve (bar)					
		Shaft input power (kW)					
		Specific energy requirement (kJ/m^3)					
		Specific energy tolerance (%)					
		Compressor speed (r/min)					
		Driver coupling power (kW)					
		Combined driver coupling power (kW)					
		Recommended driver power (kW)					
		Driver shaft speed (r/min)					
		Type of driver ☐ electric motor ☐ steam turbine ☐ combustion engine or gas turbine					
		☐ diesel engine ☐ gas engine ☐ expander					
		☐ other:					
		Manufacturer of driver: **Furnisher:** ○ U ○ S					
		Inlet point ☐ standard (see 5.1.4)					
		☐ other:					
		Discharge point ☐ standard (see 5.1.4)					
		☐ other:					
		Attendance interval ☐ 1 h ☐ 4 h ☐ 8 h ☐ 24 h					
		☐ no routine attendance					
		Service ☐ 3 shifts ☐ 1 shift ☐ intermittent ☐ other:					
		1) pV^{κ} = constant for isentropic change of state.					
		USER to mark X in Info. column where data required in SUPPLIER's proposal					

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 202									
		GAS COMPOSITION						Page	of		
		USER:		**PROJECT:**				**SUPPLIER:**			
		Ref. No.		Ref. No.				Ref. No.			
		Operating point									
		Gas designation									
		Process stage									
		Relative water vapour pressure									
		Solid impurities (see constituents)				☐ yes ☐ no		☐ yes ☐ no		☐ yes ☐ no	☐ yes ☐ no
		Toxic (see constituents)				☐		☐		☐	☐
		Flammable (see constituents)				☐		☐		☐	☐
		Corrosive (see constituents)				☐		☐		☐	☐
		Constituents	Symbol	Molar mass		mol. %		mol. %		mol. %	mol. %
		Water	H_2O	18,02							
		Hydrogen sulfide	H_2S	34,08							
		Molar mass M		(kg/kmol)							
		Gas constant R		(kJ/kg·K)							
		Specific heat capacity c_p		(kJ/kg·K)							
		Reference temperature for c_p		(°C)							
		Gas fouling factor for heat exchanger		(m^2·K/W)							
		Temperature limits due to process requirements:									
		maximum		(°C)							
		minimum		(°C)							
		Material limitations:									
		Leakage limits:									
		Reference for thermodynamic properties:									
		USER to mark X in Info. column where data required in SUPPLIER's proposal									
		Revision No.	Original	1	2	3	4	5	6	7	8	9
		Name										
		Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 203		
		SITE CONDITIONS, ARRANGEMENT		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

SITE

Name:

Geographic location:

Altitude above sea:

CLIMATICS

☐ inland ☐ close to sea ☐ desert ☐ tropical

☐ very sandy ☐ very dusty ☐ winter-proof protection required

☐ corrosive atmosphere due to: concentration: mg/m³

Rain: mm/h (maximum rainfall to be expected)

Barometer reading: normal = mbar; min. = mbar; max. = mbar

Relative water vapour pressure: normal = ; min. = ; max. =

Ambient temperature outdoors: normal = °C; min. = °C; max. = °C

Ambient temperature indoors: normal = °C; min. = °C; max. = °C

INSTALLATION	Compressor	Lubrication system	Intercoolers	Aftercoolers	Control	Steam condensing unit
Outdoors without roof	☐	☐	☐	☐	☐	☐
Outdoors with roof	☐	☐	☐	☐	☐	☐
Indoors unheated	☐	☐	☐	☐	☐	☐
Indoors heated	☐	☐	☐	☐	☐	☐
Integral with casing			☐	☐		
At machine floor level		☐	☐	☐	☐	☐
Below machine centre line (m)						
Above machine centre line (m)						
Horizontal distance from compressor (m)						

☐ Overhead tank m above machine centre line

CRANE

Erection crane ☐ installed ☐ mobile Erection opening: m by m

Erection crane lifting capacity: kg

Maintenance crane ☐ installed ☐ mobile

Maintenance crane lifting capacity: kg

Crane hook: m above machine centre line

Machine centre line: m above machine floor level

Machine floor level: m above ground level

Space required below machine centre line: m

SITE TRANSPORTATION ☐ street ☐ rail ☐ waterway ☐ airfield

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 204		
		UTILITIES 1 (electric power, fluids)		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

ELECTRIC POWER

	Direct current		Alternating current, 1 phase				Alternating current, 3 phases			
		V		V	50 Hz	60 Hz		V	50 Hz	60 Hz
Power up to: kW	☐		☐		☐	☐	☐		☐	☐
Power up to: kW	☐		☐		☐	☐	☐		☐	☐
Control instruments	☐		☐		☐	☐	☐		☐	☐
Switches, relay	☐		☐		☐	☐	☐		☐	☐

Total electric power consumption: main driver = kW; auxiliaries = kW

REQUIREMENTS FOR EXPLOSIVE GAS ATMOSPHERE

Applicable standards (see also data sheet 207):

Location	Area classification	Gas composition	Type of protection			
			Explosion-proof enclosure	Increased safety "e" 1)	Pressurizing allowable	Intrinsically safe system
Indoors				☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
Outdoors				☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
Control room				☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no

FLUIDS

	Medium	Pressure (bar)			Temperature (°C)			Relative water vapour pressure	Consumption	
		normal	min.	max.	normal	min.	max.		units	max.
Compressed air	air									
Instrument air	air									
Control gas										
Purge gas										
Seal gas										
Live steam	steam									
Exhaust steam	steam									
Heating steam	steam									
Fuel gas	2)									

Fuel oil: density = kg/m³; lower calorific value = kJ/kg

1) See IEC 79.
2) See data sheet 202.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 205										
		UTILITIES 2 (cooling water)							Page		of	
		USER:		**PROJECT:**			**SUPPLIER:**					
		Ref. No.		Ref. No.			Ref. No.					
		COOLING WATER	Units	Design	min.	max.	Design	min.	max.	Design	min.	max.
		Circuit designation										
		Open circuit		☐			☐			☐		
		Closed circuit		☐			☐			☐		
		Recirculation system		☐			☐			☐		
		Inlet effective pressure	bar									
		Allowable pressure drop	bar									
		Inlet temperature	°C									
		Allowable temperature rise	K									
		Water consumption:										
		intercooler plus aftercooler	litre/s									
		oil cooler	litre/s									
		auxiliary equipment	litre/s									
		WATER QUALITY										
		Town water		☐			☐			☐		
		River water		☐			☐			☐		
		Cooling tower		☐			☐			☐		
		Sea water		☐			☐			☐		
		Brackish water		☐			☐			☐		
		Other										
		Solid impurities		☐			☐			☐		
		(see analysis)										
		Corrosive water		☐			☐			☐		
		(see analysis)										
		pH										
		Fouling factor water-side	$m^2 \cdot K/W$									
		WATER ANALYSIS										
		Constituents										
		Ammonia	g/m^3									
		Chlorides	g/m^3									
		ANTIFREEZE										
		Type										
		Concentration	%									

User to mark X in Info. column where data required in supplier's proposal										
Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 206		
		MACHINE MOUNTING		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

FOUNDATION

☐ Block foundation	☐ at ground level	☐ elevated:	m above ground level
☐ Elevated foundation	☐ concrete table	☐ concrete supports	
	☐ skid mounted	☐ other	
Compressor mounting	☐ rigid	☐ resilient	
Furnisher of resilient elements	○ USER	○ SUPPLIER	
Subsoil condition	☐ piled	water table:	m below ground level
	☐ rocky		

Earthquake susceptibility factor (give applicable standards in data sheet 207):

BASEPLATES, SOLEPLATES

	Baseplates separate	Baseplates common	Soleplates
Driver	☐	☐	☐
Gearboxes	☐	☐	☐
Compressors	☐	☐	☐
Coolers	☐	☐	☐
Oil systems	☐	☐	☐
Steam condensing unit	☐	☐	☐

FIXING

	Foundation bolts	Furnisher U	Furnisher S
Compressor	☐	○	○
Gearboxes	☐	○	○
Drivers	☐	○	○
Coolers	☐	○	○
Oil system	☐	○	○

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 207		
		MISCELLANEOUS		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.
		This data sheet may be used to indicate:		
		Applicable standards (vibration and noise limitations, see data sheet 208)		
		Mandatory sub-furnishers		
		Prohibited sizes, ratings or materials		
		Exceptions		
		Special cleaning requirements		
		Major spare parts to be included in proposal		
		etc.		

		User to mark X in Info. column where data required in supplier's proposal									
		Revision No.	Original	1	2	3	4	5	6	7	8	9
		Name										
		Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 208		
		VIBRATION AND NOISE LIMITATIONS		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.
		SOUND POWER LEVEL		
		Item	Maximum permissible dB(A) re 10^{-12} W	Expected dB(A) re 10^{-12} W
		NOISE OUTPUT		
		Octave bands		
		Applicable standards		
		R.m.s. VIBRATION 1)		
		Item	Maximum permissible mm/s^2	Expected mm/s^2
		1) R.m.s. = root mean square.		
		USER to mark X in Info. column where data required in SUPPLIER's proposal		

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	SCREW COMPRESSOR DATA SHEET No. 301C										
		COMPRESSOR DESIGN								Page	of	
		USER:	**PROJECT:**							**SUPPLIER:**		
		Ref. No.	Ref. No.							Ref. No.		
		SUPPLIER's model designation:				Stage No.			Stage layout			
		Item				1	2	3				
		Connections — top inlet				○	○	○				
		— top discharge				○	○	○				
		— bottom inlet				○	○	○				
		— bottom discharge				○	○	○				
						○	○	○				
						○	○	○				
		Casing split in rotor plane				○	○	○				
		Casing split perpendicular to the rotor axes				○	○	○				
						○	○	○				
						○	○	○				
						○	○	○				
		Radial bearings — rolling element				○	○	○				
		— sleeve				○	○	○				
						○	○	○				
						○	○	○				
		Thrust bearings — rolling element				○	○	○				
		— tilting pad				○	○	○				
						○	○	○				
						○	○	○				
		Rated compressor speed (fastest rotor)			(r/min)							
						○	○	○				
						○	○	○				
		Rotor diameter (fastest rotor)			(mm)							
		Length-to-diameter ratio (fastest rotor)										
		Rotor lobe combination										
		Casing — cooled by air				○	○	○				
		— cooled by water				○	○	○				
		— cooled by other:				○	○	○				
						○	○	○				
		Rotors — internally cooled				○	○	○				
		— internally uncooled				○	○	○				
						○	○	○				
						○	○	○				
						○	○	○				
		Compression — oil free, dry				○	○	○				
		— oil free, liquid injected				○	○	○				
		— oil flooded				○	○	○				
		Rated absolute discharge pressure			(bar)							
		Rated discharge temperature			(°C)							
		Compressor mass			(kg)							
		USER to mark X in Info. column where data required in SUPPLIER's proposal										

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 401				
		COUPLINGS			Page	of
		USER:	**PROJECT:**	**SUPPLIER:**		
		Ref. No.	Ref. No.	Ref. No.		
		LOCATION				
		Location				
		Manufacturer				
		Manufacturer's model designation				
		Manufacturer's coupling torque capability [1] (Nm)				
		Application factor [2]				
		Rated coupling torque (Nm)				
		Maximum continuous speed (r/min)				
		Inertia [3] ($kg \cdot m^2$)				
		Type of design				
		Spacer				
		Idling adaptor				
		Limited end float (mm)				
		Guard furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S

1) Torque indicated by manufacturer as design value in his documentation.

2) See 8.2.2.

3) Approximate figure for electric drive only, inertia defined as the mass times the radius of gyration squared.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 403			
		GEARS		Page of	
		USER:	**PROJECT:**	**SUPPLIER:**	
		Ref. No.	Ref. No.	Ref. No.	
		Location			
		Location			
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S
		Manufacturer			
		Manufacturer's model designation			
		Manufacturer's gear torque capability [1] (Nm)			
		Application factor [2]			
		Starting torque ratio [3]			
		Speed ratio input/output			
		Maximum continuous speed of input shaft (r/min)			
		Direction of rotation of input shaft [4]	☐ cw ☐ acw	☐ cw ☐ acw	☐ cw ☐ acw
		Direction of rotation of output shaft [4]	☐ cw ☐ acw	☐ cw ☐ acw	☐ cw ☐ acw
		Inertia related to input shaft [5] ($kg \cdot m^2$)			
		Power loss at normal operating load (kW)			
		Maximum permissible thrust bearing load (N)			
		Type of design: single (s) or double (d) helical	☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		Shaft sealing type			
		Bearings: journal (j) or rolling elements (r.el.)	☐ j ☐ r.el.	☐ j ☐ r.el.	☐ j ☐ r.el.
		Lubrication system: splash (spl.) or pressure (press.)			
		system	☐ spl. ☐ press.	☐ spl. ☐ press.	☐ spl. ☐ press.
		Lubricant kinematic viscosity at 50 °C (mm^2/s)			
		Amount of lubricant (if self-contained system) (litres)			
		Lubricant consumption of gear (litre/s)			
		Lubricant inlet effective pressure (bar)			
		Lubricant pump power (kW)			
		Lubricant from (e.g. compressor, driver)			
		Lubricant cooler	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		single (s) or duplex (d) type	☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		coolant ☐ water ☐ air (m^3/min)			
		Lubricant filter	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		single (s) or duplex (d) type	☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		mesh size (μm)			
		Lubricant heater ☐ electric ☐ steam	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Gear mass (kg)			
		Baseplate, foundation bolts, see data sheet 206			

1) Torque indicated by manufacturer as design value in his documentation.

2) See 8.2.2.

3) Ratio of starting torque to rated gear torque.

4) Clockwise (cw) or anticlockwise (acw) when looking from driving towards driven end of respective coupling.

5) Approximate figure for electric drive only, inertia defined as the mass times the radius of gyration squared.

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Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 404		
		ELECTRIC MOTOR FOR COMPRESSOR DRIVE		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

Furnisher ○ USER ○ SUPPLIER

Manufacturer:

Manufacturer's model designation:

Type of motor ☐ synchronous ☐ induction ☐ squirrel cage ☐ wound motor ☐ other

MOTOR CHARACTERISTICS

Voltage = V; Phases = ; Frequency = Hz; Fault level = MVA

Rated driver power: kW (full load)

Speed: at full load = r/min; at 3/4 load = r/min; at 1/2 load = r/min

Efficiency: at full load = %; at 3/4 load = %; at 1/2 load = %

Power factor: at full load = %; at 3/4 load = %; at 1/2 load = %

Full-load current [1] = A; Locked rotor current = % of full-load current [1]

Full-load torque = Nm; Locked rotor torque = % of full-load torque

Starting torque: % of full-load torque

Torque fluctuation during start-up: ± % of full-load torque

Starting procedure ☐ direct on line ☐ ⅄ — △ ☐ other:

Reduced voltage starting: % of full-line voltage

Phase connection ☐ ⅄ ☐ △ Number of terminals:

External excitation: V; kW

Insulation class [2] – ; Maximum temperature = K

Coolant = ; Flow rate = m^3/s; Inlet temperature = °C

Type of enclosure:

Explosion-proof design ☐ yes ☐ no

Class [3] = ; Pressurizing with =

Bearing type ☐ journal ☐ rolling elements number of bearings:

Thrust bearing ☐ yes ☐ no

Maximum permissible axial end float of rotor: ± mm

Direction of rotation ☐ clockwise ☐ anticlockwise, when looking at the coupling

Lubrication ☐ self-contained ☐ Lubricant:

☐ bearing inlet effective pressure = bar; flow rate = litre/min

Space heater ☐ yes (W; V; phase) ☐ no

Winding temperature detectors ☐ yes (No. ; Ω; at °C)

☐ no

Rotor inertia [4]: $kg \cdot m^2$

☐ baseplate ☐ slide rails ☐ mounting pads (see data sheet 206)

Motor mass: kg

Maximum lifting capacity — for erection: kg

— for maintenance: kg

Applicable standards (see data sheets 207 and 208):

Motor testing:

1) At the lower limit of the nominal voltage range.

2) According to IEC 85.

3) According to IEC 79.

4) Inertia defined as the mass times the radius of gyration squared.

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Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	SCREW COMPRESSOR DATA SHEET No. 405C		
		STEAM TURBINE AND OTHER DRIVERS		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.
		MAIN DRIVE EQUIPMENT		
		Furnisher ○ USER ○ SUPPLIER		
		Manufacturer:		
		Manufacturer's model designation:		
		STEAM TURBINE		
		Type of turbine ☐ single stage ☐ multi-stage		
		Rated output [1]: kW at speed of r/min		
		Maximum initial pressure = bar; Rated initial pressure = bar		
		Maximum initial temperature = °C; Rated initial temperature = °C		
		Exhaust absolute pressure: bar		
		Inlet size = ; Exhaust size =		
		Steam rate (at rated condition): kg/kWh		
		COMBUSTION ENGINE		
		☐ diesel ☐ natural gas ☐ other		
		Rated output [1]: kW at speed of r/min		
		Number of cylinders = ; Working cycle =		
		☐ turbo-charged ☐ naturally aspirated		
		Cylinder bore = mm; Stroke = mm; Displacement = litre		
		Specific fuel consumption: g/kWh		
		GAS TURBINE		
		Rated output [1]: kW at speed of r/min		
		Specific fuel consumption: g/kWh		

1) Specified power standards.

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Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	SCREW COMPRESSOR DATA SHEET No. 501C			
		PIPEWORK		Page	of
		USER:	**PROJECT:**	**SUPPLIER:**	
		Ref. No.	Ref. No.	Ref. No.	
		Pipe dimension(s) not acceptable to USER:			
		Pipe material(s) not acceptable to USER:			

Piping	Category (see 9.5.1)				Applicable code	Materials	Furnisher	
	1	2	3	4			U	S
Process gas							○	○
							○	○
							○	○
Coolant							○	○
Lubricant							○	○
Drain							○	○
Vent							○	○
Purge							○	○
Instrument air							○	○
Control air or gas							○	○
Instrument piping							○	○
Seal gas							○	○

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 502				
		GAS COOLERS			Page	of
		USER:	**PROJECT:**		**SUPPLIER:**	
		Ref. No.	Ref. No.		Ref. No.	
		COOLANT ☐ water (see data sheet 205)	☐ air	☐ other		
		Compressor stage				aftercooler
		Cooler designation				
		Location				
		Cooler required	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Cooler type (e.g. shell plus tube, finned tubes, double pipe etc.)				
		Removable bundle	☐	☐	☐	☐
		Gas through the tubes	☐	☐	☐	☐
		Thermostatic control of coolant flow	☐	☐	☐	☐
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Design conditions				
		— head load (kW)				
		— gas inlet temperature (°C)				
		— gas discharge temperature (°C)				
		— gas mass rate of flow (kg/s)				
		— gas inlet absolute pressure (bar)				
		— gas pressure drop (bar)				
		— gas-side fouling factor ($m^2 \cdot K/W$)				
		— coolant inlet temperature (°C)				
		— coolant temperature rise (K)				
		— coolant mass rate of flow (kg/s)				
		— coolant pressure drop (bar)				
		— coolant-side fouling factor ($m^2 \cdot K/W$)				
		Mechanical design				
		gas side — design effective pressure (bar)				
		— design temperature (°C)				
		coolant side — design effective pressure (bar)				
		tubes — inner diameter × wall thickness (mm)	×	×	×	×
		Materials — shell				
		— tubes				
		— fins				
		— tube plates				
		— baffles				
		— heads				
		Corrosion protection — gas side by				
		— coolant side by				
		Mass of cooler				
		— empty (dry) (kg)				
		— with coolant (wet) (kg)				
		Foundation bolts — furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Cooler integral to compressor	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Applicable specifications (see data sheet 207):				
		Inspection and quality control (see data sheet 802):				
		USER to mark X in Info. column where data required in SUPPLIER's proposal				

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 503		
		SEPARATORS AND DRAINAGE		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

SEPARATORS					
Compressor stage					
Separator designation					
Location					
Separator required	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	
Furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S	
Separator type (centrifugal, impingement etc.)					
Separator integral to cooler					
Design conditions					
— inlet absolute pressure (bar)					
— inlet temperature (°C)					
— pressure drop (bar)					
— calculated separated liquid (litre/h)					
— design effective pressure (bar)					
— design temperature (°C)					
— liquid storage volume (litre)					
Material — vessel					
— internals					
Corrosion allowance (mm)					
Mass of separator (kg)					

DRAINAGE					
Vessel designation (e.g. cooler, separator)					
Location					
Drainage required	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	
Furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S	
Drainage type (valve, trap)					
Operation — manual	☐	☐	☐	☐	
— automatic continuous	☐	☐	☐	☐	
— automatic periodic	☐	☐	☐	☐	
Absolute back pressure (bar)					
Materials — body					
— internals					

Applicable specifications (see data sheet 207):

Inspection and quality control (see data sheet 802):

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Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 504			
		PRESSURE VESSELS		Page	of
		USER:	**PROJECT:**	**SUPPLIER:**	
		Ref. No.	Ref. No.	Ref. No.	
		PRESSURE VESSELS (other than coolers, separators, dampers, silencers, filters)			
		Vessel designation			
		Function			
		Location			
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S
		Design effective pressure (bar)			
		Design temperature (°C)			
		Volume (litre)			
		Materials			
		Corrosion allowance (mm)			
		Mass of vessel (kg)			
		Applicable specifications (see data sheet 207):			
		Inspection and quality control (see data sheet 802):			

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

USER to mark X in Info. column where data required in SUPPLIER's proposal

Re-vision	Info.	COMPRESSOR DATA SHEET No. 505				
		SILENCERS AND GAS FILTERS			Page	of
		USER:	**PROJECT:**		**SUPPLIER:**	
		Ref. No.	Ref. No.		Ref. No.	
		SILENCERS				
		Silencer designation				
		Location				
		Silencer required		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher		○ U ○ S	○ U ○ S	○ U ○ S
		Manufacturer				
		Silencer type (e.g. resonance, absorption etc.)				
		Attenuation	[dB(A) re 10^{-12} W]			
		Inlet absolute pressure	(bar)			
		Pressure drop	(mbar)			
		Silencer for installation without sound isolation		☐	☐	☐
		Silencer complete with sound isolation		☐	☐	☐
		Design effective pressure	(bar)			
		Design temperature	(°C)			
		Materials — vessel				
		— internals				
		Corrosion allowance	(mm)			
		Mass of silencer	(kg)			
		GAS FILTERS				
		Filter designation				
		Location				
		Filter required		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher		○ U ○ S	○ U ○ S	○ U ○ S
		Manufacturer				
		Filter type (e.g. paper, dry fabric etc.)				
		Single (s) or duplex (d)		☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		Manually operated				
		Automatically operated				
		Mesh size	(µm)			
		Inlet absolute pressure	(bar)			
		Clean pressure drop (at normal operating point)	(mbar)			
		Maximum pressure drop	(mbar)			
		Design effective pressure	(bar)			
		Design temperature	(°C)			
		Materials — vessel				
		— internals				
		Corrosion allowance	(mm)			
		Mass of filter	(kg)			
		Applicable specifications (see data sheets 207 and 208):				
		Inspection and quality control (see data sheet 802):				
		User to mark X in Info. column where data required in supplier's proposal				

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 506		
		VALVES		Page of
		USER :	PROJECT :	SUPPLIER :
		Ref. No.	Ref. No.	Ref. No.

Valve function	Item designation	Location	Size	Rating	Materials		Furnisher	
			DN	PN	Body	Trim		
			mm	bar			U	S
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
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							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○

Applicable standards and prohibited sizes, rating, materials (see data sheet 207) :

Inspection and quality control (see data sheet 802) :

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Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	SCREW COMPRESSOR DATA SHEET No. 601C		
		LUBRICATION SYSTEM		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

Item	Furnisher U	Furnisher S
Lubricant type:		
Lubricant kinematic viscosity at 50 °C: mm²/s		
Total volume of lubricant in system: litre	○	○
Main pump — type:	○	○
— make/model: /	○	○
— flow rate: litre/s		
— driven by:	○	○
Power of separate main pump driver: kW		
Auxiliary pump — type:	○	○
— make/model: /	○	○
— flow rate: litre/s		
— driven by:	○	○
Power of auxiliary pump driver: kW		
	○	○
Lubricant heater ☐ steam ☐ electric	○	○
	○	○
Lubricant cooler ☐ single ☐ change-over duplex	○	○
	○	○
Lubricant filter, change-over duplex	○	○
	○	○
Degree of filtration (nominal): µm		
Lubrication system common with:		

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										