

Topic	2 – Purchasing Terms			
Specification	2.2 – Specification for Machine Technical Plants			
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Purchaser in this document is Sør-Norge Aluminium AS

1 Mechanical Equipment

1.1 General

All mechanical equipment shall be delivered in accordance with current rules and regulations. The Labor Inspection Regulations are mentioned in particular. The most important of these regulations are:

- Machines
- Performing work, use of work equipment and corresponding technical requirements

When producing load-bearing steel in a machine, standard NS EN 1090 shall be followed (CE). Valid performing class (EXC) is defined by responsible constructor and is applied on actual work- and production drawings.

Machines and equipment shall be delivered with conformity declaration and CE-labeling. Purchaser can demand that Seller supplies the risk analyses that are basis for the conformity declaration and CE-labeling.

1.2 Standards

Delivered components and dimensions shall be in compliance with Norwegian Standards. Give careful observation to the following:

NS-EN ISO 13920:1996 – Allowed deviation for dimensions with no tolerances specified.

Length and angle dimensions in accordance with accuracy degree B

NS-ISO 1219-1:2012 – Drawing symbols for hydraulics and pneumatics

NS-ISO 3864-4:2011 – Colors and equipment (ISO R508)

For Color coding of pipelines, see Purchaser's Specification 2.7 for surface treatment.

NS EN 1090 (EXC 1-4 done by constructor) – load-bearing steel (CE).

NS EN 3834 – Welding standard.

1.3 Gears

Sew Eurodrive Gears shall be used unless a different brand is agreed otherwise.

1.4 Axle Couplings

Rotex

Ortiflex

Centa

1.5 Drive pulleys and Sprockets

To be secured with Taper-Lock Boss. Transmission belts in accordance with DIN 8187 (or equivalent to BS).

1.6 Lifting Equipment

Seller shall use known technology with a high level of security which satisfies the requirements from Norwegian authorities. Constructions shall comply with NS EN 13155 Cranes and lifting equipment, furthermore regulations from labor inspection, "Machine Regulations" and NS EN 1090 (EXC 1-4 done by constructor). Regulation reg. use of work equipment corresponding technical requirements. Deflection requirements shall be specified for each occurrence.

1.7 Surface Treatment

See Purchaser's Specification 2.7 Specification for Surface Treatment

Item 1: Description for surface treatment of steel and aluminum constructions.

Quality Control:

Work quality shall be documented by using the attached form 2.7 Specification for Surface Treatment. The completed form shall be delivered to the Purchaser following completion of the paint work. Quality inspections can be expected during the working procedure.

Recommends that utilized steel is purchased primed by the steel supplier.

1.8 Safety Fences and Safety Systems

- The design of safety devices requires clarification with the Purchaser.

1.9 Welding Procedure

All products and deliveries which include welding shall be professionally analyzed and grouped in accordance with the actual degree of significance. See Table T1.

Table T1: Welding Categories and Requirement Grouping. Requirement group 1 has the highest priority.

Requirement Group 1-3 (1=highest)	Category	1	2	3
Strength and ductility aspect	A	*	*	X
Fatigue aspect	B	*	*	0
EL – Conducting aspect	C	X	0	0
General (wind and weatherproof)	D	0	0	0

* = NS-EN729-2 Comprehensive quality requirements, Norsok M101 (Steel), and M601 (Pipes)

X = NS-EN729-3 Standard quality requirements and NS 477

0 = According to professional guidelines from recognized suppliers of welding consumables, i.e., verified testing is not mandatory.

1.9.1 Steel Welding Procedures: re. NS-EN ISO 15614-1

1.9.2 Aluminum Welding Procedures: re. NS 288-2

1.9.3 Steel Welding Certificate: NS EN 3834-2

1.9.4 Aluminum Welding Certificate: NS EN 3834-2

1.9.5 Special Notes (SN):

SN 1 All welding work shall have a visually professional character.

SN 2 National requirements, regulated by Machine and performing work, use of working equipment and corresponding technical requirements are valid independently of this specification.

SN 3 All material, design, shaping and welding choices must be based on the actual design temperature and professionally relevant welding and safety factors.

SN 4 Additional professional information regarding material and welding is available on the Internet.

2 Lubricants

- 2.1 Deviations from the standard below shall be agreed in writing with the Purchaser's Executive Officer.

Equipment	Product Type
Hydraulic System:	YX Lubricating oil RANDO HD 46
Transmissions:	YX Lubricating oil Textran 1000THF YX Lubricating oil Geartex EP-C 80W90
Compressor:	YX Lubricating oil Cetus PAO 46
Industry-Gear:	YX Lubricating oil MEROPA 68-150-220320 6 YX Lubricating oil REGAL EP 150
Grease:	YX Lubricating oil STARPLEX EP 1 og 2 YX Lubricating oil NOVATEX HEAVY EP 2
Motors:	YX Lubricating oil Motor oil URSA PREMIUM TD 15W-40
Beds:	YX Lubricating oil WAY LUBRICANT X 68
Cutting Oil:	YX Lubricating oil
Pressurized Air:	YX Lubricating oil ARIES 32

- *YX's lubricant chart shall be prepared by the Seller and approved by Purchaser.*

2.2 Special Products

In case special products are required, Purchaser must approve them.

2.3 Product Sheet

Product sheets shall be delivered and approved by Purchaser for all chemicals before the goods are delivered.

3 Hydraulic Equipment

3.1 Components

All cylinders, valves and other components shall be of the brand Bosch Rexroth or Parker based on ISO Standard, unless a different brand is agreed in writing with Purchaser. The Control voltage shall be 24V DC. Mains plugs - DIN 43650.

The tank shall have type MAHLE 3μ, series PiO 114 Sm-L breathing filters with replaceable elements, and pressure filters with filter guard and replaceable elements. Oil filter (return filter): PALL HH 8610 C24 UPTBS.

All equipment shall be clearly marked with position nos. in accordance with drawing. Engraved signs with black letters on a white background shall be used as marking labels. The signs shall not be placed on the component, but on a mounting plate or construction part that is not removed during normal maintenance work.

3.2 Pipes, Hoses and Parts

DIN 2391 (ST 37.4 DIN 2445) and DIN 2353 standard pipefittings shall be used. The pipes shall be fastened with Stauff brand clamps. Delivered pipefittings shall have BSP pipe threads. Hydraulic pipes shall be used wherever possible. Hoses are only used for moveable parts.

Type Ermeto EO -2 crimped ferrule fittings shall be used. Fittings with a 37° collar, in accordance with SAE J5141, shall be used in certain situations in accordance with agreement.

All hoses shall be suitable to the pressure class and be of the type:

- Hi-Flex hydraulic hose, 2 layers with pressure fittings.
- Hi-Flex Powertrack hydraulic hose, 4 layers with pressure fittings.
- Parker 461 hydraulic hose for high temperatures 2-layered compact hose.

3.3 Hydraulic System

All pipes of the hydraulic systems shall be flushed. The flushing procedure shall be presented to the Purchaser together with the bid. Hydraulic plants shall be equipped with measuring points (minimess) for pressure measurements. The positions shall be approved by Purchaser.

Hydraulic Aggregates: The aggregates for all machines in one shop are normally placed in a shared hydraulic room. All aggregates are mounted on the floor with machine shoes and connected to the piping with a rubber hose to avoid (if possible) vibrations to the system.

All aggregates are mounted with collecting trays including drains underneath.

Seller shall recommend filters for the pressure and return side as necessary.

Seller shall recommend positions for safety valves and the necessary number of service valves.

Pumps shall be placed on the side of the tank to avoid the risk of dry running. Stubs for filling/draining is to be made as a 1" stub or as otherwise agreed with Purchaser.

Color system according to Purchaser's specification no 2.7 Attachment 4.

4 Pneumatic Equipment

4.1 Components

All cylinders, valves and other components shall be of the brand Aventics or Parker based on ISO Standard, unless a different brand is agreed in writing with Purchaser. Lubricant free components shall be used unless otherwise stated or agreed upon.

All equipment shall be clearly marked with position nos. in accordance with drawing. Engraved signs with black letters on a white background shall be used as marking labels. The signs shall not be placed on the component, but on a mounting plate or construction part that is not removed during normal maintenance work.

All valves shall be mounted on mounting plates and if possible be equipped with indicators and manual operation. The Control voltage shall be 24V DC. Mains plugs: Bosch Rexroth: Light Plug 24V DC no. 894-101- 6122.

Valves and related equipment are mounted in a shared cabinet for each machine. The delivered cabinet shall be of the brand Rittal or equivalent, IP Class 55. The cabinet shall be mounted at the ergonomically correct height above floor plan. Air supply for cabinets shall be equipped with a lockable closing valve and ventilation so that the system becomes free from energy during maintenance.

4.2 Pipes, Hoses and Fittings

DIN 2353 pipe fittings shall be used.

Steel pipes shall be used wherever possible. Plastic pipes shall only be used as exceptions in pneumatic cabinets or as agreed with the Purchaser.

Rubber Hoses: Hi Flex 2-layered hoses with pressure couplings identical to hydraulic hoses (moveable parts) shall be used.

The pipes shall be fastened with Stauff clamps.

Pipes and fittings shall be delivered with BSP pipe threads.

Type Ermeto EO 2 from Bosch Rexroth or Parker.

Hoses to be used in the electrolysis halls and cellar shall not be electrically conducting.

Color system according to Purchaser's specification no 2.7 Attachment 4.

5 Platforms, Walkways, Stairs

5.1 General

All machines where the mechanical, hydraulic, pneumatic and electrical components are not available at the *ergonomically correct height over floor/plan* shall be equipped with platforms and necessary stairs for permanent access (maintenance)

If possible, platforms on the machine shall be designed in conformity with platforms for other machines close by.

Access to Platforms: Stairs shall be used instead of ladders. If possible, platforms and walkways shall be fastened to overhanging constructions to allow for easier floor cleaning.

5.2 Design Requirements

Platforms and stairs shall be constructed in accordance with Norsk Standard NS-EN ISO 14122:

- "Permanent access to machines".
- Part 1: "Choice of Permanent Access Between 2 Levels"
- Part 2: "Work Platforms and Walkways"
- Part 3: "Stairs, Stair Ladders and Railings"
- Part 4: "Fixed Ladders"
- . Requirements for Load Capacity: The load bearing construction shall satisfy the requirements in chapter 4.7.1
- (2kN/m²) and in chapter 4.7.2 (stair steps)

5.3 Materials

- Minimum Steel Quality: S235 JRG2, NVA, or better.
- Floors: grates of hot galvanized steel, fastened with clamps, openings in the grate are no larger than a 20mm sized ball.
- Stair Steps: with grates made from hot galvanized steel.
- Screw materials for fastening/assembly: steel quality class 8-8, or better.

5.4 Surface Treatment

- Colour system according to Purchaser's specification no 2.7 Attachment 4

6 Maintenance Manuals

6.1 General

Seller shall deliver comprehensive documentation for operation and maintenance, in accordance with the Work Environment Law, chapter IV. The documentation shall be in Norwegian.

The manuals shall be approved in writing by Purchaser, constructed and edited in accordance with Purchaser's requirements.

6.2 Principle layout of the manual

The manual shall be delivered electronically and in binders with the identification for the plant printed on the back of the binder and with dividers inside. The manuals shall contain detailed lists of maintenance routines with intervals. 1-step lessons shall be worked out whenever possible.

3 sets of manuals shall be delivered unless otherwise agreed in writing. The manual shall contain a clearly defined table of contents and comprehensive documentation under each item. A typical table of contents can be found in item 5.6.

6.3 Brochures, etc.

In brochures that contain several dimensions/sizes, the actually delivered dimensions **shall** be underlined.

6.4 Drawings

A complete drawing list shall be delivered. Complete assembly and detail drawings with parts list shall be delivered with the technical documentation. The drawings shall be of standardized formats and delivered electronically as DWG-files. The drawings shall be made in DAK, preferably Auto-CAD, alternatively Inventor. The drawings shall be delivered on memory stick or e-mail, which must be free from data viruses. The drawings shall be organized in accordance with NS 1404, 1402, and 1403 unless otherwise agreed.

The text in the drawings shall be in Norwegian (alternatively in English).

Seller shall deliver the drawings to the Purchaser in a reasonable time period before the installation commences.

Seller shall deliver updated drawings after the start of operation. (As built).

Purchaser's approval of presented drawings and documentations does not excuse Seller from the responsibility of delivery a professionally performed installation, and to follow current regulations and Purchaser's specifications.

Seller shall contact Purchaser to receive allocated drawing numbers and object numbers. Both the text files and the drawings shall be registered with Purchaser's drawing numbers. Drawing numbers shall be unique.

Lubrication instructions shall be illustrated with arrows and text on pictures of the lubrication points. ("one point lessons" with pictures).

Lubrication schedule shall be made in accordance with Purchaser's drawing no 36046

6.5 Spare parts suggestions/offers

Seller shall forward a complete parts list and suggestions for spare parts with prices for the plant/machine. The spare parts list must include a complete type description and manufacturer.

6.6 Typical Layout of a Maintenance Manual Index:

Table of Contents:

I	Technical Data
II	Drawing List
	Parts List
	Arrangement Drawings
III	Functional Description
	Instructions
IV	Hydraulic Schematic
V	Pneumatic Schematic
VI	Electrical Schematics
VII	Inspection Routines
	Lubrication Routines
VIII	Spare Parts List
IX	Brochure material specific to the plant, valves, pumps, filters, coolers, etc.
X	Conformity Declaration and Risk Analysis
XI	Miscellaneous Information

Note! The various chapters shall be approved by Purchaser.

7 Noise

7.1 General

Noise specifications are based on regulations (F) and guidelines (V) from Labor Inspection

- Regulation no 456: Noise at the Work Site
- Regulation regarding Machines

7.2 Technical Devices

For equipment that emits over 45 dB (A) in group I and over 60 dB (A) in group II and III, (see 422 section 2.2) noise data in accordance with guidelines from the Labor Inspection shall be delivered. The noise data shall be given in equivalent sound pressure level (A_{eq}) and specified as maximum and minimum values (A_{max} , A_{min}) at a defined distance from the object, expressed in dB (A).

Any specific requirements exceeding regulations from Labor Inspection shall be defined in the order expressed in dB (A) sound pressure level and measuring distance and shall be valid for the project.

Together with the inquiry, the Purchaser will present a sketch of the room/buildings where the equipment will be installed. Information about the following will be included:

- Height/length and width of building/room
- Which materials are on the various surfaces (floor/walls/ceilings/roof)
- Other installed equipment.
- Noise charts during normal operation in building/room, and if there is any activity in adjacent buildings.

7.3 Noise Limits

The following noise limits are valid for plants and equipment unless otherwise agreed in writing (Regulation no 456).

The highest allowed and recommended noise limits for various work conditions.

Work Condition Group I dB(A)		Highest Allowed Limits L AEQ 8 hours	Recommended Limits L A EQ 8 hours
I	Strict requirements for continuous concentration or need for effortless conversation.	55	45
II	Important to have conversations or lasting strict requirements for precision, speed or attention. Low noise level directly from the work	70	60
III	Loud machines and equipment for conditions that do not belong to group I and II	85	75

These noise requirements are valid for the complete, installed new equipment in the applicable rooms/buildings.

8 Dust/Gas

The following is valid for equipment that emits gas:

- Dust: 25 % of the administrative norm of 5,0 mg/m³
- Gas: 25 % of the administrative norm of 0.6 mg fluoride/m³
- PAH: 25% of the administrative norm of 40 µg/m³

9 Safety

- 9.1 *All valves* for pressured air, hydraulic oil, water, and gas shall be equipped with lockable shut-off cocks, placed in a secure area.
- 9.2 Aggregates and accumulators in hydraulic and pneumatic plants shall be enabled for depressurization.
- 9.3 Plants with more than 1 energy supply shall have LOTO system for locking/shutting down of energy supplies. This shall be agreed with Purchaser's Executive Officer.
See Purchaser's Specification no 1.8 for LOTO.
- 9.4 The following is valid for installation/work at the Purchaser's plant:
Purchaser's general safety routines shall be followed
All personnel that will perform work must have completed the general safety course
For work in Electrolysis, personnel must have completed a touch hazard course
Training for use of equipment must be documented when required.
Safe Job Analysis shall be prepared by Seller and approved by Purchaser before the work commences.

10 Training

- 10.1 A training plan shall be made for operation and maintenance. The training plan from Seller shall be in place before start up, testing, and commissioning of the machine or installation. The training plan shall be approved by Purchaser and shall cover maintenance and operation.