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Technical standard for hydraulic systems of all newly purchased production machinery, for the repairs of current production machinery and purchase of the individual hydraulic components.
The standard applies in all ŠkodaAuto plants.

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Therefore we strongly recommend that everybody checks the ITS regularly. These documents become valid on the date of their last update. For the contracts signed is decisive the validity of the ITS at the time of the order.

Note: In case of any differences between the Czech, English or German language mutation of this ITS, the Czech version takes precedence. The Czech version is available at <http://cts.skoda-auto.com/>.

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1 Settings

1.1 Operating pressure

Hydraulic system should be adjusted so that the required clamping pressures, shifting speeds, speedshifts, etc. of the operational units are safely reached at 20% of the power capacity within the installed powers. Calculated data must be submitted for hydraulic system approval.

Operating pressure range:

- a/ Cutting and special-purpose tools :
 - shift up to 50 bar
 - clamping device up to 120 bar
- b/ Welding machines up to 150 bar
- c/ Presses up to 350 bar

1.2 Temperature rise

Maximum operational temperature of oil in the tank must not exceed 65°C.

For that purpose necessary measures must be taken such as the adjustment of oil tank, amount of oil needed for speedshifts, etc. The use of a cooler must be agreed with ŠkodaAuto.

1.3 Hydraulic oil

At normal operational conditions, the hydraulic device should be adjusted for hydraulic oil with 46 mm² /s viscosity at 40 °C. Oil must fulfil the regulations under DIN EN ISO 6743-4 including the labelling HM46.

Use of extremely flammable liquids for devices with the danger of fire outbreak must be agreed separately.

Use of special hydraulic oils for hydrodynamic components must be agreed separately.

2 Construction and arrangement

- Each individual component of the hydraulic device must be easily accessible for maintenance purposes and replaceable when being repaired.
- Hydraulic construction components such as pumps, valves, distributors and oil tanks must be arranged outside of the machine. In easy cases, these construction components can be placed on the outside of the machine. To capture any leakage collecting basin must be placed underneath.
- Hydraulic aggregates should be assembled outside of the machine itself and without safety cover. In justified cases the cover may be used but it must be easily detachable.
- Piping must be easily accessible and placed in such distances that the joints can be disassembled with ordinary tools.
- Piping between the machine and hydraulic aggregate must be installed up to minimum height of 2100 mm or, in justified cases, 200 mm above the floor.
All piping is always placed and fixed so that no undue vibrations occur and it also must not be welded together with the piping holders.
Approx. 500 mm long hose must be placed between the pressure output of the hydrogenerator and pressure piping.
- If possible, no screws except cylinder joints should be inside the machine.
- To facilitate maintenance, integrated systems (tower, module and standard connection) should be used in line with EN, EN ISO, ISO, ČSN, DIN. **However, maximum three module desks plus a distributor may be used in one tower.**
- For concatenated machinery, each connected module of the individual production units at the pressure track of the hydraulic system must be provided with a stopcock and the waste pipe with a feedback valve. It should be possible to vent the highest spot of the pressure pipe.
- If necessary, the supplier is obligated to use components which fulfil the regulations under EN, EN ISO, ISO, ČSN, DIN.
- Hydraulic and lubrication systems must be separated. It is imperative that the lubricating oil does not mix with the hydraulic oil.
- Choice of material for sealing components must be in line with operational conditions.
- All components, blocks or aggregates weighing more than 15 kg must be realized so that they can be lifted with a lifting device.
- It is prohibited to use materials which contain silicone.



3 Design of the individual components

3.1 Pumps, hydromotors

These must have a **20% power capacity**. Concerning the constant pumps, the standard applies to pressure and the amount transported. Piping for leaking oil must be connected so that the pump and hydromotor remains permanently filled with hydraulic oil. Rotating shafts and joints must be provided with a cover. Flanges and shaft ends (including cylindrical shaft ends and springs) in line with ISO 3019/2 and VDMA 24560 are allowed.

3.2 Hydraulic cylinders

Flanges in line with ISO 6020/2, ISO 6020/1, ISO 6022 with end surface dampening and guided piston-rod in a casing. The piston-rod surface hardness must equal C 54 Rockwell and be protected against corrosion.

3.3 Guiding and regulation components

3.2.1 Distributors.

Perforation in line with ISO 4401/ DIN 24340-2 is allowed. Clamping height of the distributor with a valve intermediate desk in line with ISO 7790. Service life of the distributors must guarantee 10 mil. rearrangements at maximum pressure. Slide valves must be installed with a horizontal level of the slide.

3.2.2 Manual control

El.distributors, except for proportional distributors, servodistributors and safety valves must be provided with emergency manual control.

3.2.3 Pressure and choking valves

BKS - E10 lockable version of the regulation components of flow rate and pressure should be used, in particular for the adjustment of system and process values. They must be approved separately for each project. Desk or module version of the choking regulation valves (with integrated pressure stabilization) should be used.

3.2.4 Connectors

24 V direct current el.connectors with M12x1 connectors in line with IEC 61076-2-101, with pin configuration in compliance with ISO 23570-1, with LED or extinguishing diode or Connector 3-pole (2 + PE) in compliance with EN 175301-803 and EN 175201-804. **Connector design must be approved separately for each individual project.**

Magnets must be protected against liquid, dirt and must guarantee perfect function even at 85 to 110 % of the nominal voltage. Type of electric cover and climatic resistance must comply with ITS 1.11 - Electricity.

3.4 Pressure, level and temperature sensors

3.3.1 Measuring pressure

System pressure is displayed. In the case that there are more pressure levels, manometer with a switch of the individual measured spots may be used.

To check all the important working and operating pressures, operating device must be provided with measuring spots. Connectors allowing for pressure measurement must be configured for the devices.

If the individual working units are connected to the common pressure and sewage pipes, we require stopcocks to be installed in the connection spots. Connectors enabling pressure measuring should be installed behind the stopcocks.

3.4.1 Manometers

Signal scale must be divided into bars even when used for monitoring of a derived quantity. Range of the manometer scale must equal approximately double the operating pressure. Maximum operating pressure must be marked in red on the manometer scale.

3.4.2 Pressure switches

Electronic pressure switches are preferred.



3.4.3 Filling, oil surface and temperature switches

Pipe design is preferred. Oil surface switch must guarantee warning against tank overflow, warning when minimum and maximum is reached and shut-down when the tank end is minimally occupied.

Electric temperature switch has two switch degrees, warning at 55°C and shut-down at 65°C at the end of the tank

3.5 Oil tank

It must be hermetically sealed and provided with a 3μ deaerating filter. Deaerating filter permeability must be minimally 5x bigger than the fluctuation volume in the tank.

It must be possible to clean the tank without disassembling the hydraulic components. The highest and lowest oil surface level must be possible to check.

Oil surface switch must guarantee warning against tank overflow, warning when minimum and maximum is reached and shut-down when the end of the tank is empty.

The tank must enable a connection of an additional bypass filtration.

Leaking oil flowing over the tank lid, e.g. during hydraulic components replacement must not flow back to the tank.

Hydraulic oil filling slot must be protected from dirt.

The hydraulic tank may be filled and refilled with oil only with a **filling adapter and integrated MD-xx speedswitch**, see article 9.11.1.

A tag marking the hydraulic liquid used and the amount of filling needed must be close to the filling slot in line with ITS 1.17.

Parameters of the tank must prevent the oil from undesired heating. Capacity must be minimum three to five times the power of the tank (in litres).

Oil temperature must be checked with a device with two sensor spots. Optic warning at 55°C, machine shut-down at 65°C at the end of the tank.

Machine frames and bases must not be used as oil tanks.

Each tank must be equipped with an oil, visual indicator with a level of min. max.

3.6 Accumulator

If the inner battery capacity exceeds one litre or if the product of the nominal volume in litres and maximum pressure in MPa according to technical conditions exceeds value of 10, while stable overpressure exceeds 0.07 MPa, the battery is considered a stable pressure tank ČSN 690010 and the ČSN 690012 regulation must be followed for its operation, which stipulates that documentation in line with ITS 6.21 must be enclosed to the battery.

Fixing must not strain the battery cover mechanically and must fulfil technical conditions. Placement of the battery must allow the filling pressure to be checked. Nitrogen is to be used as a filling gas, use of other gas in justified cases must be agreed in writing.

3.7 Filters must be designed as given by DIN 24550-1-8.

Filtration system quality must meet the ISO 4406 (ISO 4406-1999) and ISO 16889 standards.

Minimum service life of the filtration fillers must be more than or equal six months or approx. 3000 operating hours.

Maximum pollution of the hydraulic system allowed as stated by ISO 4406:

- | | | |
|----------------------------|---------------|---|
| • servovalves | 13/10 - 15/12 | $\beta_3 \geq 75$, (ISO 4406-1999: 14/12/09 $\beta_5 \geq 200$) |
| • proportion components | 15/12 - 16/13 | $\beta_{10} \geq 75$, (ISO 4406-1999: 17/15/11 $\beta_{10} \geq 200$) |
| • overall hydraulic system | 17/14 - 18/15 | $\beta_{10} \geq 75$, (ISO 4406-1999: 19/17/14 $\beta_{10} \geq 200$) |

When selecting a filter manufacturer's instructions must be followed regarding the quality of filtration and surface load of the filtration component. Maximum pressure slant must not exceed the value given by the producer of the filters.

The filter must be configured with connections from both sides. Pressure filter without outlet is to be used before servovalves and proportional components as a protection.

Waste filters are preferred. Pressure filter is to be used only when it is necessary for hydraulic elements. Suction filters are not allowed.

For critically important machinery we require **double filters with a switch** to be used in the main flow.

By-pass filtration is required in addition to the exiting filters for hydraulic tanks larger than 1000 litres. Filter capacity must equal the volume power within the system.

Filters must be easily accessible, their replacement must be possible without disassembling other components.

Filters must be equipped with optical-electric signalization of pollution. Two levels of warning are required: 1.level at 75% pollution, 2.level at 100% pollution of the filtration filler.

green LED – light on permanently /feeding voltage/

yellow LED – light on when 75 % Δp is reached (1. switch contact)

red LED – light on when 100 % Δp is reached (2.switch contact)



3.8 Fitting and connecting components

3.8.1 Pipes

Only steel, exact, „Chrom VI – freie“ pipes are to be used in line with EN 10305-4-E235.

Use of plastic, Al, Cu or CuZn pipes is prohibited. Pipes must not be plated. Deaeration is to be conducted at the highest spot of the hydraulic system.

3.8.2 Screws

Only complete screws are to be used. „Chrom VI – freie“ with elastic seal, neck or changed matrix screws are preferred in keeping with EN ISO 8434-1.

Types of screws to be used must be agreed with the submitter.

3.8.3 Hoses with fitting

1SN and 2SN hoses are to be used as given by EN 853 a EN 857.

Hoses and fitting design must follow DIN 20066.

Hoses must meet the requirements of ČSN EN ISO 6802, ČSN EN ISO 6803, ČSN EN ISO 8032.

Hoses should be used only when mobile units are connected or to prevent the transfer of mechanic and hydraulic vibrations.

Hose and terminal must be selected so that maximum pressure of the hose equals or exceeds maximum operating pressure of the system. Pressure thrust or pressure peaks must be under maximum operating pressure.

Deformation must be avoided during assembly. Minimum diameter of the folding must be less than 5 times the hose diameter.

3.9 Diagnostics

The use of complete or partial sensors for hydraulic fluid condition monitoring should be considered for both new and already used hydraulic equipment with the tank volume larger than 1000 liters. It is mandatory for new equipment to have requirements for the sensors defined in its technical specification. Design of HMI visualisation, software requirements and connectivity to Škoda Auto internal network should be discussed and agreed with authorized department.

4 Control

General conditions

When dividing the production line into stations and units, independent working of all functions must be secured in fixed sequence of all working movements including control signals.

Control must be installed so that the aggregate is shut down, clamping pressure remains secured and working movements are blocked when power failure occurs or control pressure is lost. Further, oil outlet from the hydraulic system back to the tank must be prevented.

Dangerous movements must be prevented upon renewal of the power supply or control pressure.

4.1 Manual control

Emergency switch must be within the reach of the operator who, if necessary, shuts down the aggregate, secures the clamping pressure in the clamps and blocks all movements.

If necessary hand protection during operation have not been secured, two-hand safety device must be used.

It must be possible to switch all devices with programmed control also by a step-by-step procedure without undue overlap of working movements and control signals.

4.2 Movement control

Hydraulic movements must always be controlled in relation to the route. Pressure control must be agreed.

4.3 Shifting

In the surrounding temperature of 18-30°C and after 10 minutes of operation, the shifting speed deviation must not be more than 5% from the adjusted value. This must be achieved without rearranging the hydraulic components.

4.4 Arrangement of hydraulic components on production machinery

Controlling components must be easily accessible and as close to the appliance as possible.

When replacing the individual hydraulic components, hydraulic liquid leakage must be prevented.

This must be captured in a special dischargeable tank.

ITS 1.11 - Electricity (electric installation and equipment) is obligatory for electric circuits.



5 Labelling components on production machinery

All hydraulic components must be clearly labelled. Labelling in the hydraulic scheme and on the hydraulic components must follow the labels on the hydraulic component. list must

5.1 Each hydraulic component must give the following information:

- Type
- Symbol under ISO 1219-1
- Component manufacturer
- Maximum pressure allowed

All pressure control components must contain information on the operating pressure setting.

All connection piping must be labelled at both ends based on the hydraulic scheme.

In-built valves, screens and the like used in control blocks or connection desks must be labelled in the in-built area and provided with the „COMPONENT CONCEALED“ label in line with article 5.1.

Labels must be engraved, adhesive tapes are inadmissible. Labels are to be placed on irreplaceable components, too.

6 Noisiness

Maximum noise level allowed: - for the whole machine as stated in ITS 1.19 75 dB for the hydraulic aggregate -Deviations must be permitted by ŠkodaAuto.

7 Safety

7.1 General conditions

Every device must follow the regulations under CSN EN ISO 4413 and ITS 1.18 – Working safety.
ITS 1.11 – Electricity must be followed for hydraulic device el.circuits.

Every hydraulic device must be secured against exceeding maximum working pressure with a safety pressure valve.

Every hydraulic device must be constructed so that the operating personnel is not threatened when the control pressure drops or electricity shuts down.

The supplier is obligated to use all hydraulic components only in the range of admissible technical parameters given by the manufacturer in question.

Original versions of all hydraulic components are assembled. No changes are allowed.

Any leaks in the hydraulic system are inadmissible.

8 Technical documents

8.1 General conditions

The scheme of the hydraulic system, list of hydraulic components, functional graph, pressure fluid consumption graph and the hydraulic components layout must be delivered in two copies to ŠkodaAuto for testing and approval before the supplier launches production. Testing and approval of the documents delivered does not involve functional correctness of the machinery or construction parts setting. If there are any changes to the hydraulic system caused by construction or operational reasons, amended documents must be sent back for approval in two copies.

The operation and maintenance manual must include the hydraulic system scheme, list of hydraulic components, pressure fluid consumption graph and hydraulic component layout.

8.2 Hydraulic system scheme

Hydraulic system scheme must be drawn in line with ČSN ISO 14617-x

Hydraulic scheme drawings must be rendered as per ITS 1.01. Apart from data on data carriers, data is to be submitted in paper (A3/A4 format).

8.3 List of hydraulic components

All hydraulic components will be included in a separate list. The list must include:

- Number of pieces
- Component labelling
- Complete type label of the component
- Component manufacturer
- Component and block index



8.4 Functional graph

Time sequence of all working movements including control signals must be depicted in the functional graph. Manner of submitting the graphs must be agreed.

8.5 Consumption graph

Time sequence of the pressure fluid consumption during the working cycle must be depicted in the consumption graph. Manner of submitting the graphs must be agreed.

8.6 Hydraulic component layout

Hydraulic component layout on the machine must give a clear overview of the actual hydraulic component placement on the production machinery.

8.7 Hydraulic component operation and maintenance manual

Manual for the operation and maintenance of hydraulic machinery must contain:

- Data on starting, stopping and operation run-up of hydraulic machinery
- Settings of operating pressures, flow rate (shifting) and mode of their adjustment
- Lubrication spots, lubricants used, oils and lubrication periods in line with ITS 1.17
- Exact maintenance manual for special hydraulic machines
- Placement of hydraulic components, oil feeding slots, filters and filtering sieves, diagnostic connectors, etc. which are important for regular maintenance
- List of recommended spare parts
- Documentation in line with 8.1.2 must be enclosed

9 Release list of hydraulic component manufacturers

List of hydraulic component manufacturers is valid for the deliveries of new machinery, repairs of hydraulic systems of the current machinery and deliveries of the individual hydraulic components

If technical reasons make it necessary to select a manufacturer who is not on the supplier list, written approval of ŠkodaAuto is needed for the hydraulic elements stated on the list.

Hydraulic elements which are not on the list below may be selected freely. The only condition is a written approval of ŠkodaAuto.

9.1 Hydrogenerators

9.1.1 General requirements

Fixing flanges and shaft ends in line with ISO 3019/2 and VDMA 24560 are allowed.

Short centrings, cylindrical shaft ends with a tight spring in keeping with ISO 3019/2 are preferred.

Types according to the catalogue of individual manufacturers.

9.1.2 Pumps with constant supply

Bosch Rexroth	Parker
Bucher	Eaton

9.1.3 Regulation pumps

Sliding vane pumps are preferred.

Lockable pumps with E10 - BKS locks are preferred. They must be approved separately for each project.

Bosch Rexroth	ATOS
Moog	Parker
Eaton	

9.1.4 Rotation and swing hydromotors

Use must be agreed.

9.1.5 Hydraulic valves

Types according to the individual manufacturers.

Flanges as stated by ISO 6020/2, ISO 6020/1, ISO 6022.

Use of special hydraulic valves must be agreed.

Eaton	
Bosch Rexroth	Parker
Hydropneu	ATOS



9.2 Multiplying gear

Use must be agreed.

9.3 Hydraulic aggregates

9.3.1 General conditions

Components given by article 9.0 are allowed as aggregate equipment.
Types according to the catalogue of individual manufacturers.

9.3.2 Hydraulic aggregates

Bosch Rexroth	Hydac
ARGO	HYTOS
Parker	Eaton

9.3.3 Small and high-pressure aggregates

Applies for tanks smaller than 63l and pressures above 250 bar.

Hydac	Hawe
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9.4 Distributors

9.4.1 General conditions

Manual emergency conversion must be secured against unintentional conversion.
Perforation according to ISO 4401/ DIN 24340 required.
24 V direct current electric connections with the M12x1 connectors as given by IEC 61076-2-101, PIN as given by ISO 23570-1, with LED and switch-off diode or as given by EN 175301-803.
Connector design must be approved separately for each individual project.
El.cover and climatic resistance as given by ITS 1.11 – Electricity.
Types according to the manufacturer's catalogue.

9.4.2 Directly controlled slide valve distributors, two-, three- or four-way

Bore diameter: Js 4,6,10

Perforation as given by ISO 4401/ DIN 24340, A shape is allowed.

Bosch Rexroth	Hydac
ARGO	HYTOS
ATOS	Kracht
Eaton	Parker

9.4.3 Indirectly controlled slide valve distributors

Bore diameter: Js 10,16,25,32,40

Perforation as given by ISO 4401/ DIN 24340 A shape, B shape for Js 40

Bosch Rexroth	Kracht
Parker	ATOS
Eaton	

9.4.4 In-built two-way valves

Bore diameter: Js 16, 25, 32, 40, 50, 63, 80, 100.

In-built space design as given by DIN ISO 7368 is allowed

Bosch Rexroth	ATOS
Parker	Eaton
Moog	

9.4.5 Directly controlled three- or four-way saddle distributors

Bore diameter : Js 6, 10

Hydac	Bosch Rexroth
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Hawe	ATOS
Eaton	

9.5 Servovalves, proportional elements: pressure, current distributors

Manual emergency control is inadmissible.

Perforation according to ISO 4401/ DIN 24340 A, B shape is allowed.

Preferably, we require valves with integrated electronics.

Standard or high dynamics & standard or high repetition & with or without position measuring must be agreed with ŠkodaAuto.

24 V direct current electric connections with the M12x1 connectors as given by IEC 61076-2-101, PIN as given by ISO 23570-1, with LED and switch-off diode or as given by EN 175301-803. Connector design must be agreed with ŠkodaAuto for each individual project.

Bosch Rexroth	Moog
Parker	Eaton

9.6 Controlling and regulation components:

Back valves, controlled back valves, pressure valves, choke valve

9.6.1 General conditions

Flow rate and pressure regulation elements are to be used in lockable design BKS - E10, in particular for system and process values setting.

Types according to the manufacturer catalogue.

9.6.2 Control and regulation components – modular design

Bore diameter : Js 6, 10

Perforation as given by ISO 4401/ DIN 24340 A shape.

Bosch Rexroth	Eaton
ARGO HYTOS	Kracht
ATOS	Parker

9.6.3 Control and regulation components – connection desk design

Bore diameter : Js 6, 10, 16, 25, 32

Perforation as given by ISO 5781, ISO 6264, DIN 24340 C,D,E,F shape

Bosch Rexroth	ARGO HYTOS
ATOS	Parker
Eaton	Kracht

9.6.4 Piping: back valves, choke valves

Bore diameter: Js 6 - 32

Bosch Rexroth	Hawe
ARGO HYTOS	Parker
Argus Fluidtechnik	ATOS
Hydac	Eaton Walterscheid

9.6.5 Stop valves

ARGO HYTOS	Hydac
Argus	Parker
Eaton Walterscheid	Bosch Rexroth

9.6.6 Module desks

Design as given by DIN 24340 A,D,E,F,G shape

Bosch Rexroth	Kracht
ARGO HYTOS	Parker
Eaton	



9.6.7 Pressure switches

Preferably, electronic switches should be used

24 V direct current electric connections with the M12x1 connectors as given by IEC 61076-2-101, PIN as given by ISO 23570-1, with LED and switch-off diode or as given by EN 175301-803. Connector design must be agreed with ŠkodaAuto for each individual project.

El.cover and climatic resistance as given by ITS 1.11 – Electricity.

Types according to the catalogue.

IFM	Hydac
Parker	Bosch Rexroth
Barksdale	

9.6.8 Pressure sensors

24 V direct current electric connections with the M12x1 connectors as given by IEC 61076-2-101, PIN as given by ISO 23570-1, with LED and switch-off diode or as given by EN 175301-803. Connector design must be agreed with ŠkodaAuto for each individual project.

Types according to the catalogue.

Hydac	IFM
Bosch Rexroth	Parker
Vogel	

9.6.9 Thermometers

Types according to the catalogue.

Bühler	Kobold
Barksdale	

9.6.10 El. temperature sensor

Warning at 55°C and shut-down at 65°C at the end of the tact.

24 V direct current electric connections with the M12x1 connectors as given by IEC 61076-2-101, PIN as given by ISO 23570-1, with LED and switch-off diode or as given by EN 175301-803. Connector design must be agreed with ŠkodaAuto for each individual project.

Types according to the catalogue.

Bühler	Kobold
Parker	Hydac
Bosch Rexroth	IFM

9.6.11 Surface gauge – el.

Preferably, pipe design should be used with tank overflow control, minimum and maximum oil surface control

24 V direct current electric connections with the M12x1 connectors as given by IEC 61076-2-101, PIN as given by ISO 23570-1, with LED and switch-off diode or as given by EN 175301-803. Connector design must be agreed with ŠkodaAuto for each individual project.

Types according to the catalogue.

Bühler	Barksdale
Vogel	Wörner
IFM	Hydac
Parker	Bosch Rexroth
Kobold	



9.7 pressure accumulators

9.7.1 General conditions

Manufacturer's certificate, agreement with ITS 6.21 Stable pressure tanks.
Types according to the manufacturer's catalogue.

Hydac	Bolenz-Schäfer
Bosch Rexroth	Olaer

9.7.2 Safety blocks

Closing and filling devices of batteries
Types according to the manufacturer's catalogue.

Bosch Rexroth	Hydrotechnik
Hydac	Eaton
Olaer	

9.8 Filters

9.8.1 General conditions

Filter construction as given by DIN 24550.
Filtration quality as given by ISO 4406 (ISO 4406-1999) and ISO 16889.
Minimum service life of filtration fillers \geq six months or approx. 3 000 operating hours
Filtration values given in article 3.6 are required.
El. sensor of pollution must have 2 grades of warning.
24V direct voltage is preferred.
Types according to the producer's catalogue.

9.8.2 Pressure filters

Design without by-pass.
Filtration filler design:
 $\Delta p = 20 \text{ bar}$ (pro $p_i = 25 \text{ bar}$)
 $\Delta p = 160 \text{ bar}$ (pro $p_i = 160, 400 \text{ bar}$)
Surface load of the filtration component max. 0.08 l/min cm^2 at oil temperature 40°C
Initial $\Delta p_{\text{max.}} = 1,0 \text{ bar}$ for HM 46, at oil temperature 40°C
Bore diameter: Js 100, 250, 400
Nominal pressure: 25, 160, 250, 400 bar

ARGO HYTOS	Parker
Pall	Mahle
Hydac	Bosch Rexroth

9.8.3 Reverse filter

Design with by-pass
Filtration filler collapse limit: 10 bar
Filtration element surface load max. 0.05 l/min cm^2
Initial $\Delta p_{\text{max.}} = 0.5 \text{ bar}$ for HM 46, oil temperature 40°C .
Bore diameter : Js 100, 250, 630
Nominal pressure : 10 bar

ARGO HYTOS	Parker
Pall	Mahle
Hydac	Bosch Rexroth

9.8.4 Deaerating filter

Replaceable filtration element with integrated optical pollution sensor
Initial $\Delta p_{\text{max.}} = 0.01 \text{ bar}$.
Filter quality 3μ .
Deaerating filter, oil filling adapter and oil filling quick-coupler consist a single construction module.

ARGO HYTOS	Parker
Pall	Mahle
Hydac	



9.9 Screws

Only complete screw sets may be used; these must be approved separately for each project.

grooved with elastic seals, necks and union nuts as given by DIN 2353/EN ISO 8434-1

lined as given by DIN 3949 with the 37 / 24 adaptor and with two O-rings for the screw necks as given by DIN 2353/ 8434-1. EN ISO

WALFORM with sealing, necks and union nut as given by DIN 2353/EN ISO 8434-1

with a welded journal and 24 sealing cone A-shape with O-ring as given by DIN 3865 / ISO 8434-4, necks and union nut as given by DIN 2353/ EN ISO 8434-1.

with sealing cone joint as given by DIN 3865/ISO 8434-4 and O-ring.

Eaton Walterscheid	Parker
Voss	KNOMI

9.9.1 Oil filling adapter with quick-coupling

MD-019 or MD-012 quick coupling with a cap

Deaerating filter; oil filling adapter and oil filling quick coupling form a single construction module.

Walther	
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9.10 Hoses and connecting fixing

Hoses must fulfil the regulations of ČSN EN ISO 6802, ČSN EN ISO 6803, ČSN EN ISO 8032 (hose attest). Design as given by DIN 20066. Types according to the manufacturers' catalogue.

9.11 Quick-coupling with back valve

Types according to the catalogue.

Eaton Aeroquip	Parker
Argus	Stäubli
Cejn	Walther
KNOMI	

9.12 Screw journals

Only elastic sealing journals are to be used.

Journals as given by DIN EN ISO 9974-2/ DIN 3852-11 or ISO 1179-2/DIN 3852-11 Form E.

Screw threads as given by ISO 9974-1/ DIN 3852-1 or ISO 1179-1/DIN3852-2.

Types according to the manufacturers' catalogue.

9.13 Measuring devices

- measuring pressure
- measuring flow rate
- measuring temperature
- diagnostics of the condition of hydraulic fluids

Types according to the manufacturers' catalogue.

Hydrotechnik	Barksdale
Hottinger-Baldwin	Bosch Rexroth
Hydac	IFM
RMF	

9.13.1 Measuring connectors

Only the following types are allowed :

1620 line Hydrotechnik
EMA 3 Parker

9.13.2 Manometers

Design as given by EN 837-1,2,3.

Types according to the manufacturer catalogue.

9.13.3 Diagnostics of the condition of hydraulic fluids

Partical counter:output by ISO 4406



Measuring water content output in ppm or RH % (relative humidity %)