

TECHNICAL DELIVERY SPECIFICATION

II Technical Equipment Instructions

TA02 Mechanics

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1 Scope of Application

The technical instructions described here apply specifically to the machine/machine system's mechanical components. They supplement the instructions listed in document I General Information of the Technical Delivery Specification of ZF Friedrichshafen AG and alongside these, are valid for all ZF plants.

2 Normative References

As a basic principle, the agreements listed in document I General Information regarding normative references apply.

An informative overview on the country-specific laws, guidelines and standards can be found in the Appendix (Chapter 19) of this document.

3 Definitions

The definitions listed in document I General Information and in VDA-LVE are binding.

4 General Requirements

4.1 Approved list

Only components, assemblies and devices appearing in the approved list may be used. They must be in their original condition and without any modifications whatsoever when installed. Deviations must be approved in writing by the respective technical department and marked differently than the original part (see TA08 Technical Documentation, Chapter [4.1.5](#) Spare parts and wear parts lists).

4.2 Standardized components

The unlimited exchange of different brands of standardized components and assemblies must be possible in terms of function and installation. This only applies to components which do not have a safety function (see TA07 Safety of Machinery, Environmental Protection and Fire Protection, Chapter 2.1.2 Risk assessment).

4.3 Tool breakage control

Tool breakage control must be coordinated with the Customer.

4.4 Other instructions

No hoses may be installed around the chip area of the machine/machine system.

Industrial shock absorbers may not be used as a limit stop.

Alignment pins must be tempered and have internal threading if the alignment pin is not accessible from both sides.

If screws are used, only screw driver systems with independent torque measurement lines may be used.

5 Test Stations and Measurement Tools/Gages Requiring Inspection

The Contractor must coordinate the design and supply of test devices and master gages for test stations as well as measurement tools/gages requiring inspection with the Customer.

6 Measuring Systems

All measurement equipment (mechanical, optical, electronic, hydraulic, pneumatic) within the machine/machine system must be adequately protected against all forms of damages as well as chip and cooling lubricant contamination.

Linear measurement systems (glass scales) must be equipped with sealing air and be easy to assemble, disassemble and adjust.

7 Drive Technology

7.1 Ball-screw drives

Ball-screw drives must be protected against contamination and be durable. They must also feature lifetime lubrication or be lubricated with a centralized lubrication system.

It must be possible to remove the ball-screw drives without disassembling the main assembly (e. g. carriage) in which they are integrated.

Ball-screw drives must comply with the DIN 69051 and ISO 3408 series of standards.

7.2 Coupling systems

Coupling systems have to be aligned in such a way that it is possible to quickly adjust or exchange the corresponding wear parts.

7.3 Chains and belts

Chains and belts must be protected from any kind of disruptions and be replaceable without disassembling other components – with the exception of protective equipment. After consulting with the Customer, the Contractor must provide automatic tensioning options for chain belt, V-belt and flat belt drives.

Turn pulleys, turn wheels and chains must be lubricated via a centralized lubrication system.

7.4 Transmissions/Drives

The transmission must have a power reserve of 10%.

Preferably, the transmission will be designed with lifetime lubrication; otherwise, an oil level gage glass must be incorporated in a suitable, easily visible place so that the oil level may be monitored.

8 Workpiece and Tool Spindles

Workpiece and tool spindles that take longer than two seconds to slow down with a workpiece and/or operating equipment must have a brake (max. braking time $\leq 10\%$ of the normal slowing time without braking).

For each spindle, the machine/machine system's technical documentation must include a geometric measurement report (test run) and a frequency measurement report based on DIN/ISO specifications.

9 Bearings

9.1 Rolling bearing units

Only rolling bearings with inner and outer ring based on DIN dimensions may be used; they must be sealed from foreign substances. It must be possible to pull off the rolling bearings for disassembly.

9.2 Plain bearing units

Hydrostatic bearings must come equipped with continuous pressure monitoring.

10 Guideways and Linear Systems

Guideways/ Guideway elements must be tempered, replaceable and adjustable.

Standard linear systems shall be used. If necessary, spring-loaded limit stops shall be used.

11 Strippers and Covers

The strippers used in the machine/machine system must be permanently resistant to cooling lubricants, cooling lubricant vapor and chips as well as any mechanical and thermal loads.

Large covers on all sides must cover over the guide systems.

12 Sealing Elements

All machine/machine system assemblies (e. g. spindle bearings, transmission cases and linear systems) must use suitable elements to seal out foreign particles (dirt, cooling lubricants, etc.) and seal in lubricants.

13 Closed Cooling Systems

Closed cooling systems must use oil that meets the following purity grades:

Purity grade ISO 4406 (Hydraulic fluid power - Fluids - Method for coding the level of contamination by solid particles)

Purity grade ISO 4406	Pressure	Rotational speed
17/15/12	> 40 bar	> 10,000 rpm
20/17/14	> 20 bar	< 10,000 rpm
21/19/17	< 20 bar	< 10,000 rpm

The heat exchanger should be located outside of the tank.

Compressor cooling units should always be designed with a 10-pin Harting plug (pin configuration see Approved List Electrical Engineering (motors and drives, plugs for motors)), 2 stop cocks for the cooling unit lines, flow monitors, and when set up on level ground, with rollers. Pumps are to be used according to the approved list.

14 Chip Conveyors

14.1 Switch

The chip conveyor must have a separate on/off switch and a directional reversing switch.

The machine/machine system may not shut down when the on/off switch is used.

14.2 Eject height

The eject height for the chips must be at least 1,200 mm.

14.3 Accessibility for cleaning

The chip conveyor must be easily accessible for cleaning.

14.4 Miscellaneous

When selecting or designing the chip conveyor, the type of chips must be taken into account. If necessary, the Customer shall be consulted.

All cavities in the chip conveyor must be protected from deposits of any kind.

15 Containers for Liquids

For requirements, see II Technical Equipment Instructions, TA04 Hydraulics.

16 Evacuation Devices

- Risks caused by emissions must be assessed and, where required, dissipated and eliminated with suitable extraction and separation systems.
- Explosion and fire prevention must be considered.
- If possible, separation systems must be suitable for recirculating air operation.
- In the case of exhaust/outgoing air operations, it must be discussed with the Customer whether sufficient ambient air is available.
- A control switch must be provided with an equipotential change-over contact by the supplier for the following functions:
 - Evacuation ON (equipotential contact closed)
 - Evacuation OFF (equipotential contact open)

16.1 Lines

Pipelines which are more than five meters long or have multiple bends must have revision openings.

All hoses and pipelines must be designed with flat inner walls. Folded spiral seam pipelines are not permissible.

All hoses and pipelines must be easily accessible and easy to disassemble (quick-snap connections). As required, e. g. in the event of a risk of fire or an explosion hazard, they must conduct electricity and be fitted with equipotential bonding.

Pipelines for oil mist, emulsion vapor and dust extraction systems must be sealed, i. e. completely drip-free and durable on a sustained basis. The materials they are made of must be resistant to oil mist, emulsion vapors and dust.

16.2 Filters

Maintenance personnel must be able to easily access the filter insert maintenance doors without any special tools.

It must be possible to reuse and clean prefilter cassette inserts.

The technical documentation of the machine/machine system must contain an IFA certificate for the filters.

Instructions for extracting **chips/dust** with suction

- The filter elements must be cleaned according to differential pressure.
- A cleaning of the filters must be ensured in Online as well as Offline modes.

Instructions on extracting **oils/cooling lubricants** by suction

- Oil/Cooling lubricant systems must collect nearly all vapors and aerosols which are produced during operations and must ensure that these are extracted.
- Separator systems in recirculating air operations must feature a HEPA filter (High Efficiency Particulate Airfilter, filter class H13).

Instructions on extraction systems for **welding plants**

- Make sure that no sparks can get into the extraction system (meshed metal baffle / spark prefilter).

Instructions on extraction by suction for **cleaning systems**

- Vapor and aerosol escaping is to be effectively prevented by taking suitable measures (vapor condenser/mist eliminator).

Instructions on evacuation systems for **furnace systems**

- Make sure that exhaust gases (e. g. CO, CO₂) are effectively collected and disposed of (forced ventilation).

16.3 Collecting elements (fume hoods)

Collecting elements are to be designed in such a way that they collect the hazardous substances as closely as possible to the source.

Make sure that the suction nozzle is fitted in the working room so that no fluids or chips can be thrown into the nozzle. A height-adjustable baffle or deflection plate should always be fitted in front on the suction outlet. If necessary, attach an additional pre-separator (possibly a chip pre-cyclone) after the suction outlet.

16.4 Outlet option

An outlet option must be provided for draining the collected medium and must be attached freely accessible at a height of at least 400 mm (siphon, ball valve).

Dust discharge systems must be shaped ergonomically. If more than 30 l of dust are discharged per week, then automatic collection systems need to be installed (e. g. double dust trap, rotary feeder or screw conveyor).

16.5 Air volume

The air volume needs to be specified and agreed with the Customer (see Annex 3: Operating Sheet for Space and Installation Planning).

A three-phase AC motor must be used for the fan.

16.6 Contamination indicator

Filtration systems must be equipped with visual displays to control contamination (pressure differential indicator).

A pollution gage must be visible from the outside.

16.7 On/Off switch

The suction system must have a separate on/off switch that can be closed and reached from the ground.

The machine/machine system may not shut down when the on/off switch is used (e. g. to change the filter).

17 Welding Technology

Rectifiers and wire feed units must be designed to be easily accessible, and so that they can be unplugged and exchanged quickly.

Long supply pipes shall be avoided.

Dual drives must be coordinated/harmonized with the Customer.

18 Screening Grids

See also TA07 Safety of Machinery, Environmental Protection and Fire Protection, Chapter 6.4.4.

18.1 Exchange frame

The screening grids must be located on the outside of the machine/machine system by means of an exchange frame. It must be possible for a person to easily replace the screening grids from the outside.

18.2 Anchorage

The screening grids must be sufficiently secured in the machine covering against any load or stress that might occur while the machine/machine system is operating.

19 Marking

19.1 General requirements

Identification signs must always be

- engraved, etched or lasered in aluminum or two-layer plastic
- legible
- permanently attached at a clearly visible location
- located next to components, assemblies and devices
- when the devices are concealed, located next to the installation

The identification signs may not be located on replaceable components, assemblies and devices.

Marking components which have safety functions: see TA07 Safety of Machinery, Environmental Protection and Fire Protection, Chapter 2.1.2 Risk assessment.

19.2 Additional information

The following information is important for marking the mechanical components installed in the machine/machine system:

- The device names are also attached to all coverings.
- All workpiece-dependent operating equipment and replacement parts are to be identified with the respective ZF operating materials number (tools, jigs and fixtures, etc.).
- Arrows indicating the direction of rotation must be placed on all pumps and motors.

20 Maintenance Orifices

Maintenance doors must not be fitted with dual-bit locks; these may only be fitted on electrical housings (see TA01 Electrical Engineering, Chapter 12.1.3). Preferably, square socket locks (8 mm) should be used.

21 Appendix: Other Applicable Documents

21.1 Global requirements

ISO 4406	Hydraulic fluid power - Fluids - Method for coding the level of contamination by solid particles
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21.2 European requirements

Re 16 Evacuation Devices

- Directive 2006/42/EC of the European Community on machines (Machinery Directive)

21.3 German requirements

Re 9.1 Rolling bearing units

Inner and outer ring based on DIN dimensions

Re 16.2 Filters

- Filter materials must be certified by the BGIA (dust/filter class). The BGIA inspection certificate must be supplied.

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