



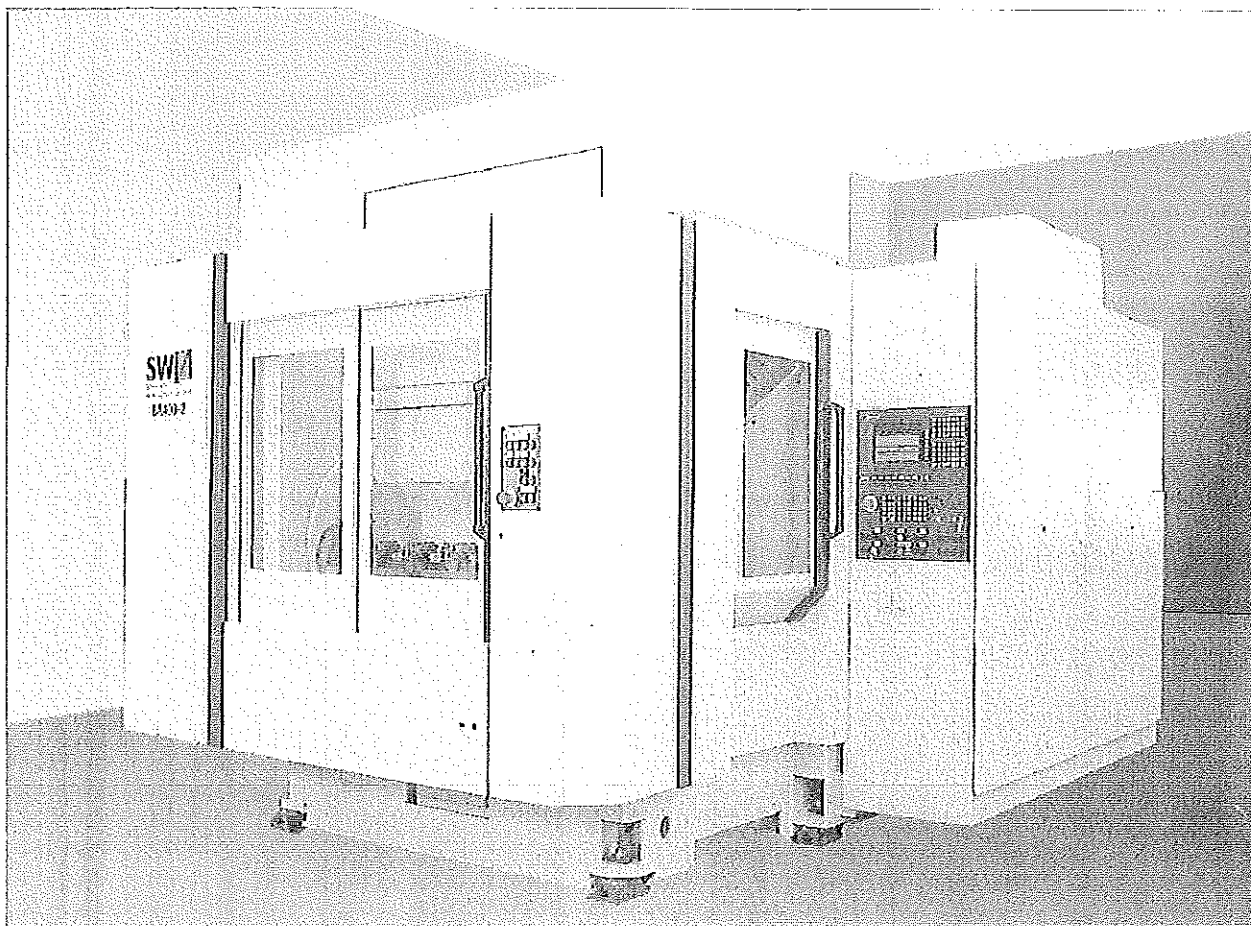
Schwäbische



Werkzeugmaschinen GmbH

OPERATING INSTRUCTIONS

HORIZONTAL PROCESSING STATIONS
BA400-2, BA400-4



Machine type: BA 400-2 CNC
CNC control: SIEMENS 840 D
Order number: 4164 04 0223
Serial no. of machine: 164 0 336
Year of manufacture: 2008

Contents

0.1 Product	0-3
0.2 Manufacturer	0-3
0.3 Supplier	0-3
0.4 Proprietary rights	0-3
0.5 Normal use	0-4
0.6 Dangers associated with the machine	0-4
0.7 Environmental factors	0-5
0.8 Warranty / liability	0-6
0.9 Complete table of contents	0-7

0.1 Product

The standard "BA400 .." processing stations are three-axled drilling and milling stations with two horizontal working spindles and an automatic tool rack; these processing stations can carry out either the same or different batch CNC operations automatically and in succession, in two separate work areas. At present there are two different models. A two spindle model „BA400-2" and a four spindle model „BA400-4".

The machines are equipped with a swivelling support system for the workpiece, with two user-specified workpiece holders (e.g. clamp bars or clamp frame). Each workpiece holder is treated as an independent work area, thus bringing the advantages of simultaneous loading and unloading.

The machines are operated from the CNC control console.

Trained personnel are needed in order to operate the machine correctly.

The main changes to the series fabrication type which the customer can specify are listed in Chapter 10.

0.2 Manufacturer

Schwäbische Werkzeugmaschinen GmbH
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D 78713 Schramberg (Ortsteil Waldmössingen)
Tel: 0 74 02 / 74-0
Fax: 0 74 02 / 74-211

Service department:
Tel: 0 74 02 / 74-240 or -542
Fax: 0 74 02 / 74-195

Spare part order:
Tel: 0 74 02 / 74-239
Fax: 0 74 02 / 74-195

0.3 Supplier

0.4 Proprietary rights

Copyright (©) for this documentation is held by "**Schwäbische Werkzeugmaschinen GmbH**", and for certain sections by **suppliers of other manufacturers' documentation**.

The information contained is intended solely for the end users of the machines we supply, and - unless our prior written permission has been granted - it must not be altered, added to, reproduced, stored on data storage media, distributed nor used in any other way that contravenes other justified interests

The information contained in the documentation does not claim to be complete. We have made every effort to ensure that the contents are up-to-date and accurate with regard to our products. However, we can make no guarantee that it is free from all errors. Photos and other illustrations in particular may include components that do not form part of the standard package (i.e. optional extras), or components which have been modified in the meantime.

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0.5 Normal use

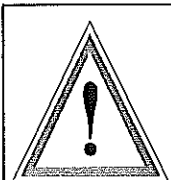
The "BA400 .." machines are designed and built exclusively as CNC-controlled drilling and milling stations, whose function is the machining of metal materials whose spontaneous combustion temperatures are not reached despite maximum machining performance and unfavourable environmental conditions (temperature, air pressure, oils, coolants and cleaning agents), and which do not produce any dangerous vapours, dusts or aerosols during machining.

The machine must only be operated in self-contained areas and normal conditions (see technical data for details of permissible temperature and humidity).

Other prerequisites for normal use are as follows:

- Compliance with statutory regulations and guidelines from authorised institutions
- The observance of the information contained in the operating manuals which are delivered with the machine, paying special attention to the sections regarding safety precautions and accident prevention
- Correct operation of the machine, including components supplied by the manufacturer as part of the package, by qualified personnel
- Timely and correct performance of maintenance and inspection tasks
- The technically speaking, perfect condition of the machine especially its safety features, which should be unchanged from the condition of the machine at the time of delivery.

Any other use, or use which goes beyond that intended shall be considered incorrect, and is entirely at the risk of the end user unless additional safety measures have been mutually agreed and incorporated by "Schwäbische Werkzeugmaschinen GmbH" (extinguisher, filter, extractor, monitoring system).



"Schwäbische Werkzeugmaschinen GmbH" shall not accept liability for any damages that arise from improper use.

0.6 Dangers associated with the machine

The design and construction of the BA400-2 machines is state-of-the-art, and conforms to the acknowledged regulations on safety and the relevant rules on machine construction.

Nonetheless, it is impossible to completely remove all danger to life and limb of users or third parties, or risk of damage to the machine or other assets.

However, to ensure the highest possible degree of safety, the following fundamental rules should be observed:

- Only ever use the machine for the purpose it was designed for
- Only ever allowed qualified and appropriately trained operators to work on the machine
- Always follow the universal and specific safety instructions, accident prevention instructions and operating instructions supplied by "Schwäbische Werkzeugmaschinen GmbH"
- Never allow any unauthorised modifications to be made to the machine

2.2 Description of the mechanics

2.2.1 General

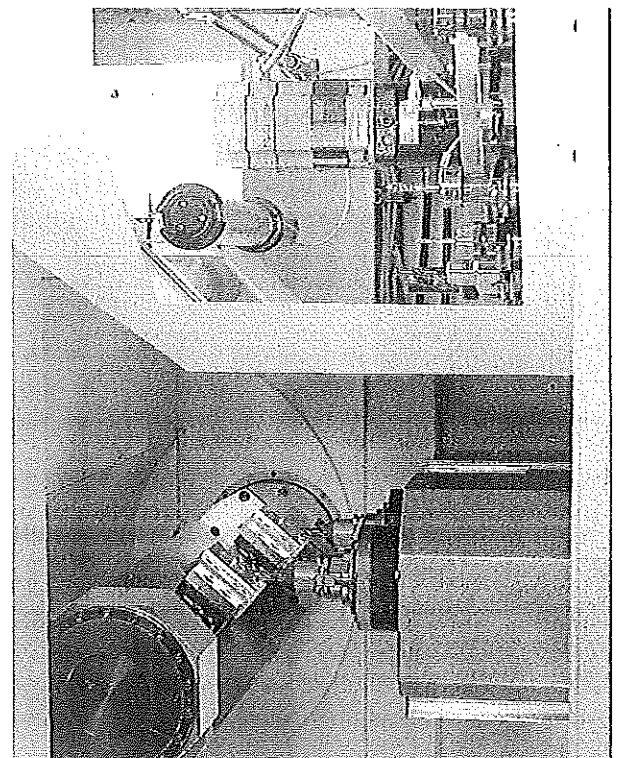
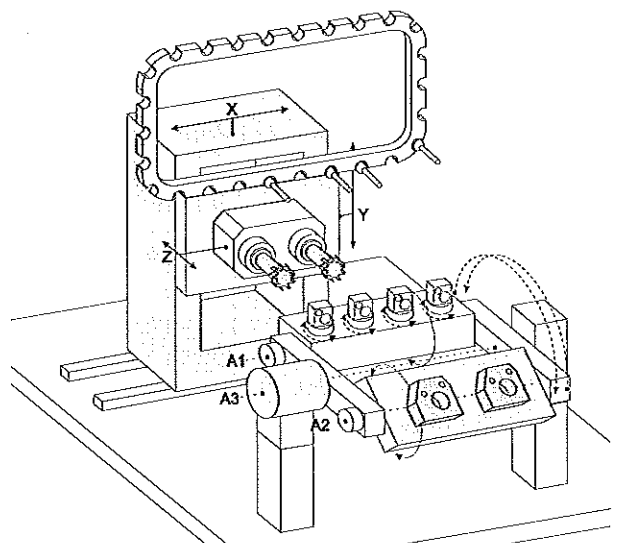
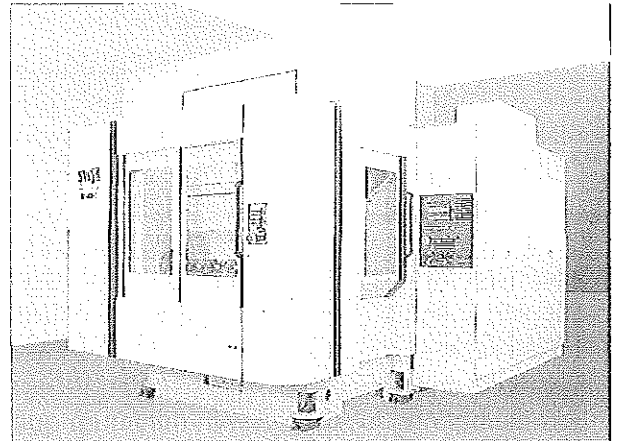
The machining stations BA400 have horizontal, adjacent motor spindles running synchronously. There are two different models, a two and a four spindle model.

- BA400-2 = two working spindles
- BA400-4 = four working spindles

The swivelling support system has the effect of forming two separate work areas, so that two (identical or different) customer-specific devices can be used..

The devices are incorporated in the swivelling support system by an NC rotating axle. This two-spindled, horizontal machining station is designed for milling, drilling, countersinking, abrasion and thread-drilling tasks.

- Horizontal work unit with motor spindles running synchronously.
- Two-site machining by virtue of two separate work areas (0° - 180° / 180° - 360°) in the swivelling support system (simultaneous loading and unloading).
- Equipment / tool tensioning systems can be swivelled horizontally by means of independent NC axes with thrust bearings (solid-angle processing).
- Encapsulated tool rack, pick up
- Solid, welded, machine stands that are resistant to twisting, with an integral coolant drain pan.
- Control consoles designed with pre-tensioned linear guides.
- Extremely dynamic and precise digital feed drives
- Machining area with sharply-angled baffle plates and covers for directing swarf and coolant into the swarf conveyor.
- Safety cabin totally partitioned off from the work area.



The machines leave the production line and are delivered in an operation-ready state, and include the following equipment:

(The specifications listed under technical data are fixed)

- SINUMERIK 840 D control system
- Complete electrical system
- Slide guides with rotating roller shoes
- Crown-gear swivel bearer, 0/180 degrees
- 2 NC circular milling attachments with thrust bearings, hydraulically clamped, for holding gripping yokes or clamp bars (optional extras).
- 1 Tool rack
- Hydraulic unit
- Spindle bearing lubricated with minimum quantity oil
- Automatic spindle orientation
- Tapping with no adjustment clamping
- Automatic pneumatic spindle cone cleaning
- Automatic central lubrication
- Pneumatic system with maintenance unit
- Coolant system with swarf conveyor
- Full-view safety cabin satisfying U V V
- Partition wall separating machining area from tooling area
- CFC-free central cooling unit
- Loading can be carried out from front / top
- Cleaning gun and cold-light lamp
- Supports (1 set of mounting fixtures)
- Standard painted finish
- Documentation

OPTIONAL ADDITIONAL MECHANICAL FEATURES

- Increased range of speeds (only BA400-2)
- Tool interface for hollow-shank cone
DIN 69 893-HSK-A63 with pneumatic system control
- Adaptation to spindle to accommodate multi-spindle drill heads
- Gripping yoke supports for accommodating a gripping yoke, with hydraulic and pneumatic connection
- Gripping yoke
- Tensioning bar
- Hydraulic tensioner upgrade, comprising:
 - Pressure switch for monitoring the tensioning pressure
 - Valve system for double-acting tensioning cylinder
 - 1 tensioning circuit in work area 1
 - 1 tensioning circuit in work area 2
 - Inputs and outputs in the PLC control system
- 1 oil distributor for the NC circular milling attachment
 - 4/8 hydraulic connections
 - 1 pneumatic connection

- Enhanced coolant system for tools with internal coolant channels:
 - Supplied centrally through the main spindle
 - High-pressure pump
 - Backflush filter
- Automatic loading door (opening and closing)
 - Door protected by a contact strip
- Emulsion mist separation system
- Direct path measuring system with incremental glass scales

ADDITIONAL FEATURES WITH CNC CONTROL SYSTEM

- Automatic zero correction for 3 axes by using a 3D measuring feeler for correcting the zero points of the workpiece (measurement of unmachined parts) and for measuring wear in tools.
- Monitoring system for service life of tools, and automatic retrieval of compatible tools.
- Additional memory
- Loading from hard disk a block at a time (only possible in operating mode 'Automatic - F')
- Second V 24 interface
- electronic hand wheel

2.3 CNC control

The BA 400 processing stations from "Schwäbische Werkzeugmaschinen GmbH" are supplied with the SINUMERIK 840D control system.

The standard set of manufacturer's documentation covering operation and programming of the control system is included in a separate folder.

The special operating and programming notes from "Schwäbische Werkzeugmaschinen GmbH" for adapting the standard control system to the individual processing stations (menus, user guidance, operating modes, messages, M functions and cycles, examples etc.) are included later in these operating instructions in the chapter entitled "Operation".



**HORIZONTAL MILLING AND DRILLING STATION
BA400-2 / BA400-4 CNC**

3 Illustrations

Contents

3 ILLUSTRATIONS	3-1
3.1 Preliminary information	3-2
3.2 Photographs of the machine	3-3
3.2.1 General view	3-3
3.2.2 Loading area	3-7
3.2.3 Work area	3-9
3.2.4 Tool magazine BA400-2	3-11
3.2.5 Tool magazine BA400-4	3-13
3.2.6 Units	3-14
3.2.7 Separate components	3-17
3.2.8 Optional extras	3-23

Subject to technical changes.



3.1 Preliminary information

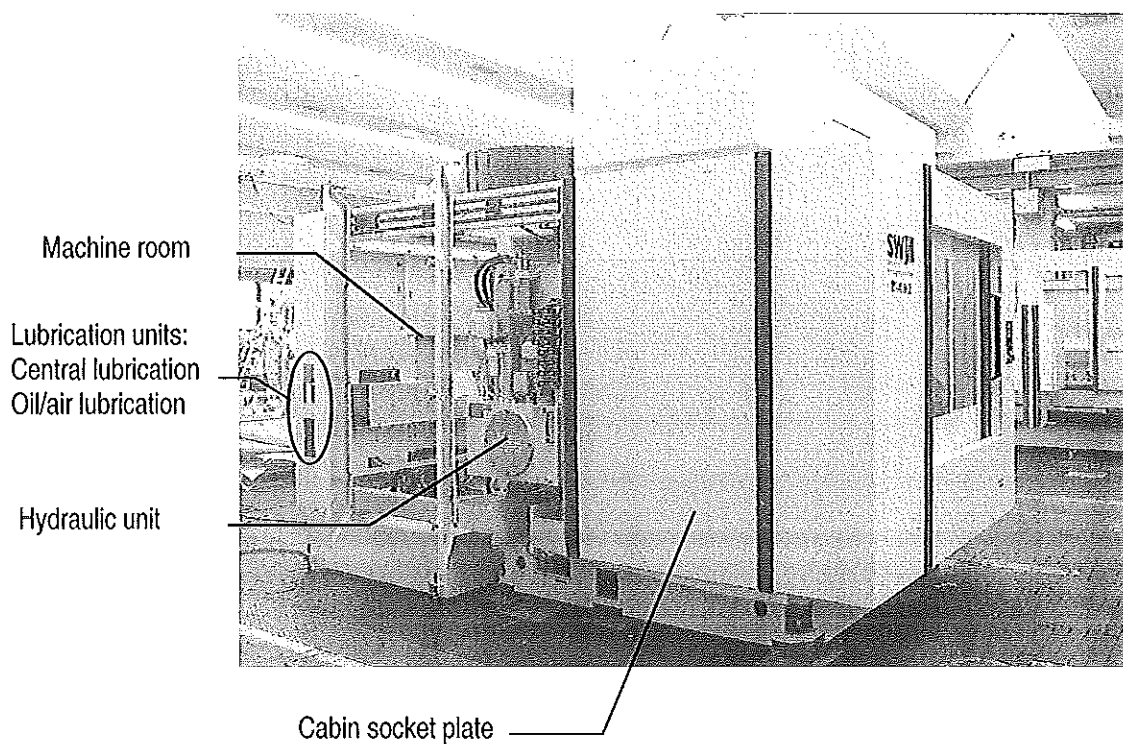
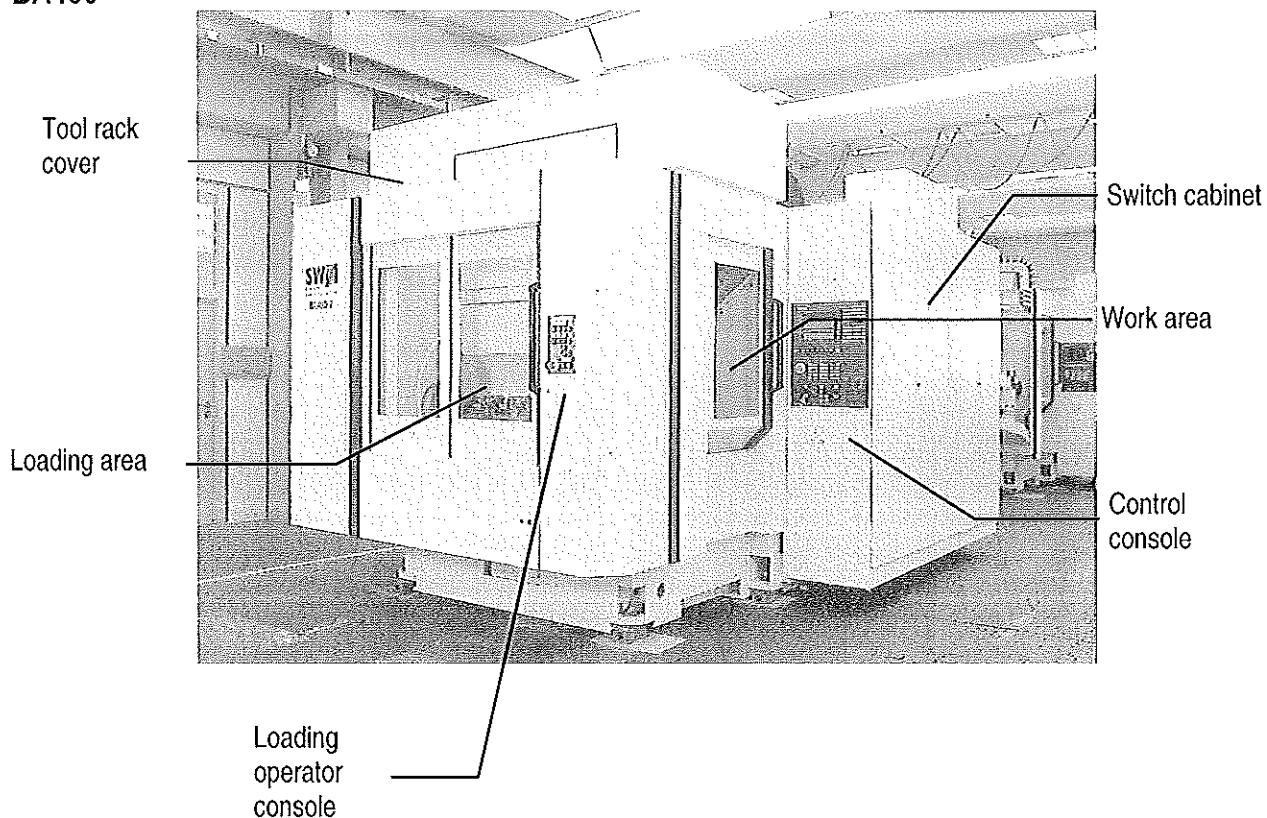
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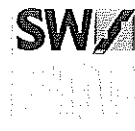
3.2 Photographs of the machine

3.2.1 General view

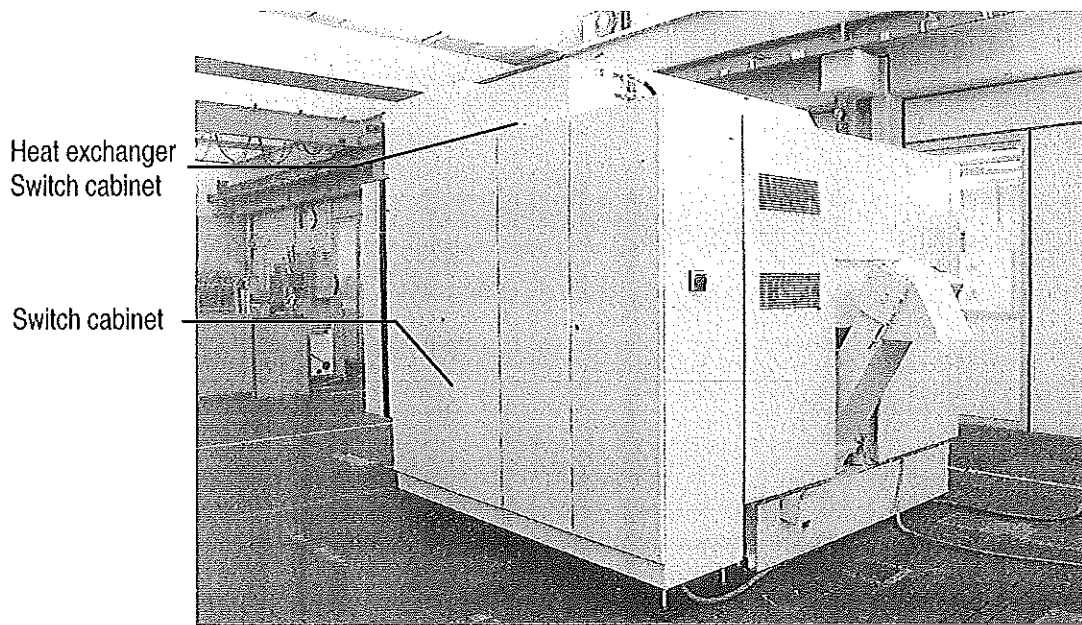
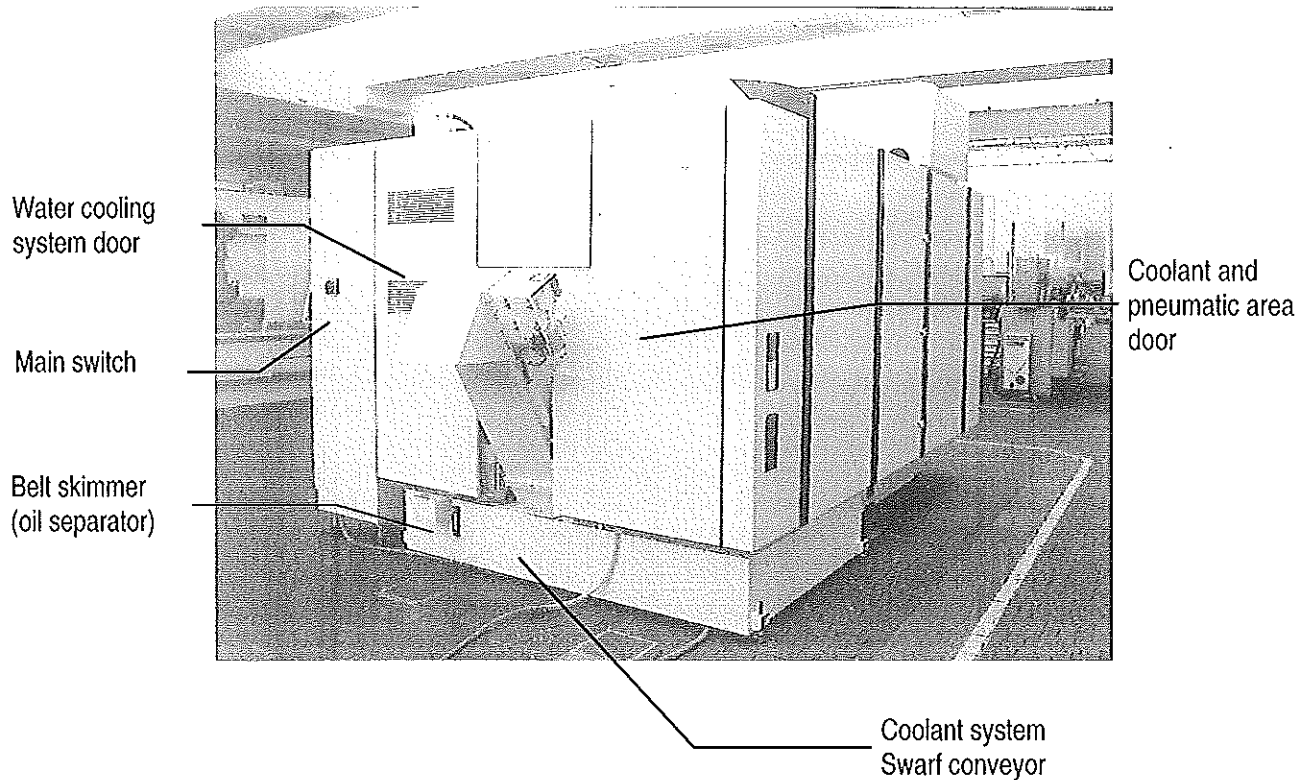
BA400



**HORIZONTAL MILLING AND DRILLING STATION
BA400-2 / BA400-4 CNC**



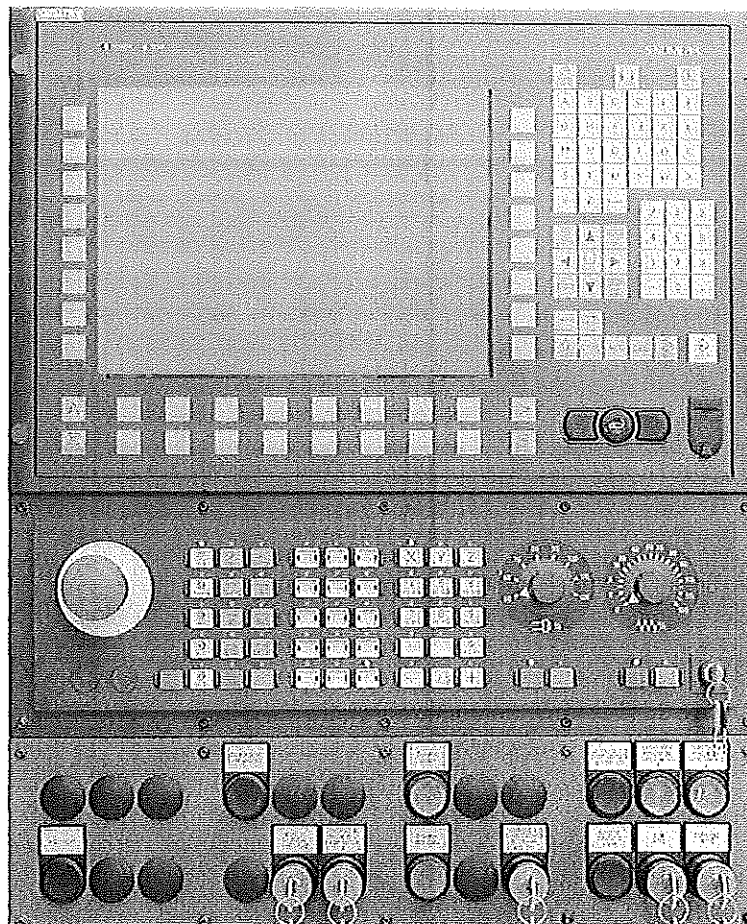
BA400-4



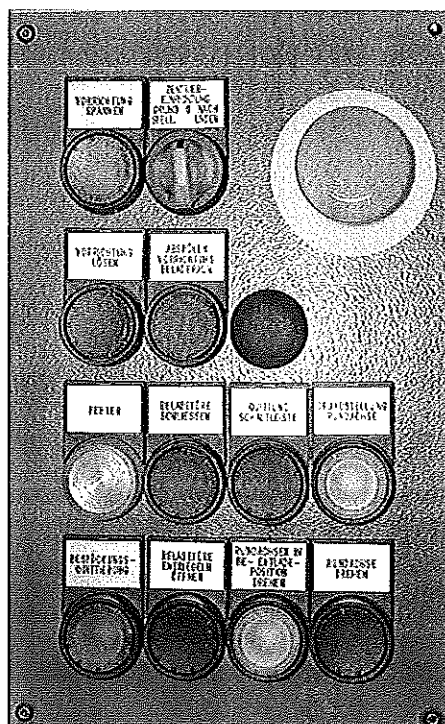
HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC



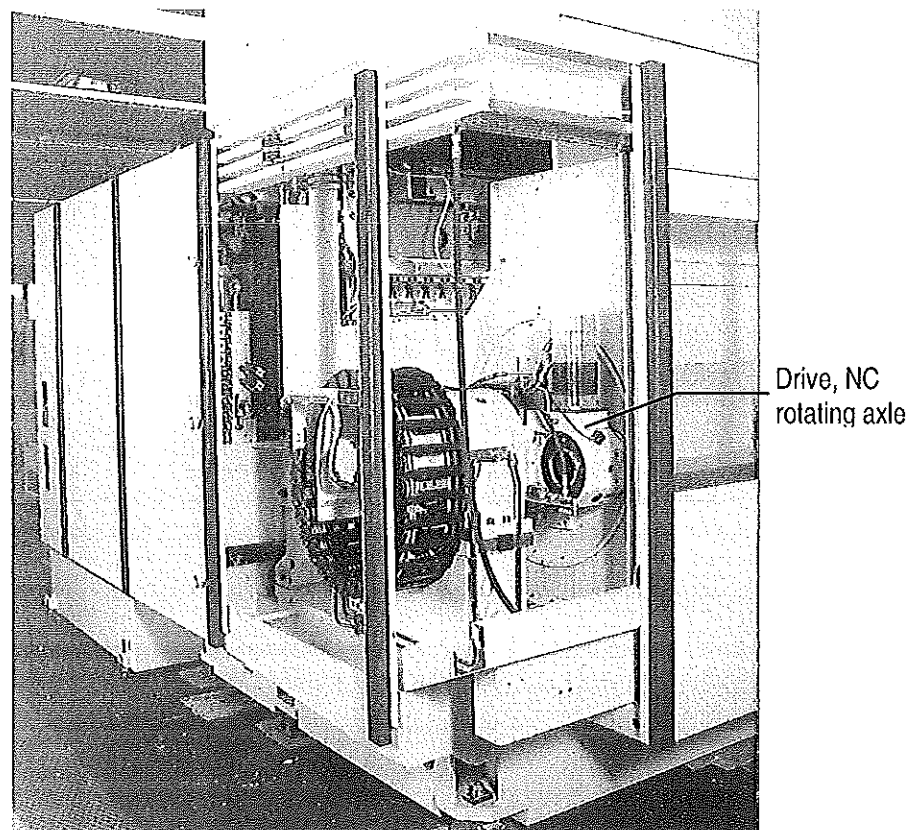
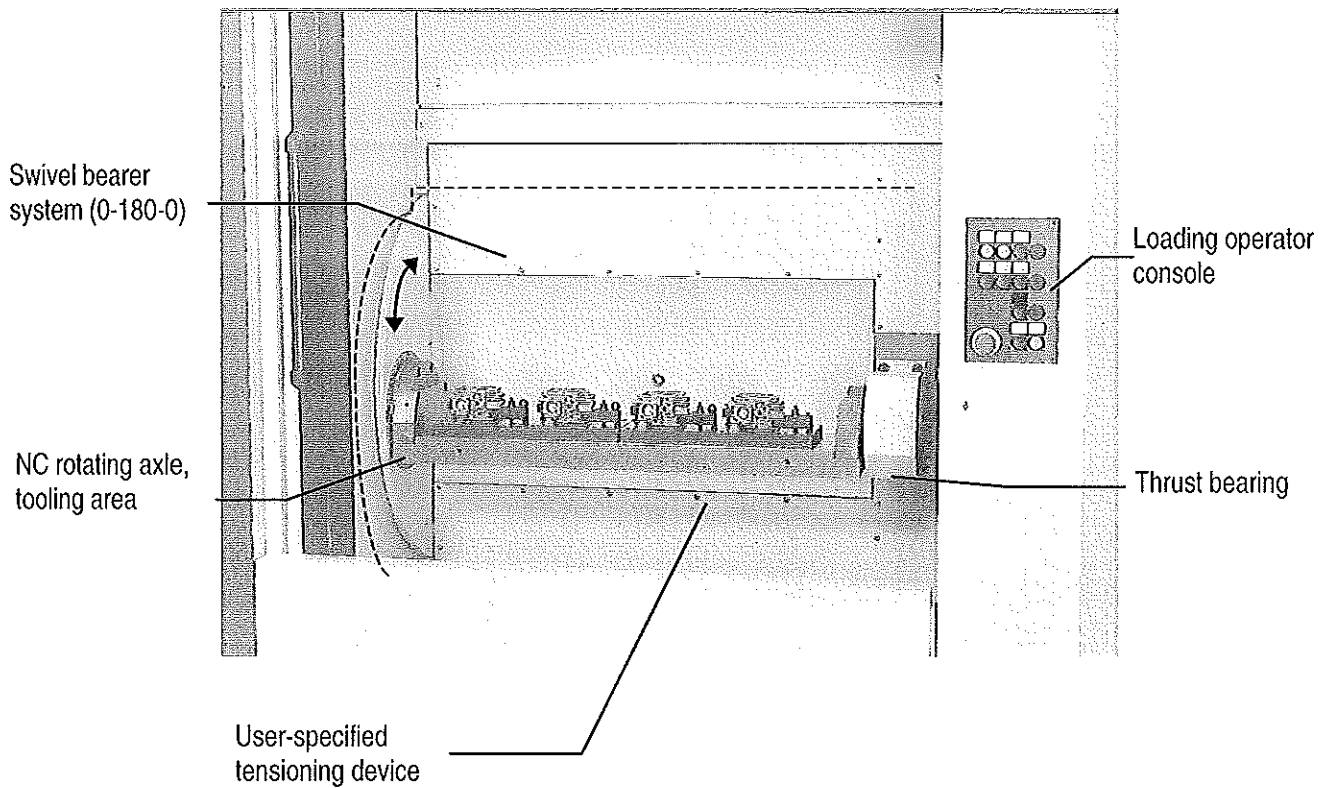
Control console



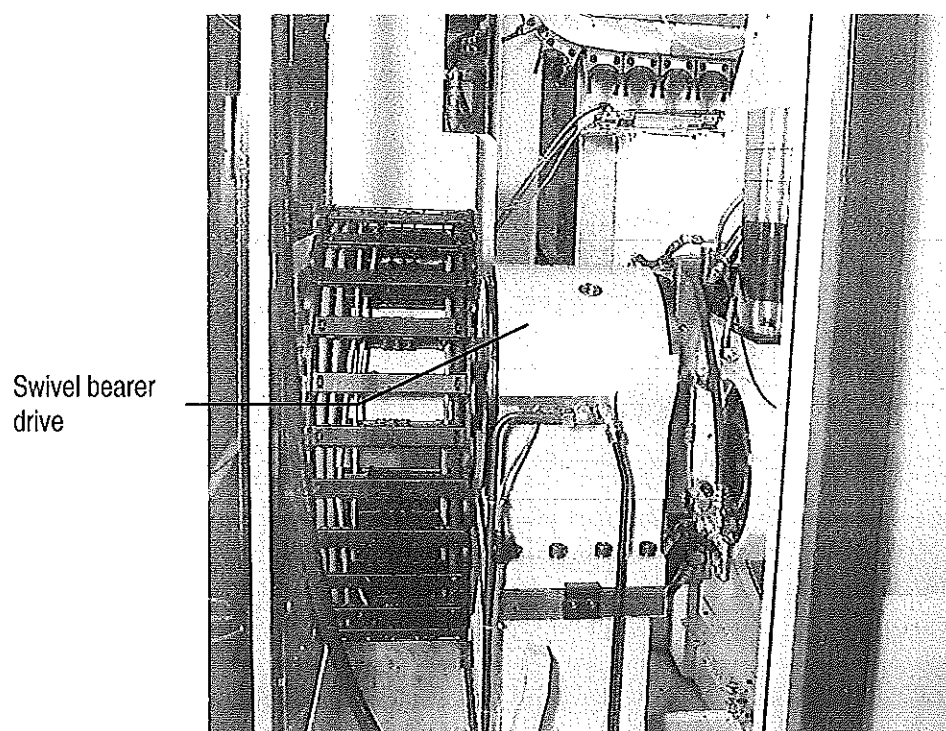
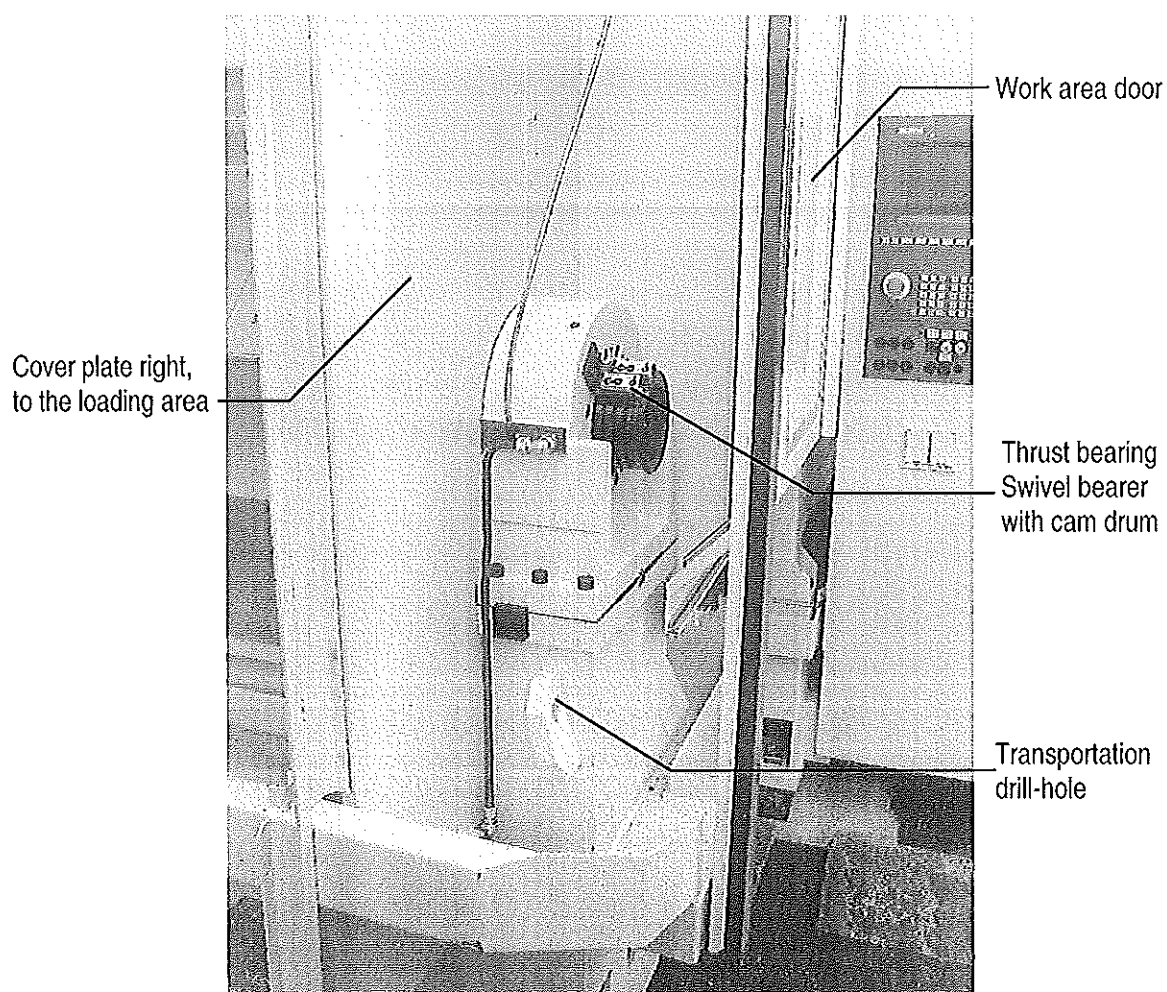
Loading operating console



3.2.2 Loading area

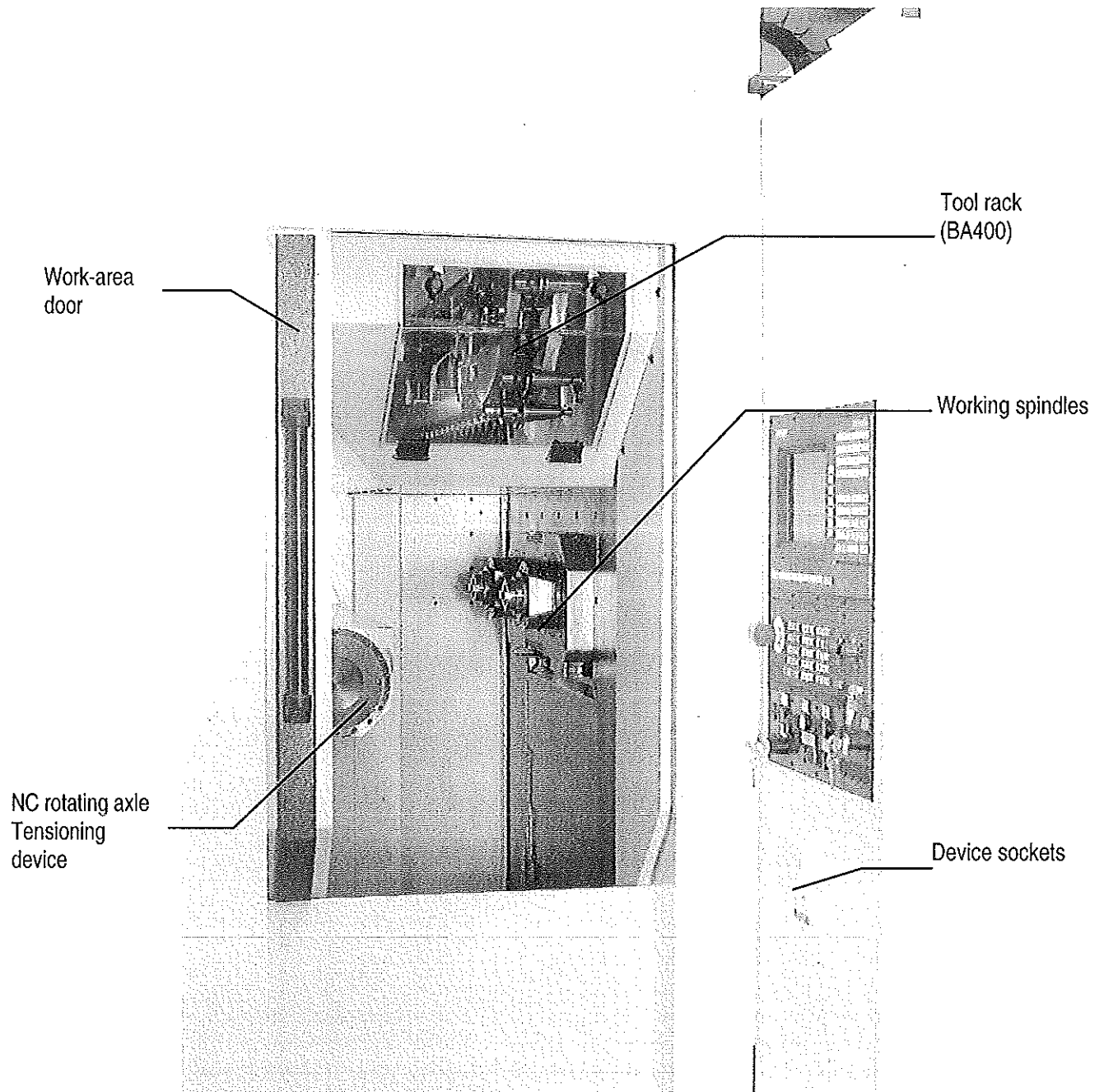


HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC



3.2.3 Work area

BA400-2

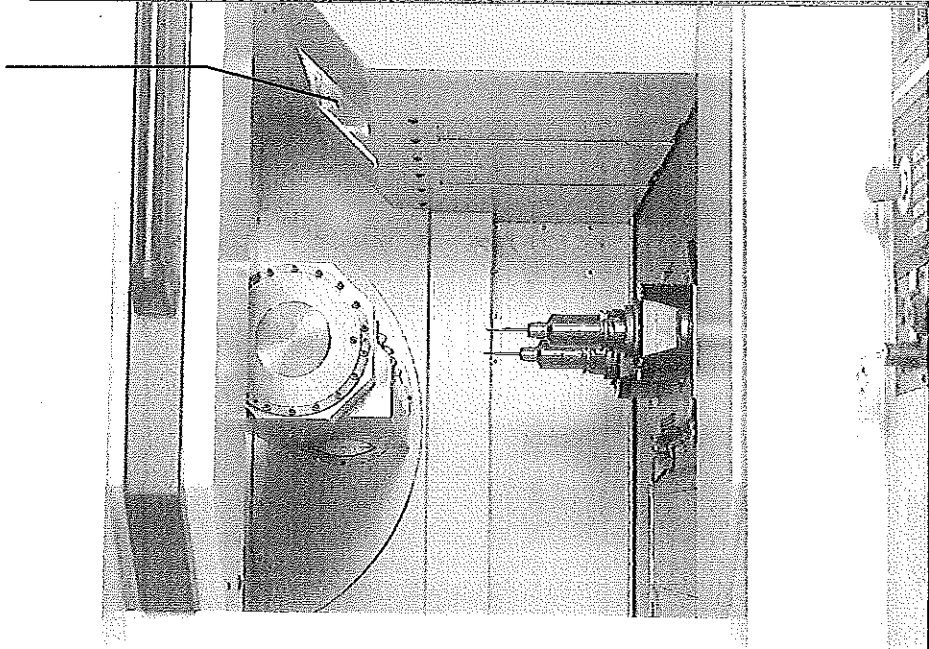


HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC

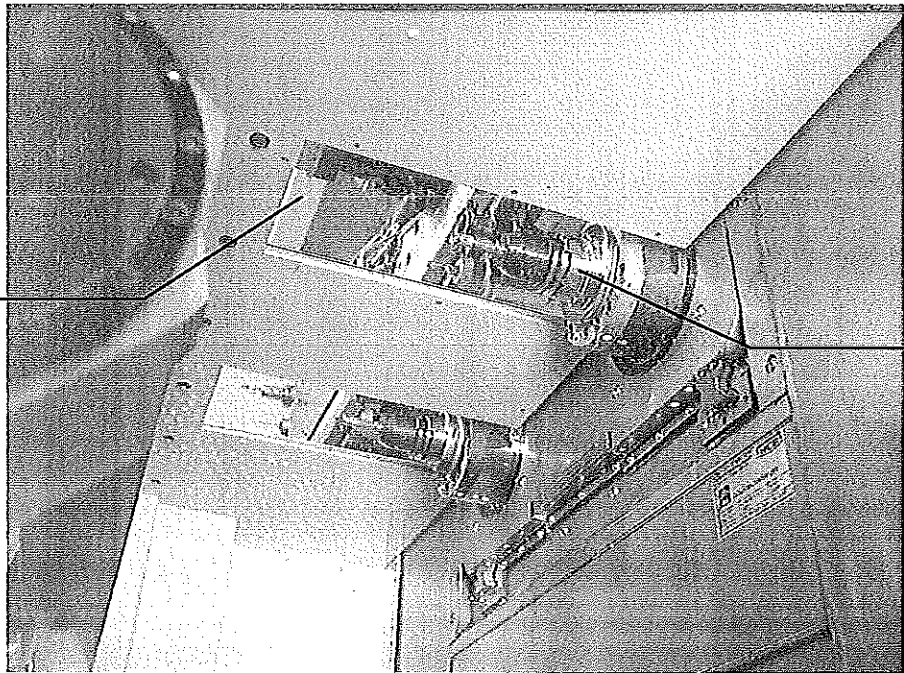
Work area

BA400-2

Lighting



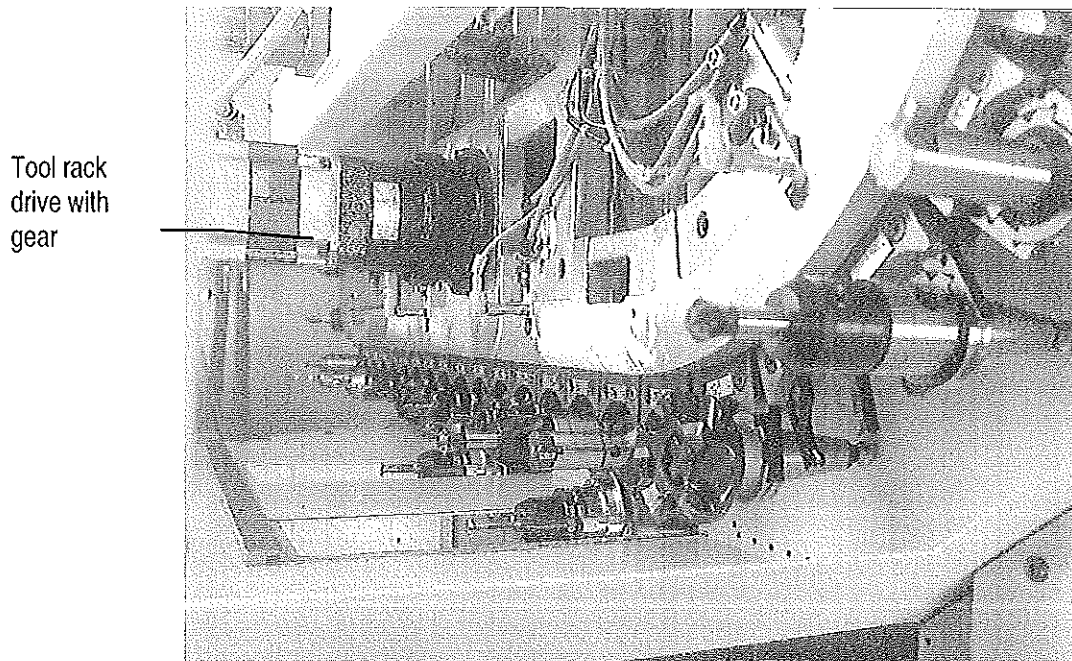
Tool rack
sheet metal
cover



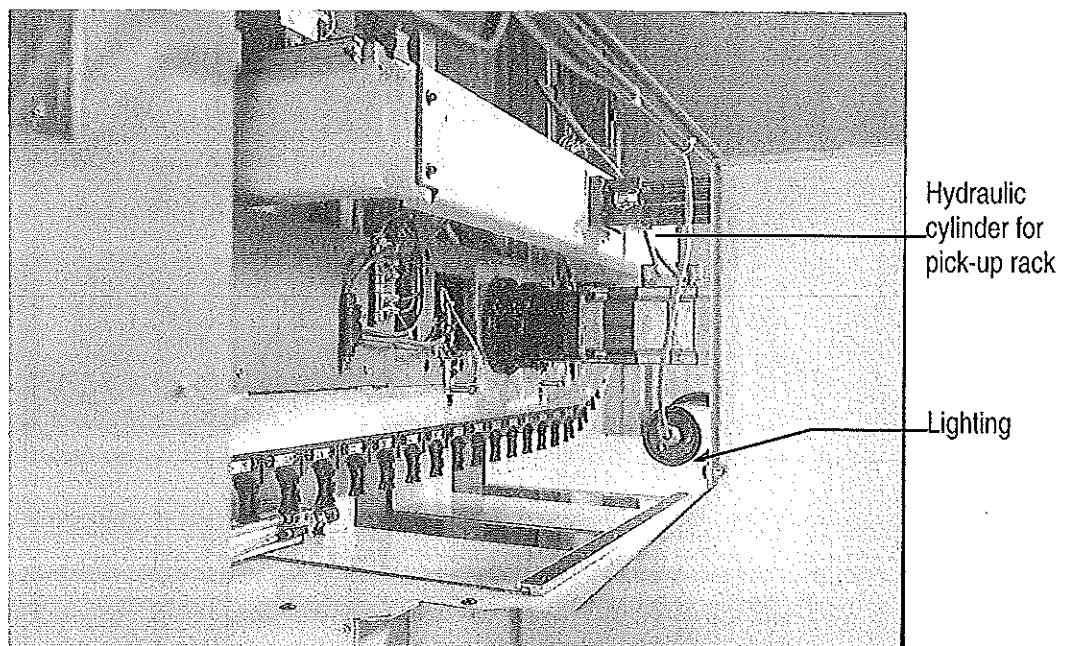
Spindle between
work area and
tool rack

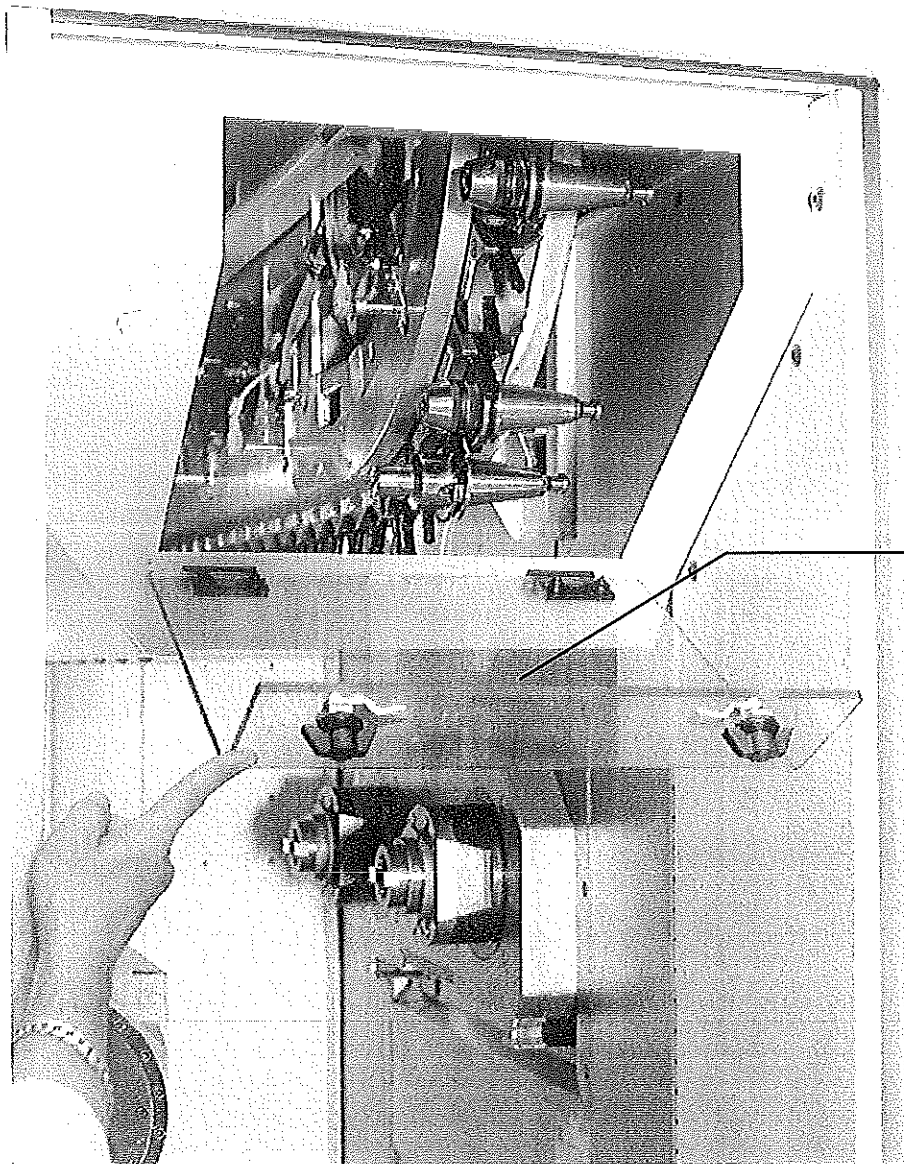
3.2.4 Tool magazine BA400-2

View from the right



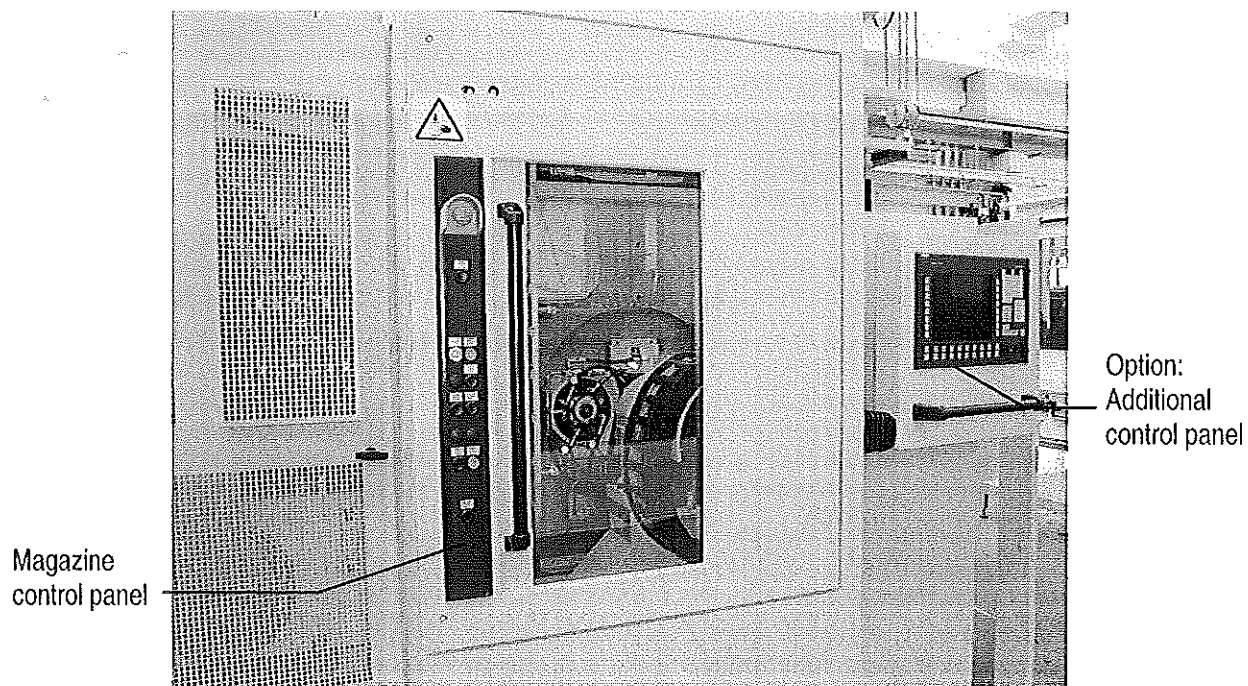
View from the left



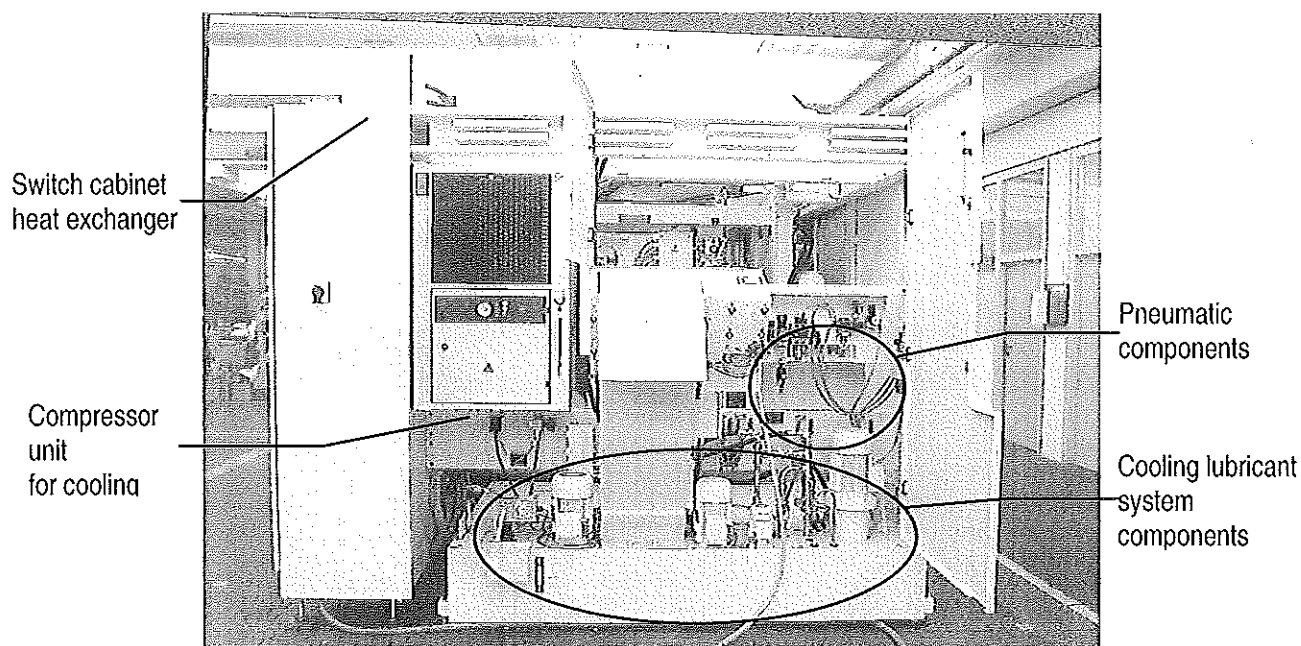


Tool rack
loading cover
BA400-2

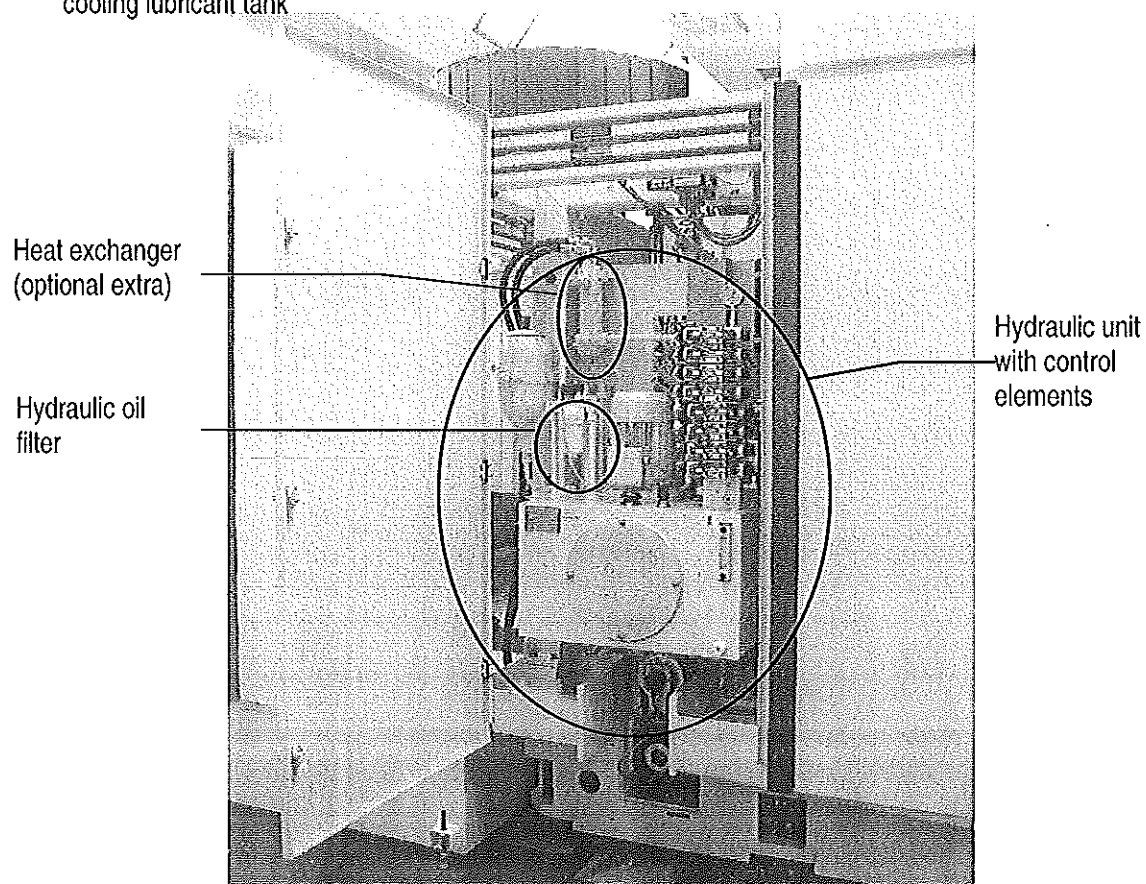
3.2.5 Tool magazine BA400-4



3.2.6 Units

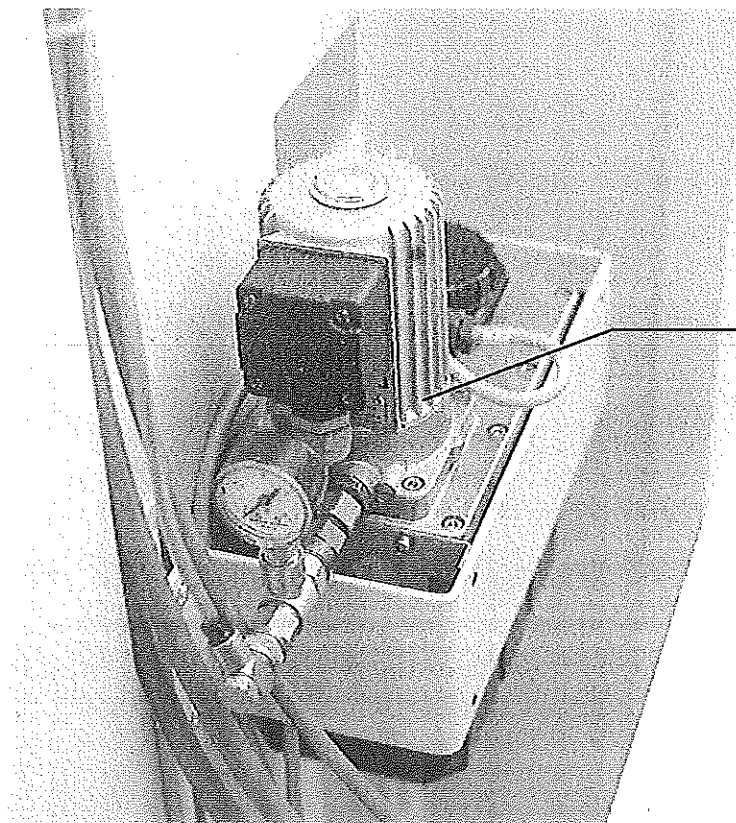


Swarf conveyor with cooling lubricant tank





Central
lubrication
unit

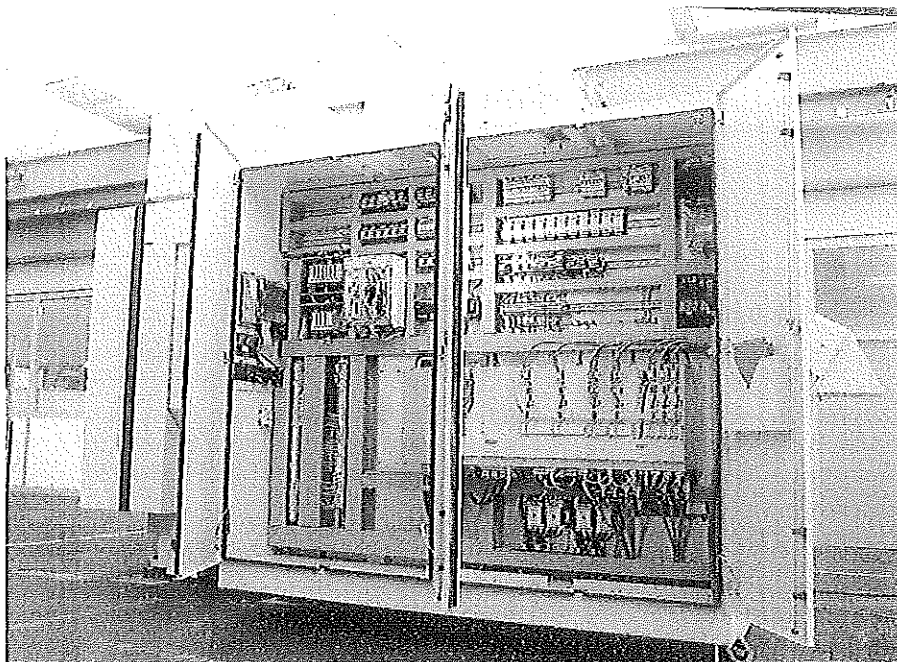


Oil/air lubrication
unit

HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC

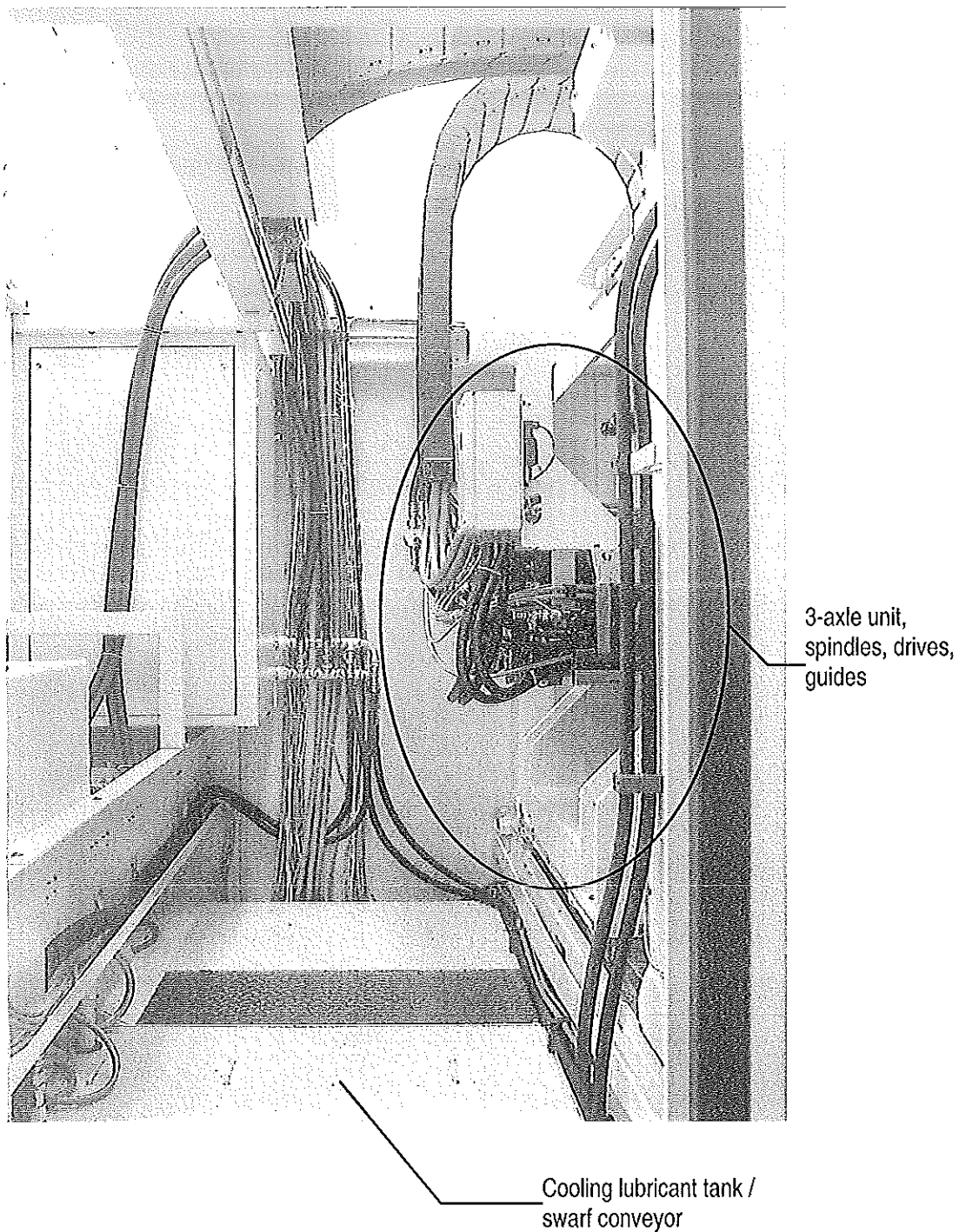


Switch cabinet



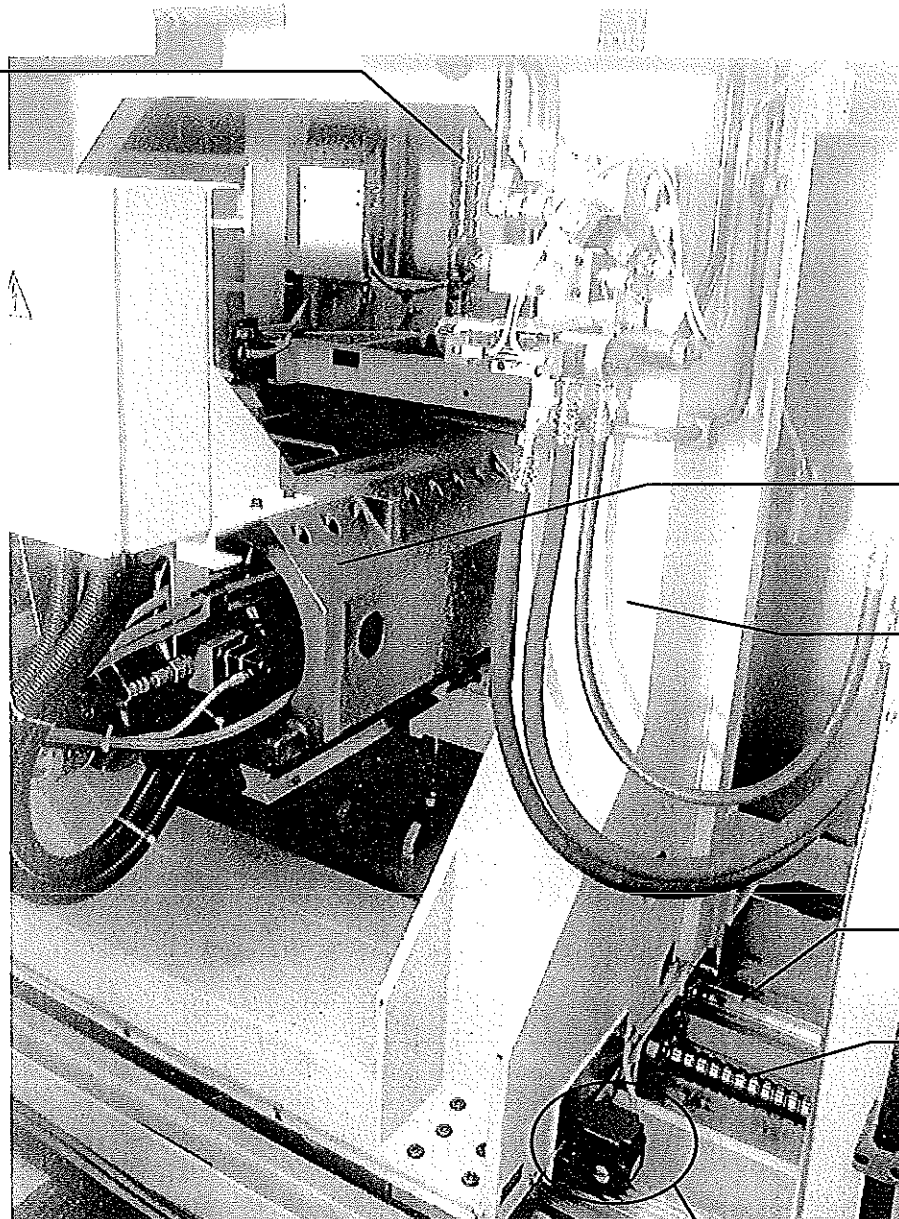
3.2.7 Separate components

Machine room



Control console (3-axe unit)

Circular rack
Y-axis



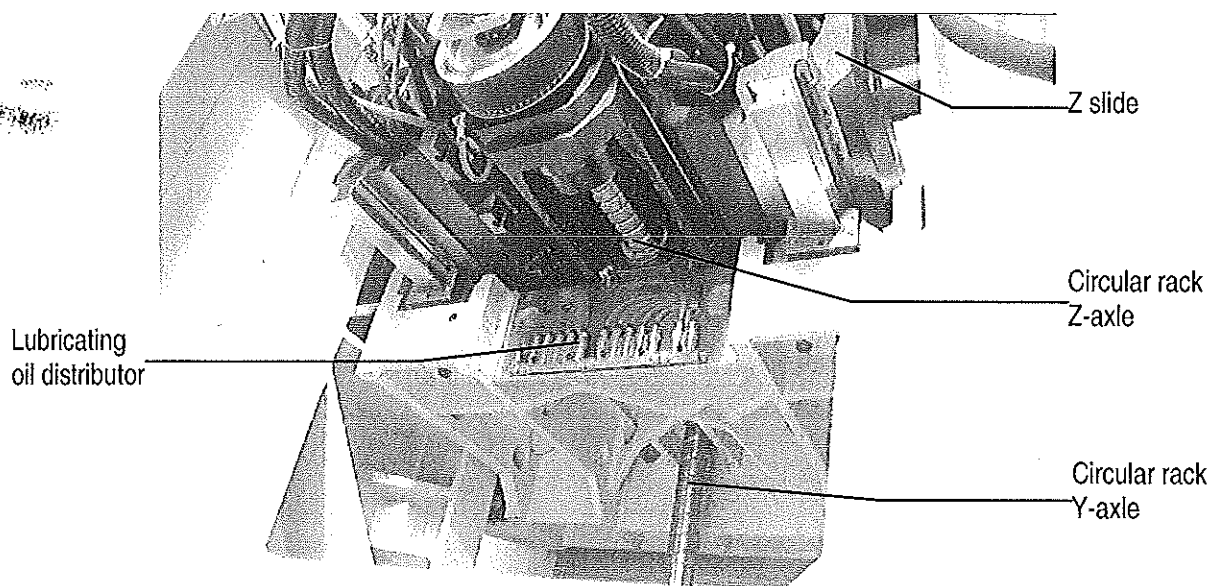
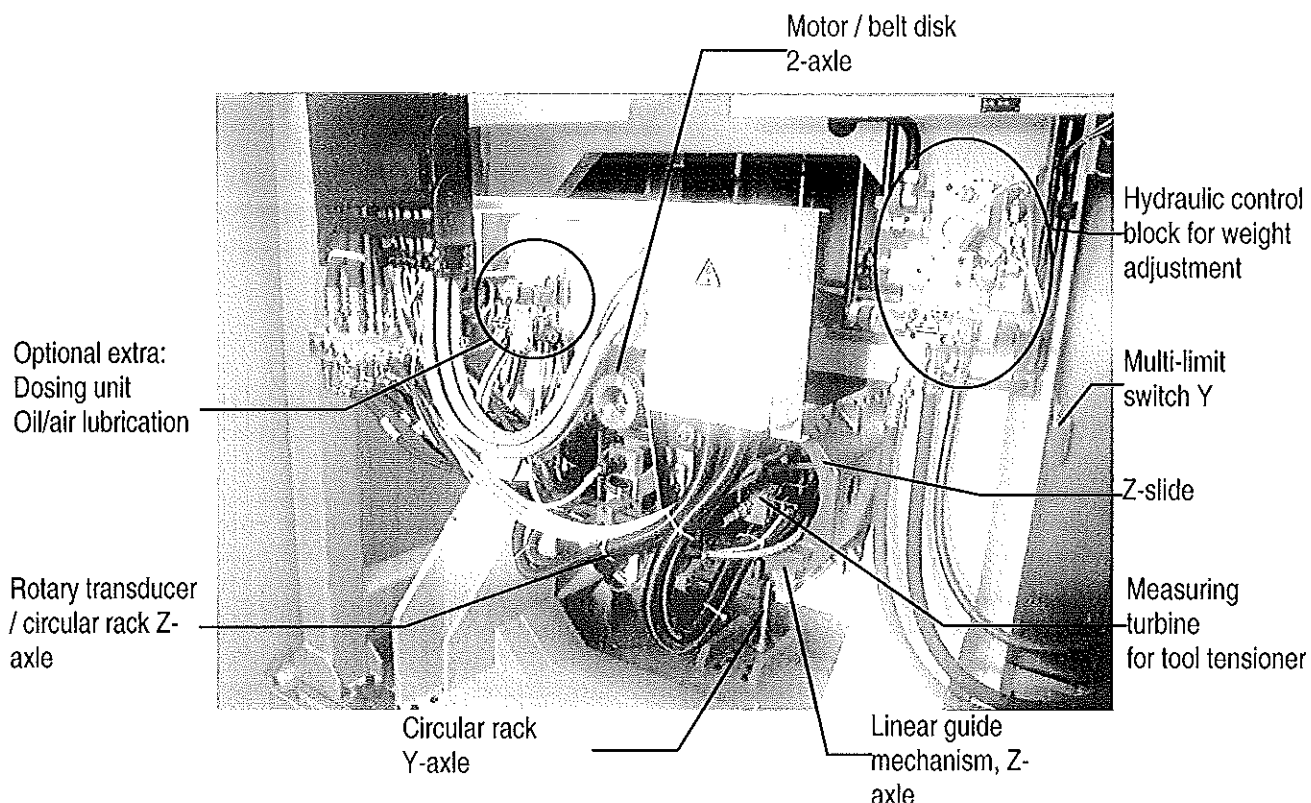
Z-slide

Control console

Linear guide
mechanism,
X-axis

Circular rack
X-axis

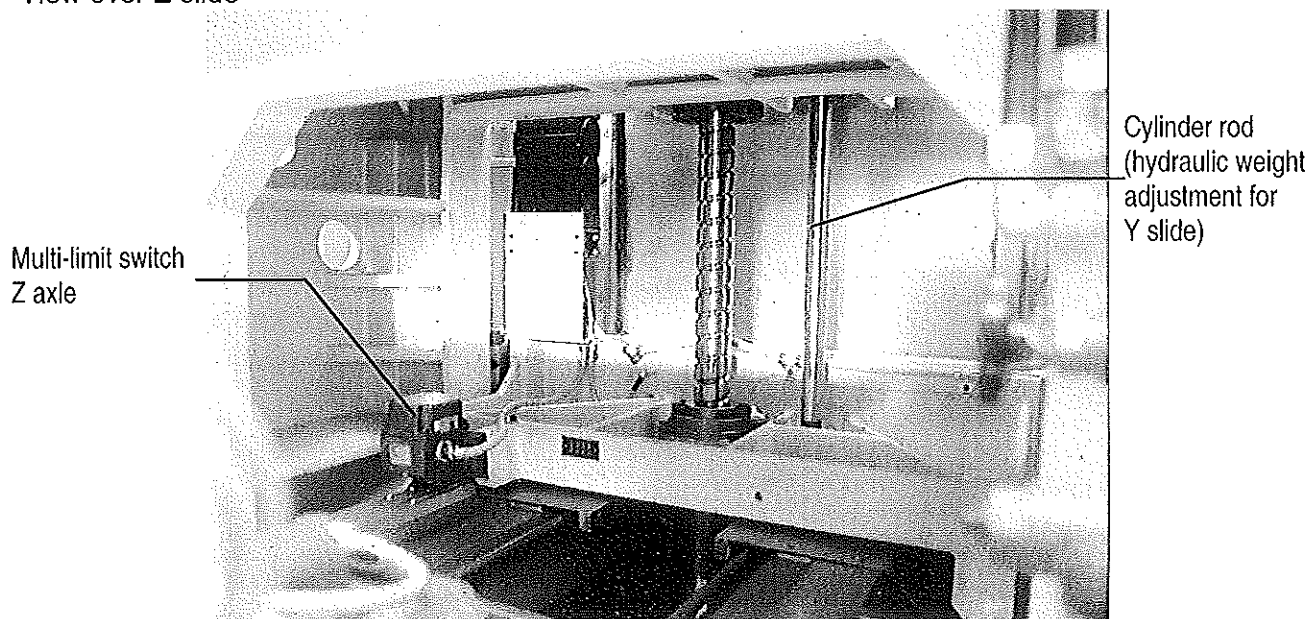
Multi-limit switch /
cam strip
X-axis



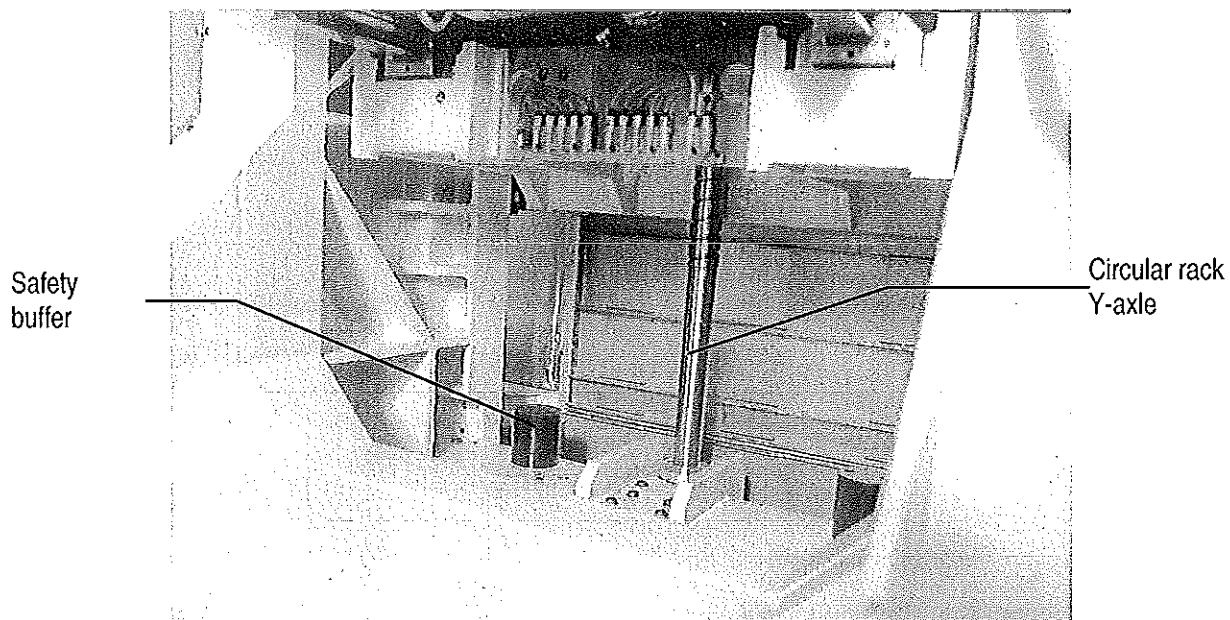
HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC



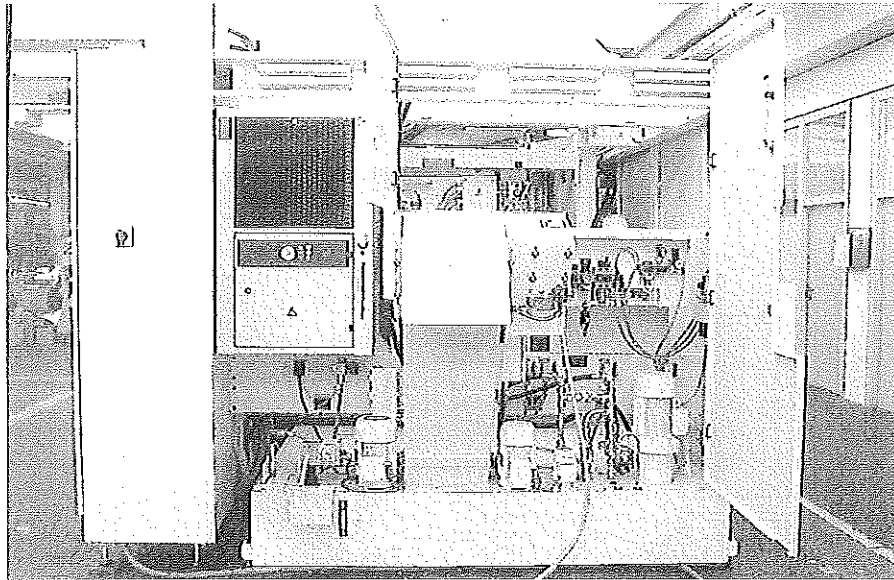
View over Z slide



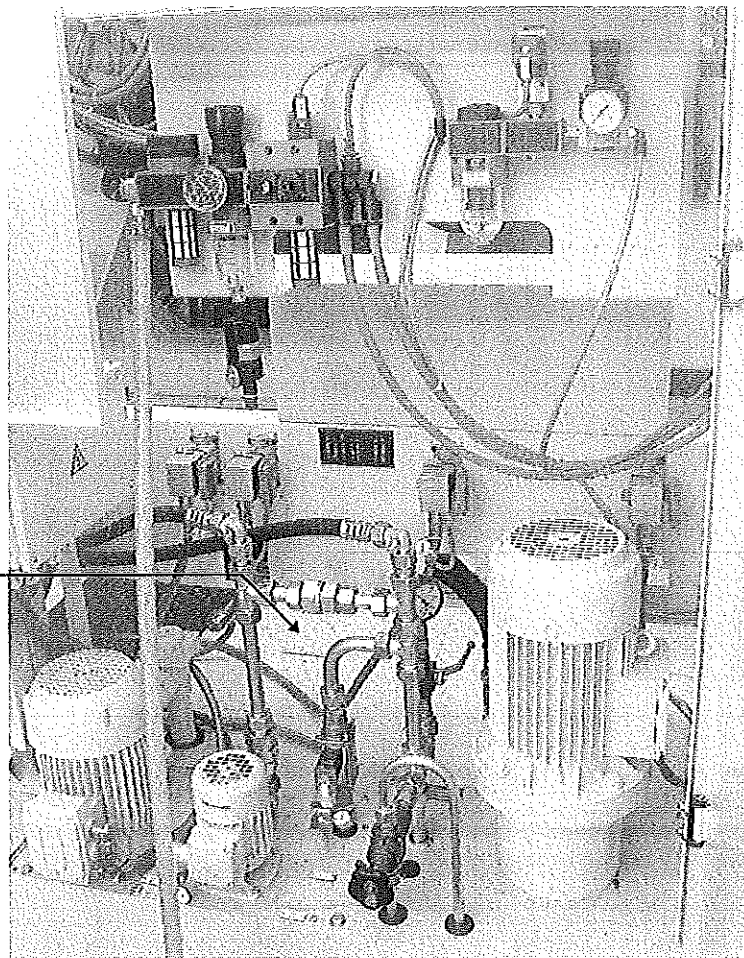
View under Z slide



Coolant (/cooling lubricant) and pneumatic system area



Heat exchanger
cooling lubricant
(optional extra)



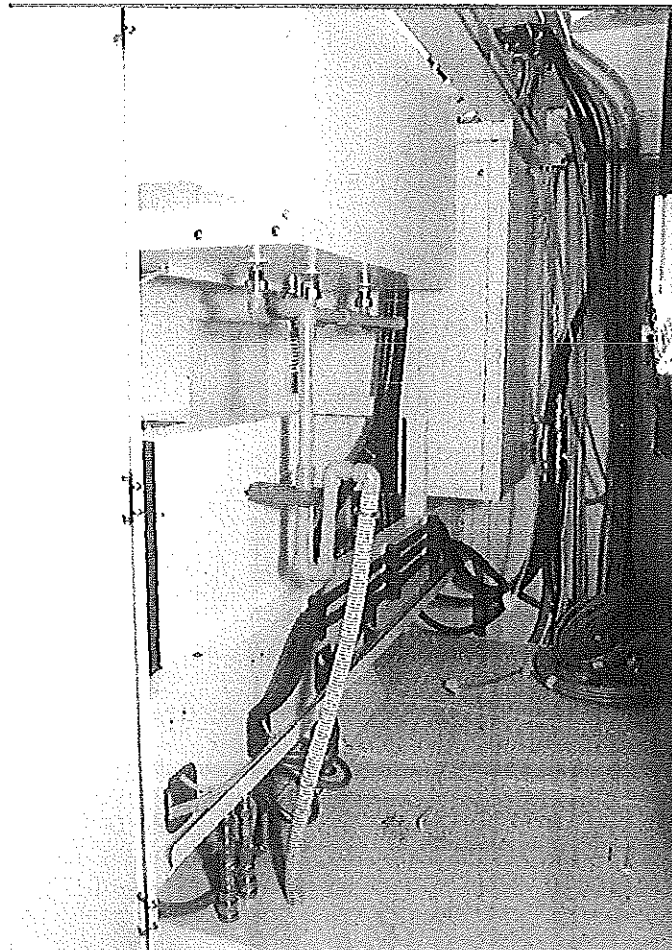
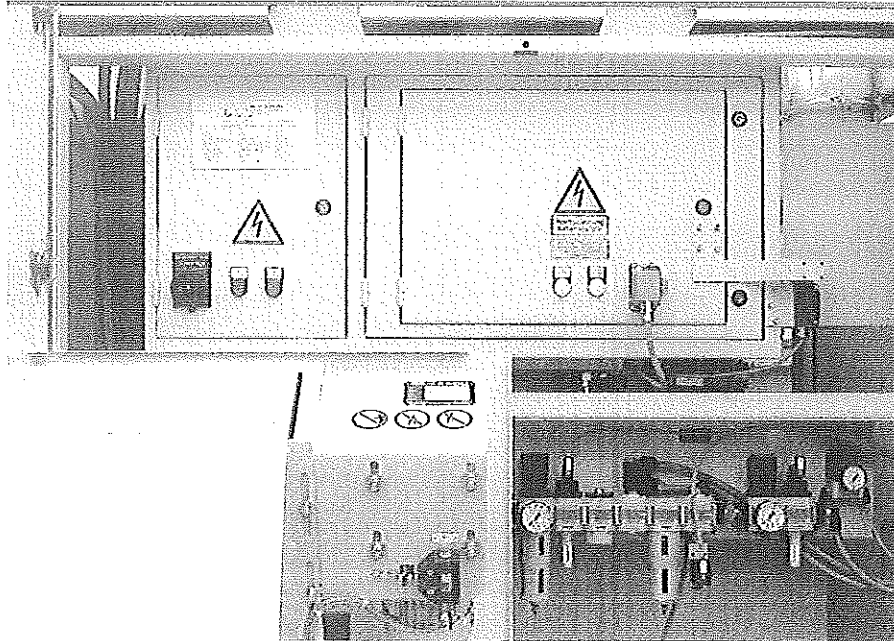


HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC

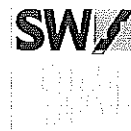


3.2.8 Optional extras

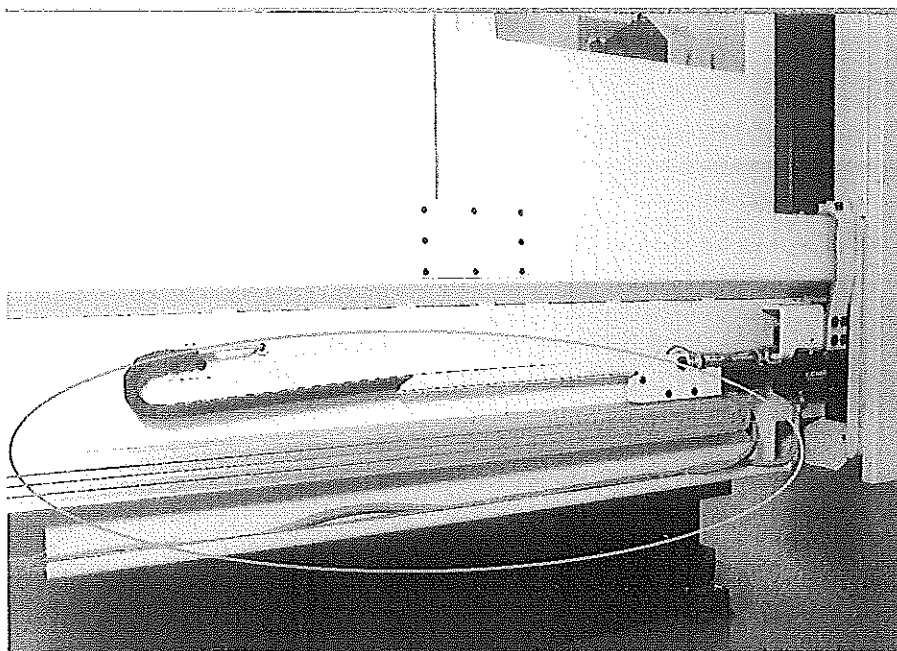
Compact electric filter



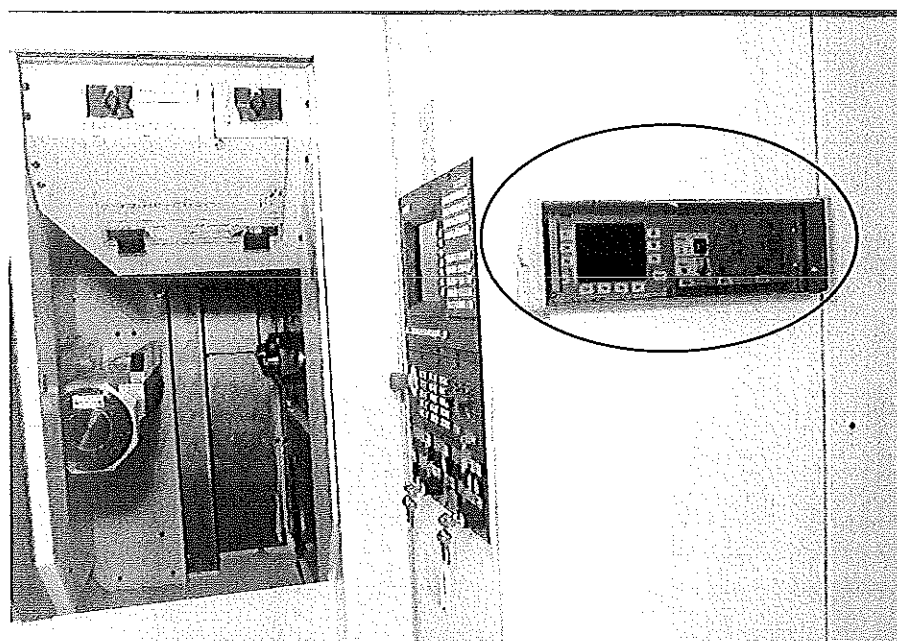
HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC

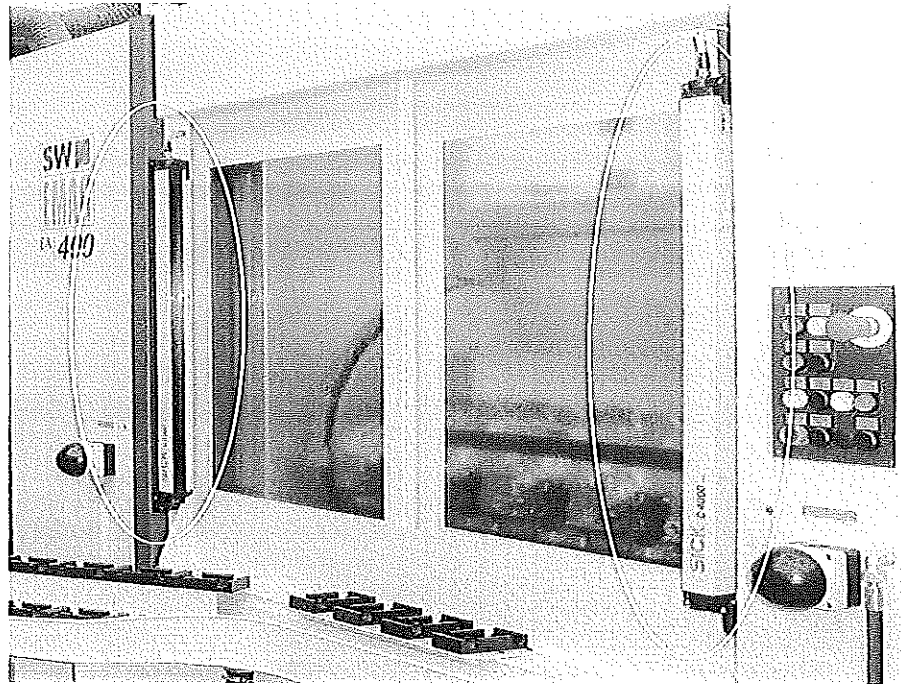


Automatic loading bay doors



Tool monitoring system (Artis)





Safety light curtain SICK

HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC





6 Technical data

CONTENTS

6 TECHNICAL DATA	6-1
6.1 Technical data for BA400-2 / BA400-4	6-2
6.1.1 Performance and torque chart	6-9

6.1 Technical data for BA400-2 / BA400-4

GENERAL DATA	BA400-2		BA400-4	
MAINS ELECTRICITY CONNECTION				
Supply voltage:	3 x 400 V / 50 Hz, earthed, TN-S or TN-C mains no current-operated e.l.c.b. system			
Total connection rating	approx. 88 kVA		approx. 100 kVA	
PNEUMATIC CONNECTION				
Compressed air quality conf. to ISO 8573-1	purity class 4			
Operating pressure	min. 5.5 bar			
Supply pressure	max. 12 bar			
Average air requirement at 5.5 bar	200 l/min		250 l/min	
Dimensions of connection	G 1/2"			
DIMENSIONS (L x W x H) [m]				
Setup area (excluding escape routes)	6.35 x 4.50 x 3.50		6.35 x 4.50 x 4.00	
Machine dimensions	4.70 x 3.00 x 3.05		4.7 x 3.4 x 3.3	
Dimensions for transportation	see chapter on transportation			
WEIGHT				
Machine (operational)	approx. 13800 kg		approx. 14800 kg	
Transportation weights	see chapter on transportation			
EMISSIONS				
Sound level in nominal operation (not machining)	approx. 78 dB(A)			
Electromagnetic emission				
ENVIRONMENTAL CONDITIONS				
Permissible altitude	1000 m amsl			
Permissible ambient temperature	15-40 °C			
Permissible humidity	max. 90% (no condensation)			
Atmosphere	no corrosive air			

CONTROL	
CNC control	Siemens 840D
Hard disk storage	200 MB
Main memory	256 kB
Main memory (optional)	max. 1.5 MB
Compensation for pitch error in spindle	
Compensation for thermal expansion	(optional)
Serial interface	RS232
LAN interface, Ethernet (option)	SINDNC or SINCOM
Telediagnostic, MMC (option)	Modem / Internet
Teleservice, PLC (option)	Modem / Internet

WORKING SPINDLES	BA400-2	BA400-4
Number of spindles	2	4
Spindle arrangement	horizontal, adjacent	
Gap between spindles	400 mm	each 200 mm
Design	motor spindles, liquid-cooled, AC engineering	
Cooling lubricant (standard)	Nozzles at the working spindle	
Cooling lubricant (optional)	internal coolant delivery	

SPINDLE DRIVING GEAR	BA400-2	BA400-4
Model 12500 (Kessler (SK))		
Torque range	50 - 12500 1/min	
Performance (at 2600 1/min)	2x25 kW (S6/40% ED) 2x18 kW (S1/100% ED)	
Torque	2x80 Nm (S6/40% ED) 2x60 Nm (S1/100% ED)	
Run-up time to:	12,500 1/min ca. 1.4 s	
Main spindle Ø	70 mm	
Main spindle bearings	- 3-times	
Spindle lubrication	minimum quantity oil lubrication	
Tool interface	steep-angle cone DIN 69871-A40 (AD40) tightening bolts DIN 69872 - 19	
Tool tensioner	pulling force 11 kN; hydraulically operated;	
Model 12500 Kessler, reinforced (HSK)		
Torque range	50 - 12500 1/min	
Performance (at 2600 1/min)	2x35 kW (S6/40% ED) 2x25 kW (S1/100% ED)	
Torque	2x80 Nm (S6/40% ED) 2x60 Nm (S1/100% ED)	
Run-up time to:	12,500 1/min approx. 1.55 s	
Main spindle Ø	70 mm	
Main spindle bearings	3-times	
Spindle lubrication	minimum quantity oil lubrication	
Tool interface	hollow-shank cone DIN 69893-HSK-A63	
Tool tensioner	pulling force 25 kN; hydraulically operated	

HORIZONTAL MILLING AND DRILLING STATION
BA400-2 / BA400-4 CNC



SPINDLE DRIVING GEAR	BA400-2	BA400-4
Model 17500 Cyttec (HSK)		
Torque range	50 - 17500 1/min	
Performance (at 2600 1/min)	2x23,5 kW (S6/40% ED) 2x18 kW (S1/100% ED)	4x16 kW (S6/40% ED) 4x12 kW (S1/100% ED)
Torque	2x80 Nm (S6/40% ED) 2x60 Nm(S1/100% ED)	4x50 Nm (S6/40% ED) 4x38,2 Nm(S1/100% ED)
Run-up time to:	12,500 1/min ca. 1.5 s	17,500 1/min ca. 2.5 s
Main spindle Ø	70 mm	65 mm
Main spindle bearings	5-times	
Spindle lubrication	minimum quantity oil lubrication	
Tool interface	hollow-shank cone DIN 69893-HSK-A63	
Tool tensioner	pulling force 20 kN; hydraulically operated	
Model 17500 Kessler (HSK)		
Torque range	50 - 17,500 1/min	
Performance (at 2800 or 3000 1/min)	2x25 kW (S6/40% ED) 2x18 kW (S1/100% ED)	4x16 kW (S6/40% ED) 4x12 kW (S1/100% ED)
Torque	2x80 Nm (S6/40% ED) 2x60 Nm(S1/100% ED)	4x50 Nm (S6/40% ED) 4x38,2 Nm(S1/100% ED)
Run-up time to:	17,500 1/min ca. 3 s	17,500 1/min ca. 1.6 s
Main spindle Ø	70 mm	65 mm
Main spindle bearings	3-times	4-times
Spindle lubrication	minimum quantity oil lubrication	
Tool interface	hollow-shank cone DIN 69893-HSK-A63	
Tool tensioner	pulling force 25 kN; hydraulically operated	



HORIZONTAL MILLING AND DRILLING STATION BA400-2 / BA400-4 CNC

FEED DRIVES		BA400-2	BA400-4
Model		AC engineering	
Feed / input rate	X	1 - 40,000 mm/min	
	Y	1 - 40,000 mm/min	
	Z	1 - 40,000 mm/min	
Feed force	X	9,250 N	11,000 N
	Y	9,250 N	11,000 N
	Z	9,250 N	11,000 N
Mean axle acceleration	X	3 m/s ²	
	Y	3 m/s ²	
	Z	5 m/s ²	
Path measurement (standard)		X-, Y-, Z-axle indirect	X-, Y-axle indirect Z-axle direct
Path measurement (optional)		X-, Y-, Z axle direct	X-, Y- axle direct

FAHRWEGE		BA400-2	BA400-4
X - axle		400 mm	200 mm
Y - axle (Change position)		400 (700) mm	
Z - axle		400 mm	

PRECISION		
Positional tolerance Tp		0.01 mm

With reference to our basic specifications these values can be guaranteed on the part of the user, and are measured in accordance with VDI/DGQ 3441 with a reference temperature of 20 °C.

TOOL RACK		BA400-2	BA400-4
Chain rack		2 x 30 tools	4 x 30 tools
Chain rack (optional)		2 x 60 tools	
Tool rest		position-coded	
Numbering		2 x 1-30 (60)	4 x 1-30
Max. tool Ø		70 mm (125 mm if adjacent spaces are unoccupied)	
Max. tool length		275 mm (see tool data sheet)	
Max. tool weight		10 kg	6 kg
Max. total loading:			
for 2x30 WZ		240 kg	
for 2x60 or 4x30 WZ		480 kg	480 kg

TOOL CHANGE		BA400-2	BA400-4
Tool change system		pickup, automatic	
Mean interruption time		approx. 4,5 sec	approx. 5 sec
in connection with "M58" (plan arrangement)		approx.. 6 sec	

HORIZONTAL MILLING AND DRILLING STATION
BA400-2 / BA400-4 CNC



Work area	BA400-2	BA400-4
Work room		
Lighting	35 W	
Crown-gear swivel bearer		
Max. transport load	1,100 kg	
Swivel time 0/180 degrees	ca. 4 s	
2 NC circular milling attachments, clamped hydraulically		
Surface plate speed	33.3 1/min	
Precision of division (seconds of angle)	+/- 15 "	
Clamping moment	2,400 Nm	
Max. transport load	450 kg	
Max. transport moment	300 Nm	
Loading area		
Facility for crane loading		
Max. door opening (W x H)	1200 x 1135 mm	

Units and equipment

Central lubrication	
Operating pressure	16 +/- 1 bar
Volumetric flow	0.1 dm ³ / min (counter-pressure 5 bar)
Lubricant tank	2.7 litres
Lubrication interval (standard)	approx. 2/h automatically adjustable by PLC
Duration of lubrication	15 sec (after pressure buildup)
Lubricant consumption	approx. 0.2 ccm/interval
Equipment supplied	see chapter on units and equipment

Minimum oil lubrication	
Operating pressure	20 bar
Volumetric flow	0.5 dm ³ / min (counter-pressure 5 bar)
Lubricant tank	2.7 litres
Lubrication interval (standard)	approx. 12/h automatically adjustable by PLC
Duration of lubrication	continuous by stream of oiled air
Schmierstoffverbrauch	approx. 0,6 cm ³ / interval
Equipment supplied	see chapter on units and equipment

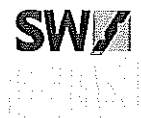
Swarf conveyor / Coolant system	
Swarf conveyor	
Model	scraping conveyor with coolant tank
Max. swarf length	150 mm, no balls of swarf
Ejection height	approx. 1200 mm
Additional equipment for separating swarf / coolant	bar sieve 100 µm, suction pump
Coolant system	
Fill quantity	approx. 850 dm ³
Delivery quantity	200 l/min (at 3 bar)
Recommended cooling lubricant	emulsion
Equipment supplied	see chapter on units and equipment
Internal coolant delivery (optional)	
Pressure	adjustable, max. 40 bar
Amount delivered (at 20 bar)	38 l/min
Coolant cleaning	backflush filter
Filter insert	steel mesh 50 µm
Clean water tank	approx. 40 dm ³ , mounted in the coolant tank

Hydraulic system	
Operating pressure	150 bar / 12 dm ³ /min
Fill quantity, hydraulic tank	100 dm ³
Oil quality	HLP 46
Filter	
Equipment supplied	see chapter on units and equipment

Maintenance unit, pneumatic	
Motional pneumatic system:	
Control range	0.5 - 7 bar
Filter unit (automatic condensate drainage)	
Filter insert	5µm
Min. oil quantity lubrication	
Control range	0.5 - 7 bar
Superfine filter unit (automatic condensate drainage)	
Filter insert	0.01µm
Airlock	
Control range	0.05 - 0.7 bar
Equipment supplied	see chapter on units and equipment

Central cooler (closed-circuit water cooler)	
Cooling performance	approx. 7,5 KW at 25 °C ambient temp.
Recommended temperature adjustments	25 °C (in a central european climate)
Circulation	centrifugal pump
Type of evaporator	coaxial or tube-bundle heat exchanger
Coolant type	R134a
Cooling water tank	approx. 70 litres
Cooling water additive (corrosion protection)	Tyfocor (25,3 % by vol.)
Equipment supplied	see chapter on units and equipment

Emulsion mist separation system (optional)	
Medium / pollutants	emulsion mist
Air quantity	900 cbm/h
Operating temperature	max. 45 °C
Equipment supplied	see chapter on units and equipment



6.1.1 Performance and torque chart

see following pages

