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*for a sustainable future*

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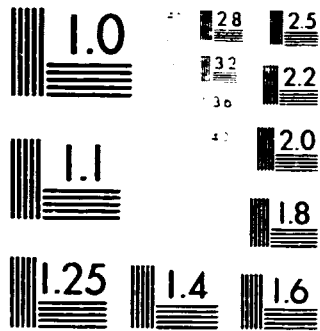
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**UNIDO**



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

**24x**

**2 OF 2**

AR (HM5, HM6) e- quipment switch off	M2, P2, YV1, YV3,	Identified by TR/1, TR/2
Realization of the equilibrium of the hanger and MU pis- ton		By the small supple- mentary weights
AR (HM5, HM6) - quipment switch on	M2, P2, YV1, YV3,	Identified by TR/1, TR/2
Dropping of the piston of MU into zero position	YV6/2, S/4, VS/6	
Dropping of the piston of WU into zero position	YV6/1, S3, VS/5 (M7, M8, IP)	
Closing of the con- nection between MU and WU branches	YV7, S/2, VS/4	
Dropping of the ca- ge CG (HM2) with all the weights	YV2, S/1, VS/1	
5. Selection of the value of the for- ce (of the active weights	MP1..MP8 KA1, KB1..KA8, KB8	Fully automatic
Cage CG is going up	M2, P2, YV1, S/1, VS/1	Identification by the stop switches K3, K4
6. Piston of MU, HM1 is going up	M1, P1, YV4, YV5, VS/2, VS/3	Identified by IS1 Fully automatic
7. Piston of WU, HM3 is going up	M7, M8, IP	Identified by IS2
8. Working position of both pistons a- chieved	PS1	Identified by PS1
Connection between MU and WU is opened	YV7, S/2, VS/4	Fully automatic

## Scheme 3, cont.

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AR equipment switch off	M2,P2,YV1,YV3,	Identified by TR/1, TR/2
Reading of the force value by the dynamometer		

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9. Closing of the connection between MU and WU	YV7,S/2,VS/4	Fully automatic
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10. Dropping of the piston of MU, HM1 in the zero position	YV6/2,S/4,VS/6	Fully automatic
Dropping of the cage CG in the zero position	YV2,S/1,VS/1	

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11. Case a), force increasing, points from 5 to 10 again Point 7, pressure increasing in WU, HM3 unit	M7,M8,IP	Identified by PS1, IS2
Case b), force decreasing, points from 5 to 10 again Point 7, pressure decreasing in WU, HM3 unit	YV6/1,S/3,VS/5 (M7,M8,IP)	Identified by PS1, IS2

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12. Switch off the FCM	"STOP" button M3 (aut. s.off) M4 (aut. s.off) PC key "START" main supply	Stop MU piston rot. Stop WU piston rot.
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## 6. UTILIZATION OF THE FCM

By the utilization of the machine, especially the part 5 with the schemes, functions describing, switch on and switch off proceeding must be taken in the account. The following remarks must be followed:

The computer executive program contains all the commands for the steps which were described above. By the press of the key F1, the commands and connected describing can be found

The program is installed in the PC-computer of the FCM by the supplier. The reserve floppy disc are also to disposition for the utilizer of the machine.

By the usual utilization of the FCM, all the measuring steps given in part 5, scheme 3 are going on automatically. There are not any supplementary requirements for the staff.

Important remark: As for the principle of the machine (hydraulic multiplication), by the measurements near of the upper limit of the measuring, range the temperature of the hydraulic oil may increase over the suitable value. This fact can influence the results of the measurement. From this point of view, it is recommended to provide the measurement by the values over 700 kN not longer as 30 minutes.

It is recommended before every utilization of the FCM:

After the switch on proceeding and after the start of PC and its executive program, to check the functions at least of the following items:

- stop switches of the reversor K7, K8 (by its movement)
- stop switches of the cage K3, K4 (on the PC-monitor)
- inductive sensors IS1, IS2 (on the PC-monitor)
- working statement of the programable automats T1.C (flashing of the LED diode - RUN), T2.B (flashing of the LED diode - RUN), T3.C.

The periodical audit is recommended (interval 1 month):

When the FCM is not being in the utilization for the longer time, it should be checked in the 1-month period as follows:

- checking of the same points as given above
- outside audit of the machine aimed mainly on the checking of the not leakage of the oil from the hydraulic circuits of the machine and from the gear boxes on the reversor CR and on the main frame FR (under the WU unit)

## 7. MAINTAINCE AND REPAIR

### LUBRICATION POINTS, OIL MARKS

There are 3 lubrication points on the machine, pictures 2.2. and 2.4 (the points are identified by the red marks):

- on the both sides of the reversor for the lubrication of the gear boxes of the motors M5 and M6
- on the upper side of the main frame (under the WU unit), for the lubrication of the gear box of the motor M4 (for the rotation of the piston of WU and for the driving of the release pump RLP

The oil marks (the contain of the oil in the machine must be checked as for the switch on procedure before every start of work) are situated on the parts (identified by the red color):

- reversor CR, oil contain in the gear boxes of the motors M5, M6 (picture 2.2.)
- main frame (under WU unit), oil contain in the gear box of the motor M4 (picture 2.2.)
- hydraulic aggregate HA, picture 2.13.d., contain of the hydraulic oil in the circuits of the FCM.

Hydraulic oil used in the machine: see part 3., technical parameters. Rem.: It is recommended to exchange the hydraulic oil in the 2 years working interval of the FCM

Oil for gear boxes: f.inst., PP90 (value of viscosity), may be mixed with the vaseline.

### SPARE PARTS

List of the spare parts which were delivered to the utilizer of the machine, see annexe D1. The contain, specification and the number of these spare parts shall assure the requirements for the usual repairs of the FCM.

The following text: Repair, troubleshooting part must be taken in attention.

### REPAIR, TROUBLESHOOTING

The machine is constructed for the utilization as the primary (reference) standard in the suitable national standard laboratory. From this point of view, when is acting in accordance with the functions being described in the part 5 and when is used in accordance with the part 6, the troubleshhoting would not arise. If, from any case, some serious problem is identified, the following schedule, obligatory in the guarantee interval, must be assured (all these cases must be remarked in the daily book of the FCM. This book must be found immediately after the start of the work of the FCM):

- the fault shall be identified by the utilizer. The identification can be done on the basis of the described steps of the function of the FCM and on the basis of the hydraulic and electric schemes (given in the part 5)
- by means of the schemes and of the detail lists of the items of the machine (see annexe D2), the damaged item can be specified
- after this specification the contact with the supplier of the machine must be realised as soon as possible with the precise characteristics of the problem
- supplier analyses the matter and the proposal for the proceeding of the repair will be announced to the utilizer during the time interval 3 weeks

Generally, the proposal will be as follows:

- a) when the spare parts are to the disposition and when the fault can be repaired by the staff of the utilizer, the precise describing for the repair will be sent to utilizer
- b) when the spare parts are not to the disposition to the utilizer, but when the repair can be realized in the duty station of the FCM, the spare part will be sent to the utilizer with the precise describing of the repair
- c) in another case, the supplier assure the solution by the most suitable way in the most possible time interval.

It is recommended to the utilizer:

- on the mechanical and hydraulic parts of the machine:

do not repair without preliminary consultation with the supplier, especially the units MU and WU (most sensitive parts of the FCM).

When the decision is taken by the utilizer to provide some usual repair without contact with the supplier and when original delivered spare parts are not to disposition, the compensation parts (f.inst. electric motor, valves, pipes, etc.) must have the same parameters as original parts of the FCM

- on the electronic parts of the machine:

do not repair the programmable automats T1.C, T2.B, T3.C. These parts which control and check all the parameters of FCM can be only exchanges as the complete set by the authorized person of the staff of FCM (on the basis of the training by the installation of the machine). By the usual electric repairs (switches, fuses exchanges, etc.), the compensation parts must have the same parameters as original parts of the FCM

- on the PC computer

when some fault arise on the hardware, the authorized office for the IBM computers must be contacted. When the executive



program is not going in the suitable way, after the checking of the functions of the FCM (part 5,6), the new installation of the program from the reserve floppy disc must be realised. When the problems last, the supplier has to be contacted.

- regularly servis

complete servis on the machine after every 2 years working interval is recommended. The supplier of the FCM may assure such a work. This servis is not insluded in the guarantee conditions

Attention: The guarantee conditions may be cancelled when not qualified manipulation and repair were proceeded on the machine.

## 8. METROLOGY

This text contains some remarks from the point of view of the utilization and capability of the FCM in accordance with the requirements of metrology.

1. The machine can be used, controlled and repaired only with the staff, having the qualification on the suitable high school or on the Technical University. The staff must be acquainted with the basic principles of the machine, its control and checking (this points were explained in the frame of the training by the installation of the machine). The staff must also have the praxis and experiences in the domain of the calibration and verification of the dynamometers
  
2. The FCM allows after its installation and calibration the calibration and verification of the dynamometers in the given measuring range (from 10 kN to 1 MN), of the secondary standards of the metrological classes 00, 0,5 1 and 2. The calibration and verification can be proceeded on the basis of the connected metrological documents (see Annexe D3, References), especially: ISO 376/1987, DIN 51 301, DIN 51 302, ASTM E 74-83, EN 10002. The national prescriptions in this domain of the Islamic Republic of Iran take the attention to these documents
  
3. Shortly said, the calibration, resp. verification of the every dynamometer is proceeding in the following steps:
  - installation of the dynamometer on the machine with the suitable parts (fixing screws, nuts, etc.) according to the required documents and the prescriptions of the producer of the dynamometer
  - the assurance of the equilibrium of the hanger with the installed dynamometer on the WU unit and the piston with the weights carrier (without weights) of the MU unit
  - the preliminary loading of the dynamometer under the maximum value of the measuring range (3-times, when the following series of the measurement are proceeded in the conformable loading, 1. inst. only tension, 6-times, when the sense of the loading is going to exchange 1. inst. from tension to pressure)
  - proceeding of the proper series of the measurements, according to the valid prescriptions
  - evaluation of the results of measurement, estimation of the uncertainty, resp. of the errors

4. The FCM had been calibrated with the accuracy better as  $5 \cdot 10^{-4}$  in all its measuring range (see Annexe D3, protocol of calibration, certification). The validity of the certificate is determined for the interval 5 years from the date of the issuing of the certificate. After the expiration of this validity, the new calibration must be assured. This new calibration must be done with the reference dynamometer having the suitable accuracy (at least class 00) and the traceability to the primary standard in the given measuring range.

## 9. GUARANTEE CONDITIONS

The guarantee conditions for the suitable function of the machine on the duty station in the ISIRI are given on the basis of the contract, Purchase order Nr. 15-2-1400W between the UNIDO Vienna and the general supplier Technical and Testing Institute for Building Industry (TZUS), Prague, Czech republic from 14.12.1992.

The text of the contract UNIDO - TZUS specifies the warranty as follows:

"Two years from the date of installation covering faulty material and faulty workmanship. The machine is to be used in accordance with instructions of the supplier and may be operated only by skilled authorized persons. The warranty does not cover damage due to mistreatment or wrong use or other similar reasons

The stability of the metrological parameters is given by the utilization and conservation of the machine as primary standard of the country by the determined reference conditions/suitable values of the barometric pressure, temperature, air humidity, etc."

The daily book of the FCM utilization must be found immediately after the starting the work on the machine. In this book, all the identification about the proceeding of the machine (measurements, defaults, etc.) are to be remarked. This book will be taken as the supporting document in the case of the warranty.

When the case of the FCM guarantee arises, the technical problems must be solved directly between the general supplier TZUS and the ISIRI. The collaboration of UN IDP Tehran, resp. UNIDO Vienna is expected.

The calibration of the FCM was proceeded on the basis of the contract between the Czech Metrological Institute (CMI) and the UNIDO Vienna, Nr. 93/164 from 31.8.1993. The protocol of this calibration and certificate, see Annexe D3. The certificate will be expired in the time interval 5 years after the issuing.

## 10. REFERENCES

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3. Standard ISO 7500/1-1986, Metallic materials - Verification of static uniaxial testing machines, Part 1: Tensile testing machines
4. Standard DIN 51 301, Kraftmessgeraete fuer statische Kraefte zur Pruefung von Werkstoffpruefmaschinen
5. Standard DIN 51 302 (Part 1,2), Pruefung von Zug, Druck und Biegepruefmaschinen
6. Standard ASTM E 74-83, Standard Practice of Calibration of Force-Measuring Instruments for Verifying the Load Indication of Testing Machines
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8. IR OIML Nr. 60, Metrological regulation for load cells
9. International Recommendation (IR) OIML Nr. 62, Performance characteristics of metallic resistance strain gauges
10. IR OIML Nr. 64, General requirements for material testing machines
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  - Part 1: Metallic materials, Tensile tests, Method of test (at ambient temperature)
  - Part 2: Verification of the force measuring system of the testing machine
  - Part 3: Metallic materials, Tensile test, Calibration of force proving instruments used for the verification of uniaxial testing machines
  - Part 4: Metallic materials, Tensile test, Verification of extensometers used in uniaxial testing
  - Part 5: Metallic materials, Tensile test, Method of test at elevated temperatures
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14. Guide ISO/IEC/OIML/BIPM, Expression of Uncertainty in Measurement

15. A. Sawla, Determination of the best measurement capability of force calibrating machines of accredited laboratories and uncertainty of calibration results of force measuring devices according to WECC - Doc. 19, PTB, Braunschweig, 1993
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17. Shi Changyan, Li Zhenmin, A new type of the loading ram. Cylinder system using hydrostatic bearing technic in hydraulic force standard machine. National Institute of Metrology, Beijing.

11. LIST OF ANNEXES

Annexe D1, Summary of the spare parts .....1 Page

Annexe D2, Specification of the items of FCM .....2 Pages

Annexe D3, Protocol of calibration, Certificate .....41 Pages

## Summary of spare parts

### Balance (B):

programable automat T2.B, NS-940	1	pc
memory pack 4 kB EPROM	1	pc
analog unit AM8I	1	pc
power unit (NS-940)	1	pc
relay Flinder 12V	5	pcs
socket relay DIN	4	pcs
power unit UNAZ	1	pc
microswitches ZIPPY	9	pcs
diode XC, XD	2	pcs
clamps, lamps, etc.	appr. 50	pcs
cable for PC	1	pc

### Central (C):

programable automat T1.C, NS-940	1	pc
memory pack 4 kB EPROM	1	pc
power unit (NS-940)	1	pc
programable automat T3.C, KIK	1	pc
transformer 220/12 315 VA	1	pc
transformer 220/24 80 VA	1	pc
AC/DC blok MUX	1	pc
air break contactor C9	4	pcs
thermal overload prot. relay T17	4	pcs
main fuses 3 phases	1	pc
fuse 1 phase	1	pc
clamps, etc.	25	pcs
connectors 20 pins	1	pcs
button key	1	pc
button STOP	1	pc

### Machine (M):

inductive sensor IS1, IS2	1	pc
microswitch	1	pc

### Computer (PC):

converter RS232/current loop	1	pc
floppy disc (exe program for the FCM)	3	pcs

### Mechanical and hydraulical parts:

pump P	1	pc
valve VP	1	pc
valve YV, RSE 2-62	1	pc
valve YV, RSE 2-63	1	pc
valve M 60-2	1	pc
motor MP complete	2	pcs
elastic pipe, 5 m	1	pc
gasket of WU	1	pc
gasket of MU (green)	1	pc
gaskets "O" ring		
4x 8	6	pcs
6x10	4	pcs
8x12	8	pcs
14x18	4	pcs
16x20	6	pcs
20x28	6	pcs
22x30	6	pcs
25x33	6	pcs
gaskets "O" ring static		
8x2	8	pcs
18x2	8	pcs
25x2	6	pcs



symbol	place	name	type	voltage	power	note	producer
<b>CENTRAL (C)</b>							
A0	C	Start button (green)	A6	24 V		run machine	Elektrořístroj Písek
A01	C	Stop button (red)	T6	24 V		red	Elektrořístroj Písek
A7	C	Start key (green)	A6	220 V		main switch	Elektrořístroj Písek
BET1	C	break stop contact	relay	24 V		part in NS-940	
D0	C	terminals	5000 M4/6	500 V			Entrelec France
D1	C	terminals	5000 M4/6	500V			Entrelec France
F1	C	Termal protecting relay for M1	T171	500 V	1.45 - 2.1 A		Elektrořístroj Modřany
F2	C	Termal protecting relay for M2	T171	500 V	0.69 - 1.0 A		Elektrořístroj Modřany
F3	C	Termal protecting relay for M3	T171	500 V	0.52 - 0.75 A		Elektrořístroj Modřany
F4	C	Termal protecting relay for M4	T171	500 V	4.3 - 6.3 A		Elektrořístroj Modřany
F5	C	Termal protecting relay for M5, M6	T171	500 V	4.3 - 6.3 A		Elektrořístroj Modřany
F8	C	Termal protecting relay for M8	T171	500 V	1.45 - 2.1 A		Elektrořístroj Modřany
H0	C	Signal lamp (white)	A6	24 V		run machine	Elektrořístroj Písek
K4	C	Watch pressure	TR 1 - 10			for AB eqpm.	TST TOS Rakovník
K10	C	Watch pressure	TR 1 - 10			for AB eqpm.	TST TOS Rakovník
M1	C	Motor for pump first	4AP 80-6	3x380V	550V 910ot/min		MEZ Mohelnice
M2	C	Motor for pump second	4AP 80-85	3x380V	180V 690ot/min		MEZ Mohelnice
M7	C	Stepper motor	SM2317-0800	24V			MICROCON Praha
M8	C	Motor for inject	4AP 80-6	3x380V	550V 910ot/min		MEZ Mohelnice
P0	C	Main fuses 3 phase		3x380V	10A		OEZ Letohrad
P1	C	Fuse 1 phase		220V	10A	control circuit	OEZ Letohrad
PK1	C	Microswitch for stepper motor	WH05 S06A0	220V	5A		ZIPPY Italy
PK2	C	Microswitch for stepper motor	WH05 S06A0	220V	5A		ZIPPY Italy
PS1	C	Pressure transducer	114 47		40 MPa		ZPA Jinonice
PV1	C	Convert RS232/loop 20mA	CONV			connect with PC	ELU+ Písek
S0	C	Contact for auxil. circuit C9.3	C9.3	coil	24V		Elektrořístroj Modřany
S1	C	Contact for M1	C9.3	coil	24V	hydr. pump	Elektrořístroj Modřany
S2	C	Contact for M2	C9.3	coil	24V	hydr. pump	Elektrořístroj Modřany
S3	C	Contact for M3	C9.3+PK4PK22E	coil	24V		Elektrořístroj Modřany
S4	C	Contact for M4	C9.3+PK4PK22E	coil	24V		Elektrořístroj Modřany
S5	C	Contact for M5, M6	C9.3	coil	24V	reversor	Elektrořístroj Modřany
S6	C	Contact for M6 M6	C9.3	coil	24V	reversor	Elektrořístroj Modřany
S7	C	Contact for main circuit	C9.3	coil	24V		Elektrořístroj Modřany
S8	C	Contact for M8	C9.3	coil	24V	inject pump	Elektrořístroj Modřany
T1	C	Power unit Tecomat	NM-50	220V/24V			TECO Kolín
T1	C	Central unit Tecomat	NS-940	24V			TECO Kolín
T3	C	Central unit	A-019	24V			RİK Praha
TR1	C	Transformer		220/24V	80VA	for aux. circuits	ESF Jevišovice
TR2	C	Transformer		220/12V	315VA	for motors balan.	ESF Jevišovice
U1	C	Rectifier	MU1-100-12	12V	16-24A	for motors balan.	ČKD Polovodiče
YV1	C	Electro-hydr. valve	RSE2-062-A51	220V	35 VA		TST TOS Rakovník
YV2	C	Electro-hydr. valve	RSE2-063-Z11	220V	35 VA		TST TOS Rakovník
YV3	C	Electro-hydr. valve	RSE2-063-Z11	220V	35 VA		TST TOS Rakovník
YV4	C	Electro hydr. valve	RSE2 062 A51	220V	35 VA		TST TOS Rakovník
YV5	C	Electro hydr. valve	RSE2-062-A51	220V	35 VA		TST TOS Rakovník
YV6/1	C	Electro hydr. valve	RSE2-062-R11	220V	35 VA		TST TOS Rakovník
YV6/2	C	Electro hydr. valve	RSE2-062-R11	220V	35 VA		TST TOS Rakovník
YV7	C	Electro hydr. valve	RSE2-062-R11	220V	35 VA		TST TOS Rakovník
Z2	C	Socket 220V		220V	10-16A		Elektrořístroj Modřany

## M A C H I N E (M)

A03	M	Stop button (red)	T6 S1A	24V				Elektropřístroj Písek
D3	M	Terminals	5000 M4/6	500V				Entrelec France
IS1	M	Inductive transducer	PD50KE	D15V	D 2.5cm			Skalický Běchovice
K6	M	Up microswitch HM3	WH05 S06A0	220V	5A			ZIPPY Italy
K7	M	Down switch for reverbtor	WH05 S06A0	220V	5A			ZIPPY Italy
K8	M	Up switch for reverbtor	WH05 S06A0	220V	5A			ZIPPY Italy
M4	M	Motor for cilinder	4AP-112M-8	3x380V	2.2 kW	rev/min		MEZ Mohelnice
M5	M	Motor for reverbtor	4AP-90S-6	3x380V	750V	940rev/min		MEZ Mohelnice
M6	M	Motor for reversor	4AP-90S-6	3x380V	750V	940rev/min		MEZ Mohelnice

## B A L A N C E (B)

B1	B	Relay	4061					Flinder Italy
B2	B	Relay	4052					Flinder Italy
B3	B	Relay	4052					Flinder Italy
B4	B	Relay	4052					Flinder Italy
B5	B	Relay	4052					Flinder Italy
B7	B	Relay	4052					Flinder Italy
B8	B	Relay	4052					Flinder Italy
BKT2	B	break stop contact	relay	24V			part in MS-940	
D2	B	Terminals	5000 M4/6	500V				Entrelec France
IS2	B	Inductive transducer	PD50KE	D15V	5cm			Skalický Běchovice
K3	B	Microswitch for cage	WH05 S06A0	220V	5A			ZIPPY Italy
K4	B	Microswitch for cage	WH05 S06A0	220V	5A			ZIPPY Italy
KAI <sub>1</sub> B	B	Microswitch for motors weight	WH05 S06A0	220V	5A			ZIPPY Italy
KBI <sub>1</sub> B	B	Microswitch for motors weight	WH05 S06A0	220V	5A			ZIPPY Italy
MP1	B	Motor for change weight	433122167017	12V				PAL Kbely
MP2	B	Motor for change weight	433122167017	12V				PAL Kbely
MP3	B	Motor for change weight	433122167017	12V				PAL Kbely
MP4	B	Motor for change weight	433122167017	12V				PAL Kbely
MP5	B	Motor for change weight	433122167017	12V				PAL Kbely
MP6	B	Motor for change weight	433122167017	12V				PAL Kbely
MP7	B	Motor for change weight	433122167017	12V				PAL Kbely
MP8	B	Motor for change weight	433122167017	12V				PAL Kbely
M3	B	Motor for rotation HM1	4AP 71-68	220V	180V	900ot/min		MEZ Mohelnice
PV2	B	Convert RS232/loop 20mA	CONV					ELO+ Písek
T2	B	Power unit Tecomat	NM-50	220V/24V				TECO Kolín
T2	B	Central unit Tecomat	NS-940	24V				TECO Kolín
T2	B	Analog unit	AM- 8	2 input DC				TECO Kolín
U2	B	Power pro transducer	UMA2	D15V	3V			MESIT Uherské Hradiště
XC1	B	Diode	P600B	100V/6A				
XC2	B	Diode	P600B	100V/6A				
XD1	B	Diode	P600B	100V/6A				
XD2	B	Diode	P600B	100V/6A				

Kablo Vrchlablí

**K**

**T447**

**96**

**05**

**07**

