EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

TN-167

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THE FES HYDRAULICS I + C

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1. INTRODUCTION

In the FES system there will be an hydraulic servoactuator installed in SS 24. The oil supply system with its two pump groups will be located on the ground floor of the ejection building.

For the smooth functioning of the hydraulic circuit, an I + C system has to be constructed. Enclosed is the first proposal (see drawing 345-102-2). This control unit will be considered as the central unit for the entire actuator system.

The actuator control unit and the actuator shaft lubrication system will form separate sub-units, acting on the hydraulics control unit.

For the design, all basic principles already applied to the HV supplies have been followed very strictly in this unit.

2. PUMP MOTOR SWITCHES

Each motor will be generated by means of a star-delta switch (see drawing 345-101-4).

Each star-delta switch will be installed in a separate cabinet (this is to make maintenance easier). Each cabinet contains, in addition, the main fuses, relay circuitry to check the three phases, and a time counter summarizing the operating time of each pump.

3. INTERLOCKS

In the interlock system every interlock has a repeater relay, while each valve has two repeater relays, one for the open and one for the closed positions. Each interlock has a lamp indicator, while both positions of each valve have a separate lamp indicator.

A fault is signalled by a flashing lamp, while continuous illumination signals the O.K. state. The fault signalling will operate according to the selected mode of operation, resp. "normal/electronics/test" and the selected number of pumps (R_{228_b}, R_{226_c}, R_{235_a}, R_{236_a}, R_{237_a}, R_{237_b}). The following interlocks are included in the protection circuit for the pump motors:

380 V 3-phase, pump 1 switched on	R_{110}
380 V 3-phase, pump 2 " "	R_{111}
Oil level too high	R_{10}
Oil level too low	R_{11}
Filter valve main return open	R_{83}
Water pressure normal	R_{107}
Air pressure normal	R_{108}
Nitrogen pressure, first accumulator normal	R_{94}
" " second " "	R_{98}
" " third " "	R_{100}
" " return " "	R_{102}
Suction valve, pump 1 open	R_{14}
" " " 2 "	R_{15}
Supply " " 1 "	R_{33}
" " " 2 "	R_{32}
Actuator, interlock normal	R_{216}
Shaft lubrication, interlock normal	R_{215}
Oil temperature, too high	R_{12}
" " too low	R_{13}
Pump 1, pressure too high	R_{90}
Pump 2, pressure too high	R_{91}
Oil return, pressure too high	R_{95}
Leak-oil return, pressure too high	R_{96}
Water flow too low	R_{84}
Oil return filter Δp too high	R_{80}
Leak oil return filter Δp too high	R_{81}
Oil supply filter servo Δp too high	R_{64}
Piston position, first accumulator normal	R_{3}
" " second " "	R_{50}
" " third " "	R_{61}
" " return " "	R_{60}
Oil supply, pressure too high	R_{92}
" " " too low	R_{93}
Oil return, pressure too high	R_{101}

Leak oil return, pressure too high	R_{103}
Oil leak actuator too high	R_{68}
Oil leak pump station, too high	R_4
Pump 1, by-pass closed	R_{22}
" 2, " " "	R_{23}
Automatic discharge valve closed	R_{35}
Star-delta switch pump motor 1 normal	R_1
" " " " " 2 "	R_2

The following valve positions are included in the main protection chain depending on the selected mode of operation:

selected → "NORMAL" on "Test Bench"

Oil supply valve	open (RO_{41_c})	closed (RC_{41_c})
Oil return valve	open (RO_{42_c})	closed (RC_{42_c})
Leak oil return valve	open (RO_{43_c})	closed (RC_{43_c})
Valve first accumulator	open (RO_{47_c})	open (RO_{47_c})
Oil supply valve, test bench	closed (RC_{44_c})	open (RO_{44_c})
Oil return valve, test bench	closed (RC_{45_c})	open (RO_{45_c})
Leak oil return valve, test bench	closed (RC_{46_c})	open (RO_{46_c})
Oil filling valve	closed (RC_{40_c})	closed (RC_{40_c})
Actuator oil leak return valve	open (RO_{62_c})	closed (RC_{62_c})
Actuator oil return valve	open (RO_{63_c})	closed (RC_{63_c})
Actuator oil supply valve	open (RO_{65_c})	closed (RC_{65_c})
Actuator oil supply servo valve	open (RO_{66_c})	closed (RC_{66_c})
Actuator leak oil return valve	open (RO_{67_c})	closed (RC_{67_c})

The main protection chain can be closed, if all interlocks are in the normal state, by pushing "Reset". "Reset" is automatically maintained until ≈ 30 sec after starting any pump on the following interlocks:

Oil supply pressure too low	R_{93}
Star-delta switch pump 1	R_1
" " " " 2	R_2
Pump 1, by-pass.valve closed	R_{22}
" 2, " " "	R_{23}
Automatic discharge valve closed	R_{35}

The main protection chain is followed by a time-interlock (≈ 66 sec), which takes care that switching "on" both pumps always occurs with a time interval of ≈ 60 sec. When either pump 1 or pump 2 is not operating, the following interlocks will be by-passed, resp. R_{1_c}-R_{22_c} with R_{221_c}-R_{232_b}, and R_{2_c}-R_{23_c} with R_{224_c} and R_{232_c}.

4. OPERATION

The pump station is switched "on" exactly in the same way as all other equipment:

Push "ON" button	"OFF LAMP	switches off
	"ON"	flashes
	Interlocks	flashing
	Reset	flashes
" "RESET"button	interlocks	continuous illumination
	"Reset"	off
" "ON" button	"ON lamp	continuous illumination
	the preselected pump operates	

This starting procedure brings normally only one pump into operation.

An additional push-button set (up-down) is provided, to switch on the second pump if required.

The following preselections are necessary before switching "ON". One of the three possibilities "test/electronics/normal" must be selected (the selection is locked if any pump operates). On each selector pump "off/on/stand-by", the operation mode of the pumps must be selected. A standard selection will be one pump "on" and one pump "stand-by" switching "ON" will then bring one pump into operation while the second pump can be switched on by the push-button "up". The selection E.Q.R./L.C.R. control must be made before switching the push-button "ON" for the second time, because this selection will be locked if the pump station is on and when any ejection channel is operating.

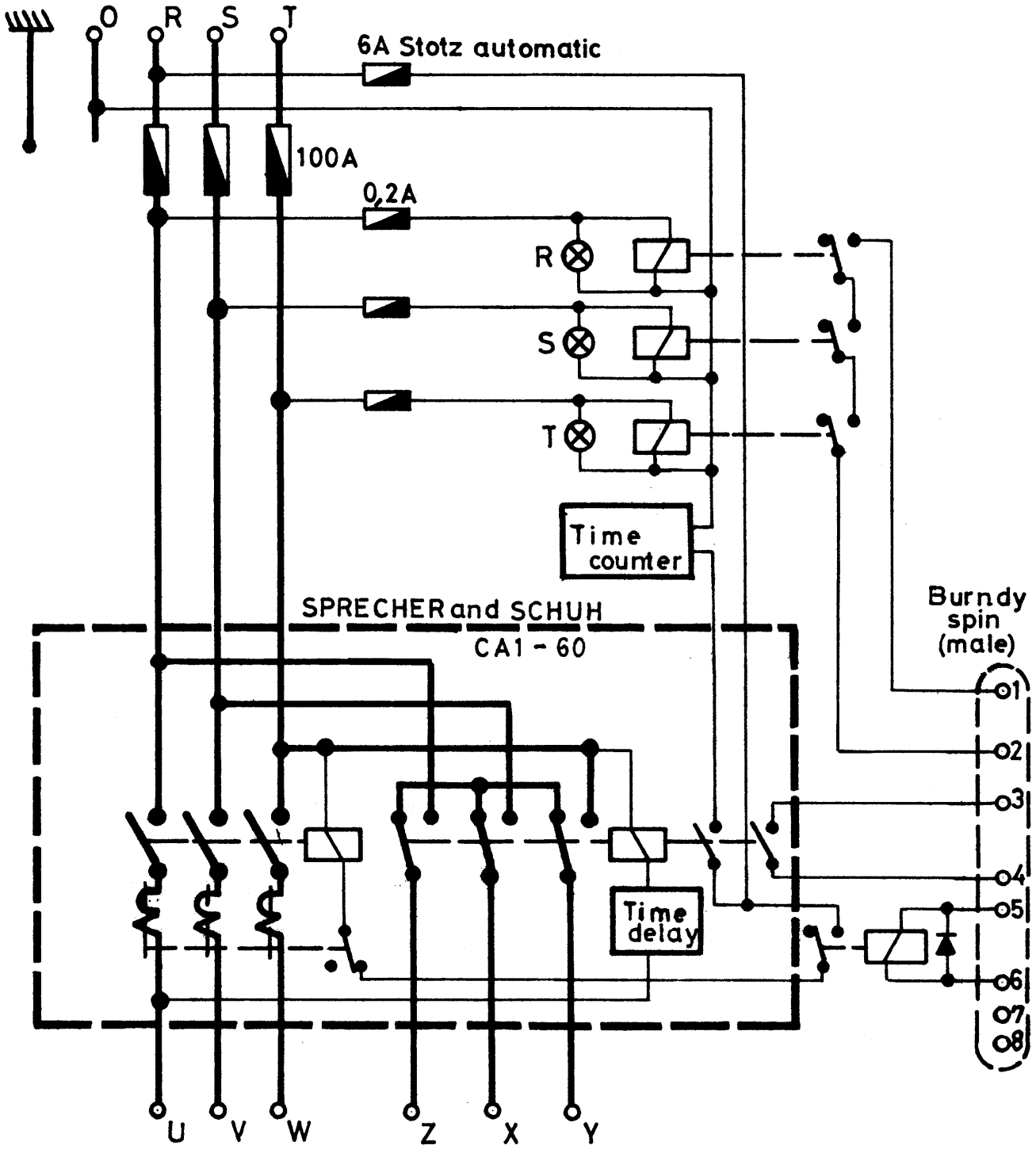
5. REMOTE CONTROL AND SIGNALLING

All controls will also be available in the L.C.R., with the exception of the operation-mode selections:

pump - "off/on/stand-by"
"test/electronics/normal"

The following signalling is foreseen:

"E.Q.R./L.C.R.
"ON/OFF"
"HYDRAULICS O.K."
"ACTUATOR O.K."
PUMP 1 on/off
" 2 on/off .



Nombre de pièces	Désignation	Pos.	Matière	Observations

III	II	I	Mod.	Date	Nom	Tolérances générales
			A			de à ±
			B			de à ±
			C			de à ±

Ensemble | S. Ensemble

Dessiné 20-2-70 Braichet
Contrôlé
Vu

Remplace
Remplacé par

Dossier N°
Dossier N°
Dossier N°

HYDRAULICS I+C

Echelle

MOTOR START UNIT FOR 1 PUMP

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
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1211 GENÈVE 23

FES

345-101-4

MODE

REMOTE CONTROL

REMOTE SIGNALISATION

PUMP I

PUMP II

TEST

ELECTRO. NICS.

NORMAL

24V D.C.

0v

R 230a R 226a R 230b R 227a R 230c R 228a

R 226 R 227 R 228

PRESSURE DOWN R 207

PRESSURE UP R 206

OFF R 205

HYDRAULICS

ON R 204

EJECTION ON R 203

L.C.R. R 202

E.Q.R. R 201

RESET R200

E.Q.R./L.C.R. R 209c

ON/OFF R 210c

READY R 212b

FAULT R 212a

ACTUATOR R 215b

HYDRAULICS R 214b

FAULT

PUMP II ON RR1a

PUMP I ON RR2a

STAND BY

ON

OFF

R 220a R 221a R 222a

R 220 R 221 R 235 R 222

STAND BY

ON

OFF

R 223a R 224a R 225a

R 223 R 224 R 236 R 225

R 219a R 222b R 221b R 217b R 218b R 212c

R 218c R 234 60s R 219b R 224b R 225b

R 110c R 111c

BY PASS VALVE CLOSED START PUMP I R 217

BY PASS VALVE CLOSED START PUMP II R 218

AUTOMATIC DISCHARGE VALVE CLOSED

AIR + WATER SUPPLY

R 231a R 203a R 201a E.Q.R. R 231c R 203b R 202a L.C.R.

R 208a E.Q.R. L.C.R.

R 208 R 209

R 216

R 203b R 208b R 204a ON R 205a OFF R 210b OFF

R 210 R 211

R 214a R 209a R 204b R 231b

R 213 R 212 R 230 R 231

R 215

ON R 212a R 214b R 209b RESET

FLASHER

R 208c R 200a RESET

R 214

R 108c R 107c R 83 Oc R 13 c R 12 c R 11 c R 10c

R 94c R 98c R 100c R 102c R 14 Oc R 15 Oc R 32 Oc R 33 Oc R 90 c R 91 c R 95c R 96c

R 4c R 68c R 103c R 101c R 61 c R 60c R 50c R 3 c R 64c R 81c R 80c R 84c

R 221c R 232b R 224c R 232c

R 215c R 35 c R 92c R 93c R 1c R 22c R 2c R 23c R 216c R 47 Oc R40 Cc

R 67 Cc R 66 Cc R 65 Cc R 63 Cc R 62 Cc R 41 Cc R 42 Cc R 43 Cc R 44 Oc R 45 Oc R 46 Oc R 226b

R 67 Oc R 66 Oc R 65 Oc R 63 Oc R 62 Oc R 41 Oc R 42 Oc R 43 Oc R 44 Cc R 45 Cc R 46 Cc R 228b

R 211a

R 207a DOWN UP R 206a R 219c

30 s R 233 30s R 232 R 229a

R 229 R 219 R 237

TO ACTUATOR I+C

1 4 6 3 5 2 7 8

TO STAFT LUBRIFICATION I+C

1 4 3 5 2 6 7 8

R 235a R 236a R 237a R 237b

R 228b R 226c

R 110 R 111 R 10 R 11 R 12 R 13 R 107 R 108 R 94 R 98 R 100 R 102 R 90 R 91 R 95 R 96 R 84 R 80 R 81 R 64 R 3 R 50 R 60 R 61 R 92 R 93 R 101 R 103 R 68 R 4 R 22 R 23 R 35 R 1 RR1 R 2 RR2 R

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

R 83 O R 83 C R 14 O R 14 C R 15 O R 15 C R 32 O R 32 C R 33 O R 33 C R 41 O R 41 C R 42 O R 42 C R 43 O R 43 C R 47 O R 47 C R 44 O R 44 C R 45 O R 45 C R 46 O R 46 C R 40 O R 40 C R 62 O R 62 C R 63 O R 63 C R 65 O R 65 C R 66 O R 66 C R 67 O R 67 C

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

Nombre de pièces III	II	I	Désignation	Pos.	Matière	Observations
			Mod. Date Nom — Tolérances générales			
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			C de à ±			
			Ensemble	S. Ensemble		

Dossier N°

Dossier N°

Dossier N°

HYDRAULICS I+C

CONTROL UNIT FOR HYDRAULICSSYSTEM

Echelle

Dessiné	22-04-70	J.Braichet	
Contrôlé			
Vu			
Remplace			
Remplacé par			

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