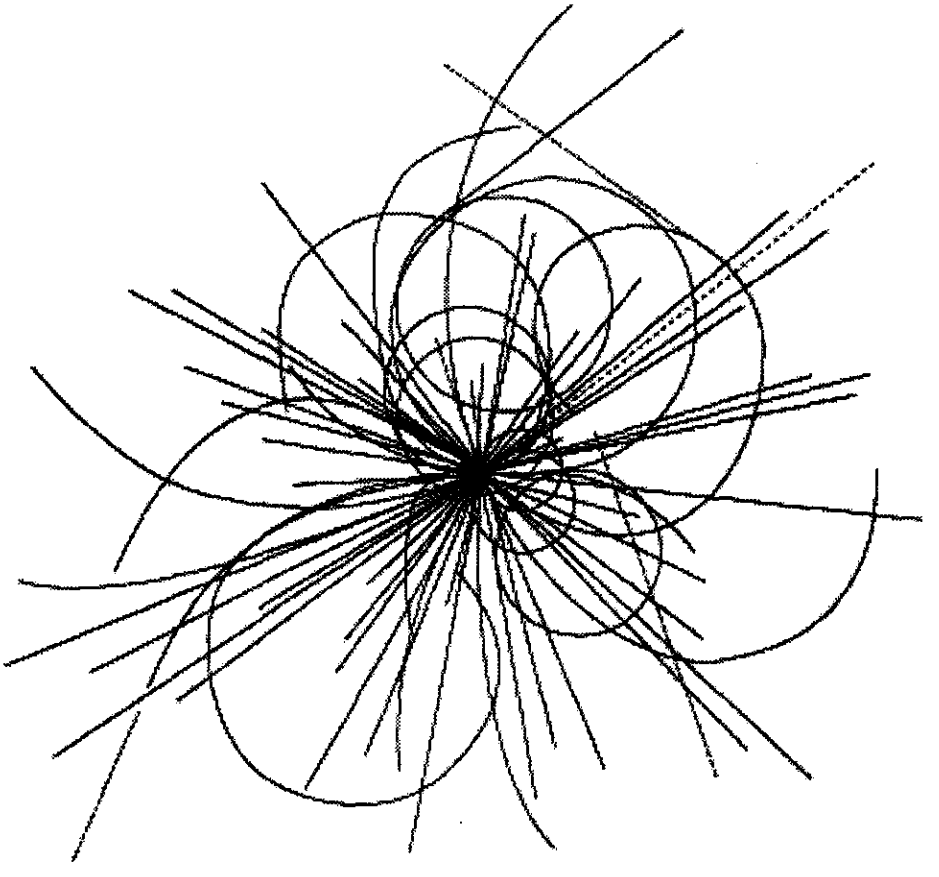
SSCL–N–874
SSC Cryo Note 92–13

Process Control Description Example for a Compressor Skid



Superconducting Super Collider Laboratory

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Distribution Category:

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Process Control Description Example for a Compressor Skid

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October 1992

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Introduction

This note contains a complete example of a process control description for the sector refrigerator station (SRS) compressor skid module CMP-11. This example was developed according to the SRS technical specification, Section 3.8.5. The example includes reports from the following databases:

- The instrument database (Section 3.8.5.4)
- The object interface database (Section 3.8.5.2)
- The truth table database (Section 3.8.5.3.)
- The cause and effect database (Section 3.8.5.3)
- The PID loop database (Section 3.8.5.5)

and includes the following diagrams:

- SRS organization diagram (from Figure 3.0-C)
- CMP-11 module partitioning (Section 3.8.5.2)
- CMP-11 simplified P&ID
- CMP-11 state and transition diagram (Section 3.8.5.3)
- Sequential Function Charts (Section 3.8.5.3)

The main purpose of the example is to illustrate the level of detail and scope expected in the required documentation.

The example has been developed for a generic compressor skid and is based on the experience of running similar systems. Because the example describes a generic compressor skid, some modifications are expected in order to describe a particular compressor skid. In addition, the example may or may not contain all of the subcontractor's CMP-11 control requirements for acceptance testing.

SSCL is generating similar examples for all other SRS control objects defined in figure 3.0-C of the SRS technical specification. These examples are based on the P&IDs included in the SRS technical specification, and will be made available to SRS subcontractor(s).

Upon receiving the final SRS detailed P&IDs from subcontractor(s), SSCL will update the examples to reflect the new P&IDs. The updated examples will be made available to the SRS subcontractor(s). At that point, the subcontractor(s) are to fill in the details of the example and verify that it describes the control requirements of their particular equipment. The corrected example can be then submitted to SSCL and will constitute the controls data deliverables specified in the SRS statement of work.

[AN EXAMPLE OF THE COVER PAGE]

Process Control Description

Object Name	CMP-11
Object Number	101
Revision Number:	0
Date:	10/12/92
Description:	Helium Compressor Skid–First Stage
Reference Drawings:	P&ID Helium Compressor Skid
Other References:	Compressor Skid Local Controls Manual
Definitions:	
Attachments:	Written description SRS organization diagram CMP-11 module partitioning diagram CMP-11 P&ID State and transition diagram Sequential function charts Object interface list Instrumentation list Alarm list Truth table Cause and effect table PID loop list Appendix 1: Naming Conventions

General Description

The first stage compressor skid, CMP-11, compresses to medium pressure the low pressure helium gas returned from the coldbox. For this skid to perform its intended function, the compressor group subsystem (CMG) shall be ready and available (see Figure 1). In order for CMG to be ready and available, the following subsystems and modules must be ready and available: oil removal subsystem (ORM), oil management module (OMT), gas management subsystem (GMS), and instrument air module (IAR).

The compressor skid is designed for normal operation from the sector refrigerator control system (SRC). However, each compressor skid has its own local hardwire safeties and controls (unit LC-11, see Figure 2). The compressor skid may be operated from its local controls for maintenance, repair, etc., and a switch to transfer control to the SRC is provided. The SRC provides warning alarms and safety shutdown functions independent of the local controls. In general, the SRC will actuate some safety shutdowns prior to the local hardwired safeties. However, not all hardwired shutdowns are duplicated in software.

Figure 2 shows the partitioning of the CMP-11 module into units and controls equipment, and Figure 3 is the P&ID for the CMP-11 module. Table 1 is a report from the instrument database (INSTRN25.DB) showing subcontractor-supplied instrumentation details. Table 2 is another report from the instrument database, showing hardwired alarm setpoints.

Appendix 1 contains a list of naming conventions .

Major Equipment

1) Oil injected rotary screw compressor unit (SC-11)

This unit compresses the low pressure helium gas to medium pressure. Each compressor has a built-in capacity control slide valve; this valve is placed in the unloaded position for startup only. After the compressor is started and has been running for five (5) minutes, the slide valve is slowly ramped over a five (5) minute duration to the fully loaded position. The compressor remains fully loaded until shutdown. The oil in the system serves many functions, including bearing lubrication, controlling maximum operating temperature by absorbing the heat of compression, and minimizing gas leakage from high pressure to low pressure. The amount of oil injected shall be optimized to minimize the specific energy input to the compressor. This is accomplished by controlling the amount of oil injected according to the compressor discharge temperature.

2) **Electric motor unit (EM-11)**

This unit provides the energy input for compression. This is a 600 HP induction motor. Approximately 5% of the motor input energy is removed by the air flow around the windings. There are winding temperature measuring devices for monitoring the winding temperature.

3) **Bulk oil separator unit (OS-11)**

The helium and oil mixture enters this unit from the compressor at the maximum temperature. This unit separates the bulk of the oil from the helium gas. The helium gas is supplied to the aftercooler. There are N stages of coalescers in the bulk oil separator, to minimize the oil carryover to the aftercooler. The oil from this tank is supplied to the oil cooler. The oil level in this tank is monitored to ensure that it is maintained between the maximum and minimum levels; if required, the level is adjusted by the oil management skid.

4) **Aftercooler unit (AC-11)**

The aftercooler is used for cooling the helium gas to ambient temperature with the cooling water. Approximately 10% of the motor input energy used for compression is removed in this cooler. This unit has an oil drain tank to facilitate monitoring of the amount of oil leaving the bulk oil separator and this monitoring will serve as an early warning system.

5) **Oil cooler unit (OC-11)**

The oil cooler is used for cooling the oil to ambient temperature with the cooling water. Approximately 85% of the motor input energy used for compression is removed in this cooler. The low oil temperature minimizes the quantity of oil to be injected for temperature control and minimizes the specific energy input to the compressor.

6) **Oil circulating pumps unit (OP-11)**

The number of pumps used depends on the specific compressor and skid design. One auxiliary pump is used for injecting oil to the bearings before starting the compressor. A shaft-driven or other additional pump is used for supplying oil to the bearings while the compressor is running. The additional pump may sometimes also be used for supplying the cooling oil.

7) **Local controls unit (LC-11)**

The compressor skid has a local panel with the indicators, controls, alarms, and shutdowns listed below. For more detail, see "LC-11 manual."

Indicators

- Compressor hour meter (KI-10102)
- Compressor motor power (JI-10102)

- Oil pump motor power (JI-10125)
- Compressor slide valve position (ZI-10102)
- Compressor suction pressure (PI-10101)
- Compressor discharge pressure (PI-10103)
- Compressor suction temperature (TI-10101)
- Compressor discharge temperature (TI-10103)
- Aftercooler helium outlet temperature (TI-10105)
- Compressor oil manifold pressure (PI-10127)
- Compressor oil manifold temperature (TI-10127)

Controls

- Compressor motor start (1PB)
- Compressor motor stop (2PB)
- Compressor oil pump start (3PB)
- Compressor slide valve load (4PB)
- Compressor slide valve unload (5PB)
- Compressor local/remote transfer switch (1SS)
- Compressor reset (6PB)

Alarms

- Low compressor suction pressure (PAL-10101)
- Low compressor suction temperature (TAL-10101)
- High compressor discharge pressure (PAH-10103)
- High compressor discharge temperature (TAH-10103)
- High aftercooler helium temperature (TAH-10105)
- High oil injection temperature (TAH-10123)
- Low compressor oil bearing DP (DPAL-10127)
- Low aftercooler water flow (FAL-10155)
- Low oil cooler water flow (FAL-10151)

Shutdowns

- Low compressor suction pressure (PALL-10101)
- Low compressor suction temperature (TALL-10101)
- High compressor discharge pressure (PAHH-10103)
- High compressor discharge temperature (TAHH-1003)
- Low compressor bearing oil DP (DPALL-10127)
- High oil injection temperature (TAHH-10123)
- Compressor motor overload (1OL)
- Oil pump motor overload (2OL)

The alarms and shutdowns are indicated by the appropriate display going into its flash mode or equivalent. The status of each hardwired safety is transmitted to the SRC via a discrete signal. After a shutdown has occurred, the local control package requires a reset command to unlatch the shutdown safety function from either the local control package (if the control is set to local), or from the SRC (if the control is set to remote). The compressor shall not restart until the reset command has been received (all safeties unlatched) and all other permissives have been met.

When the control is set to remote mode, the SRC may command the local control package to start/stop the compressor, load/unload the compressor slide valve, reset the shutdown status function(s), and open/close all remote valves located on or about the compressor skid. The oil injection temperature control valve shall be controlled by the SRC.

Interface Between LC-11 and the SRC

This section contains a general description of the interface between the local controls unit (LC-11), and the SRC. This description includes a list of all the commands from SRC to LC-11 and all the status indicators from LC-11 to SRC.

SRC commands to LC-11

- Remote start (START-101-CMD, momentary L–TRUE)
- Remote stop (STOP-101-CMD, momentary L–FALSE)
- Remote load (LOAD-101-CMD, momentary L–TRUE)
- Remote unload (UNLOAD-101-CMD, momentary L–TRUE)
- Remote reset (RESET-101-CMD, momentary L–TRUE)

LC-11 status indicators to SRC

- Compressor motor ON indication (1M = L–TRUE)
- Local STOP (2PB = L–FALSE)
- Low compressor suction pressure shutdown indication (PALL-10101 = L–FALSE)
- High compressor discharge pressure shutdown indication (PAHH-10103 = L–FALSE)
- High compressor discharge temperature shutdown indication (TAHH-10103 = L–FALSE)
- Low compressor bearing oil DP shutdown indication (DPALL-10127 = L–FALSE)
- High oil injection temperature shutdown indication (TAHH-10123 = L–FALSE)
- Compressor motor overload shutdown indication (1OL = L–FALSE)

- Oil pump motor overload shutdown indication (2OL = L–FALSE)
- Compressor local/remote transfer switch status (1SS = L–TRUE is local)
- Compressor anti-restart timer signal (1TR = L–TRUE allows start)

The "LC-11 Manual" contains a section with detailed information about the interface between LC-11 and SRC.

Other Systems

The compressor group subsystem (CMG) must be ready and available to allow compressor skid operation. In order for the CMG to be ready and available, the following subsystems and modules must be ready and available: oil removal subsystem (ORM), oil management module (OMT), gas management subsystem (GMS), and instrument air module (IAR).

The process control description for a compressor skid does not include descriptions for other objects needed for compressor skid operation. It is assumed that all other systems needed for compressor skid operation are functional. The process control descriptions of those systems can be found in the corresponding object process control description documents.

All exchanges of information (e.g., signals, status information, and commands) between the compressor skid and other systems are described in this document. Table 3 is a report from the object interface database (OIN25.DB) showing the destination object for each signal for which CMP-11 is the source. Table 4 is another report from the object interface database, showing the source object for each of the signals for which CMP-11 is the destination object. When a unit object is not relevant to controls definitions, its equipment objects are interfaced directly to the module.

States and Transitions

CMP-11 states and transition relationships are shown in Figure 4. There are five states:

- OFF (tag: OFF)
- READY (tag: (READY)
- ON (tag: ON)
- LOCAL (tag: LOCAL)
- SAFE (tag: SAFE)

Table 5 is a report from the truth table database (TRTHN25.DB) that defines the lineup of devices, functions, and other interface objects for each state.

There are eight transitions:

- OFF to READY (tag: OFF-RDY-TRAN)
- READY to OFF (tag: RDY-OFF-TRAN)
- READY to ON (tag: RDY-ON-TRAN)
- ON to OFF (tag: ON-OFF-TRAN)
- REMOTE to LOCAL (tag: RMT-LCL-TRAN)
- LOCAL to REMOTE (tag: LCL-RMT-TRAN)
- OFF to SAFE (tag: OFF-SAFE-TRAN)
- SAFE to OFF (tag: SAFE-OFF-TRAN)

Figures 6–13 define all the transitions. There is one figure for each transition. All graphic representations follow the IEC-848 standard for sequential function charts.

There are four transition trigger commands:

- READY to ON (tag: RDY-ON-RQS)
- ON to OFF (tag: ON-OFF-RQS)
- REMOTE to LOCAL (tag: RMT-LCL-RQS)
- LOCAL to REMOTE (tag: LCL-RMT-RQS)

Table 6 defines all possible sources for the transition trigger commands.

Description of States

READY: The compressor skid is ready to service a request to start (RDY-ON-RQS = TRUE). The following conditions need to be satisfied in CMP-11 in order for it to be in the READY state:

1) Objects lined up for state READY (see Table 5).
2) All software interlocks are clear (ON-OFF-RQS = FALSE; see Table 6).
3) Normal bulk oil temperature (TAL-10120 = TRUE)
4) Helium pressure in the system is more than the minimum (PAL-10101 = TRUE)
5) Aftercooler water flow above minimum requirements (FAL-10155 = TRUE)
6) Oil cooler water flow above minimum requirements (FAL-10151 = TRUE)

ON: The compressor motor EM-10102 is ON (1M = LTRUE), and the compressor skid is running in steady-state operation. All shutdown interlocks are satisfied. The slide valve is normally in the fully loaded position.

The only differences between the READY state and the ON state are that in the ON state EM-10102 is running, the low oil bearing DPA-10127 alarm is enabled, and the slide valve load and unload commands are enabled.

Table 5 defines the lineup of devices, functions, and other interface objects for the ON state.

OFF: The compressor motor EM-10102 is OFF (1M = L–FALSE), and the permissives for the READY state are not satisfied. The compressor skid is not ready to service a request to start. In the OFF state it should be possible to perform manual operations in order to bring the compressor skid to the READY state.

Table 5 defines the lineup of devices, functions, and other interface objects for the OFF state.

LOCAL: The compressor skid is under control of the local control station. All commands from SRC to the compressor skid are disabled except the oil supply control valve, which is under control of TIC-10103.

It is possible to transfer to LOCAL state from any other state, and to transfer to any other state from LOCAL. However, the transfer can be initiated from the local control station only by changing the state of the local/remote transfer switch (1SS).

Table 5 defines the lineup of devices, functions, and other interface objects for the LOCAL state.

SAFE: CMP-11 control equipment is de-energized, and all devices are in their fail-safe status. All commands from the SRC to the field are disabled.

Table 5 defines the lineup of devices, functions, and other interface objects for the SAFE state.

Description of functions

Tables 6 and 7 and Figure 5 define all the functions for CMP-11. Table 6 is a report from the cause and effect database (CAEN25.DB), and Table 7 is a report from the PID loop database (PIDN25.DB). All functions are ENABLED in all states unless otherwise specified in the truth table (see Table 5).

TIC-10103: This is a PID loop that controls the amount of oil supplied to the compressor according the to compressor discharge temperature (see Table 7)

LC-1030: Aftercooler oil level controller (see figure 5). This is a continuous function that will drain the oil collected in the aftercooler tank after it fills up. If the drain operations are less than 24 hours apart the operator will be notified. The clock will be active only while 1M = L–TRUE.

TR-10130: This function is a clock that will keep track of how often the aftercooler oil tank is emptied. This clock is enabled only when the motor 1M is running, and can be reset (see Table 6).

TR-10102: This function is a clock that will keep track of the number of hours CMP-11 has been running (see Table 6).

The following functions are software shutdown interlocks. Some are duplicates of the hardwired interlocks. Note that not all the hardwired shutdown interlocks are duplicated in software. Shutdown interlock functions are defined in the cause and effect table (see Table 6):

SD-101-01: High compressor discharge temperature shutdown.

SD-101-02: Low compressor bearing oil DP shutdown.

SD-101-03: High compressor motor temperature shutdown.

SD-101-04: Low bulk oil separator level shutdown.

SD-101-05: High vibration shutdown.

The following functions are software response to hard-wired shutdown interlocks (see Table 6):

SD-101-20: Local low compressor suction pressure shutdown.

SD-101-21: Local high compressor discharge pressure shutdown.

SD-101-22: Local high compressor discharge temperature shutdown.

SD-101-23: Local low oil bearing DP shutdown.

SD-101-24: Local high compressor discharge temperature shutdown.

SD-101-25: Local compressor motor overload shutdown.

SD-101-26: Local oil pump motor overload shutdown.

SD-101-27: Local stop switch shutdown.

SD-101-28: Compressor motor OFF shutdown.

RS-101-01: Reset function (see Table 6). This function will reset all local hard-wired shutdown interlocks and all software shutdown interlocks.

RS-101-02: This function resets TR-10130 clock (see Table 6).

The following are miscellaneous functions (see Table 6):

FU-101-01: Operator startup from CMP-11.

FU-101-02: Startup from CMG.

FU-101-03: Operator shutdown from CMP-11.

FU-101-04: *Shutdown from CMG.*

FU-101-05: Switch to local control.

FU-101-06: *Switch to remote control.*

FU-101-07: Operator load from CMP-11.

FU-101-08: *Operator unload from CMP-11.*

FU-101-09: Operator reset from CMP-11.

The following are alarm functions (see Table 6):

YA-XXXXX: Alarm block corresponding to loop first-letter Y, loop number XXXXX (e.g., TA-10101). The alarm block includes up to four tag numbers: YALL-XXXXX, YAL-XXXXX, YAH-XXXXX, and YAHH-XXXXX.

The bulk oil separator oil level is maintained by the oil management module (OMT). Tables 1 and 2 specify the exchange of information between CMP-11 and OMT for this function.

The process description for the OMT contains a description of the function that maintains the bulk oil separator oil level for CMP-11.

Description of Transitions

READY to ON: After receiving a request to start (RDY-ON-RQS = TRUE), the following steps and transitions will occur (see Figure 6):

1) Compressor skid status is set to "RDY-ON-TRAN."
2) Send a remote start command to the local compressor controls (START-101-CMD = L–TRUE).
3) After DPI-10127 exceeds the low alarm setpoint, enable DPA-10127.
4) When 1M = L–TRUE, set skid status to ON and reset the RDY-ON-RQS command to FALSE.
5) After 10 seconds, enable slide valve load/unload remote commands.
6) If the 1M = L–TRUE signal is not received within 50 seconds of issuing a START-101-CMD command, notify the operator of CMP-11 start timeout and issue an ON-OFF-RQS command.

ON to OFF: After receiving a request to stop (ON-OFF-RQS = TRUE), the following steps and transitions will occur (see Figure 7):

1) Compressor skid status is set to "ON-OFF-TRAN."

2) Send a remote stop command to the local compressor control (STOP-101-CMD = L–FALSE).

3) After receiving 1M = L–FALSE signal, enable remote reset function (RS-101-01).

4) If the shutdown is because of low oil bearing DP, do not disable DPA-10127.

5) If the shutdown is not because of low oil bearing DP, disable DPA-10127 to avoid a nuisance alarm.

6) Disable all command signals to local control unit LC-11 and reset ON-OFF-RQS command to FALSE.

7) Set CMP-11 status to "OFF."

OFF to READY: When all permissives for the ready state are satisfied and the lineup of devices, functions, and alarms corresponds to the READY state, compressor skid status will be set to "READY" (see Figure 8).

READY to OFF: When any of the conditions for the READY state is not satisfied any longer, compressor skid status will be set to "OFF" (see Figure 9).

RMT to LCL: After receiving a request to go to local control (RMT-LCL-RQS = TRUE), all commands to CMP-11 are disabled with the exception of TCV-10103; this will remain under TIC-10103 automatic control. The compressor skid status is then set to "LOCAL." The only way to set the RMT-LCL-RQS command to FALSE or TRUE is via LC-11 local/remote switch 1SS (see Table 6)

LCL to RMT: After receiving a request to go to remote control (LCL-RMT-RQS = TRUE) while CMP-11 status is LOCAL, the following possibilities exist (see Figure 11):

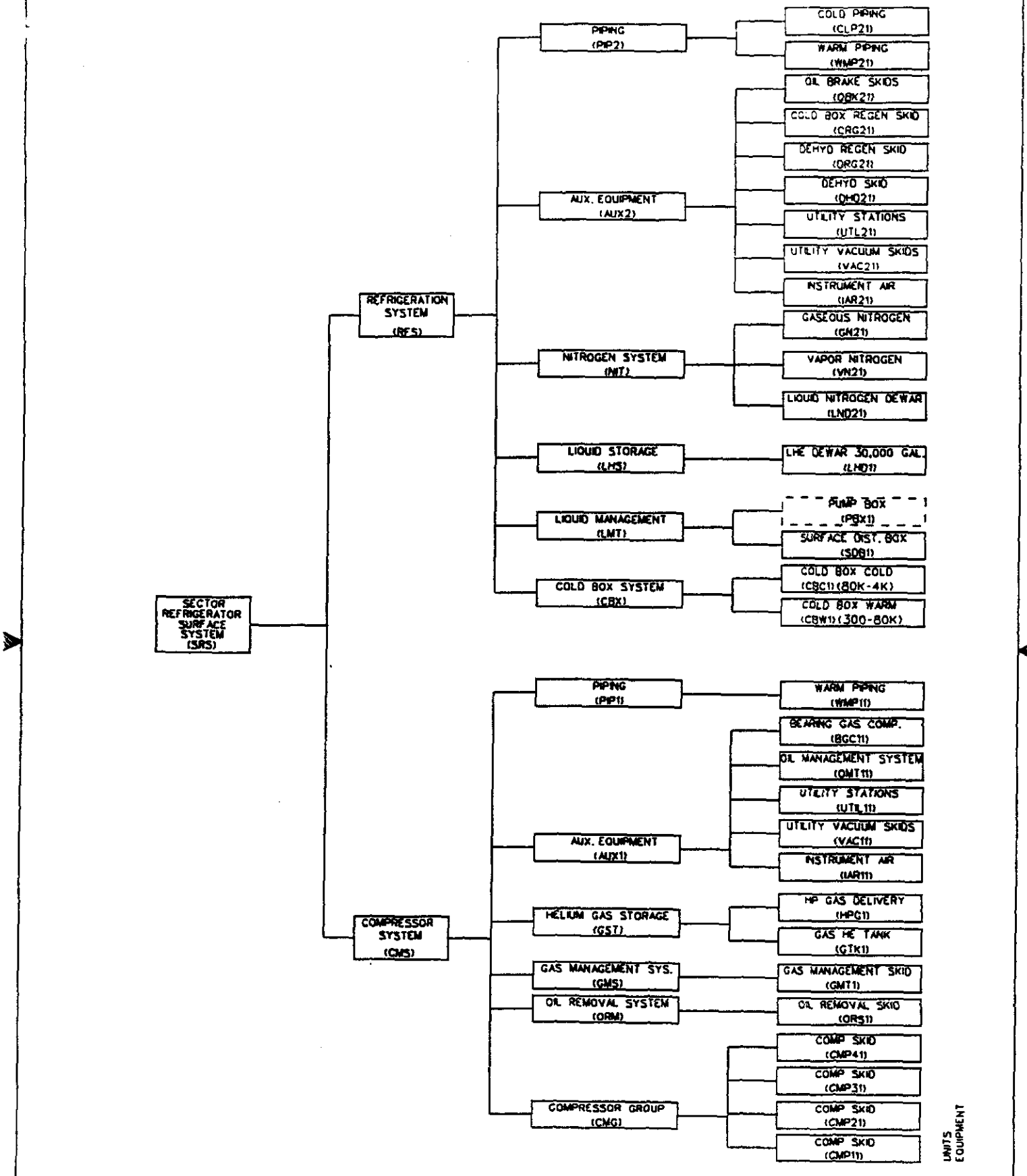
a) If 1M is L–TRUE, the computer will verify whether the lineup corresponds to the ON state. If the lineup does match, the computer will enable the corresponding commands for the ON state and set CMP-11 status to "ON." If the lineup does not match, the computer will issue an ON-OFF-RQS command

b) If 1M is L–FALSE, the computer will enable the RESET-101-CMD and set CMP-11 to "OFF."

The only way to set the LCL-RMT-RQS command to FALSE or TRUE is via LC-11 local/remote switch 1SS (see Table 6).

OFF to SAFE: The OFF-SAFE transition will be made automatically when the computer determines that CMP-11 control devices are de-energized and in their fail-safe position (LC-11-POWER = L–FALSE). During the transition, all SRC commands to the field are disabled (see Figure 12).

SAFE to OFF: The SAFE-OFF transition will be made automatically when the computer determines that CMP-11 control devices are no longer de-energized (LC-11-POWER = L-TRUE). During the transition, all SRC commands to the field are enabled (see Figure 13).



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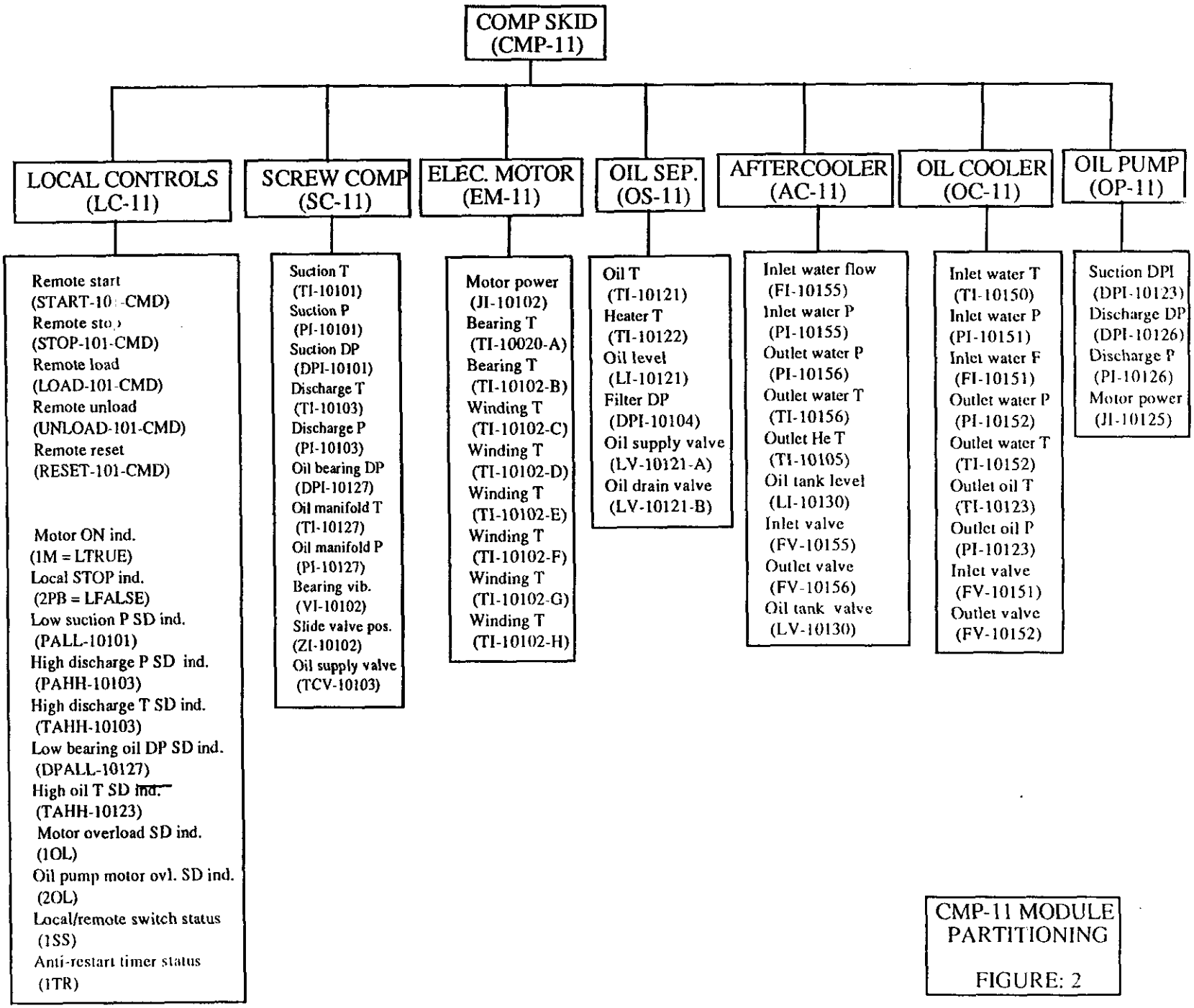
SRS ORGANIZATION

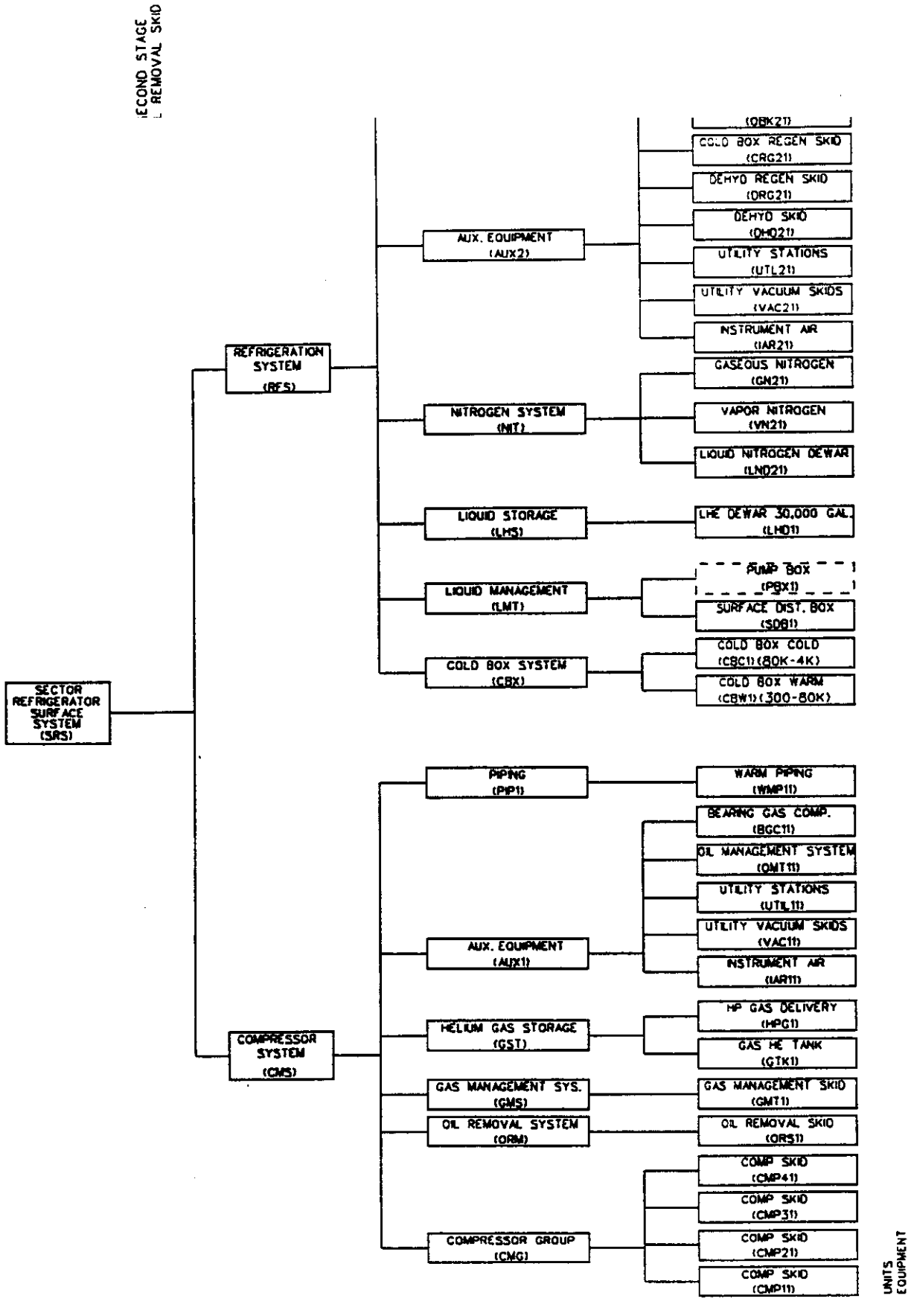
FIGURE: 1

EQUIPMENT UNITS MODULE



CMP-11 MODULE PARTITIONING

FIGURE: 2



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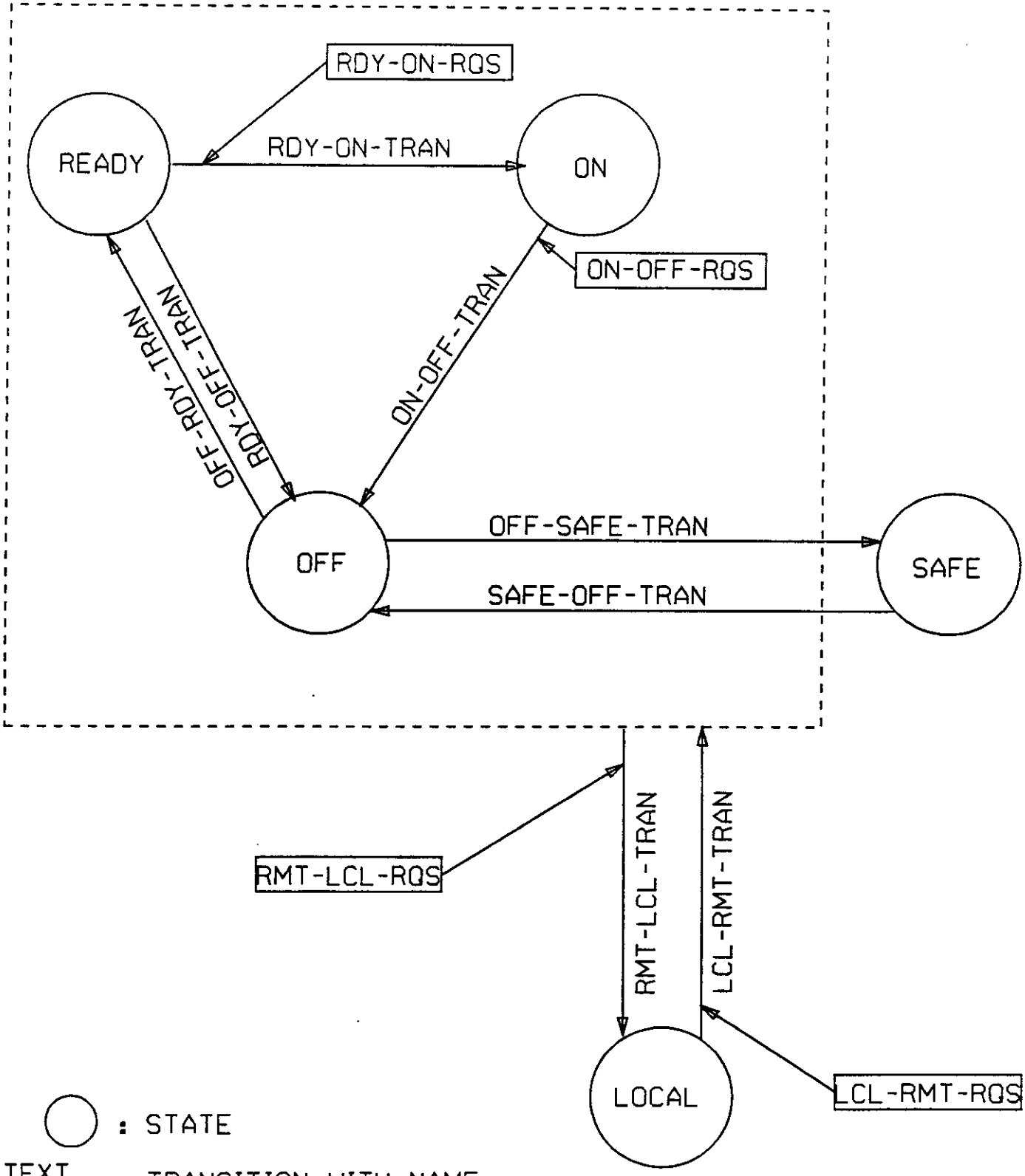
SRS ORGANIZATION

FIGURE: 1

OBJECT NAME: CMP-11



○ : STATE

TEXT → : TRANSITION WITH NAME

[- - -] : TRANSITION APPLIES TO ALL STATES WITHIN BOX

[TEXT] : TRANSITION TRIGGER REQUEST

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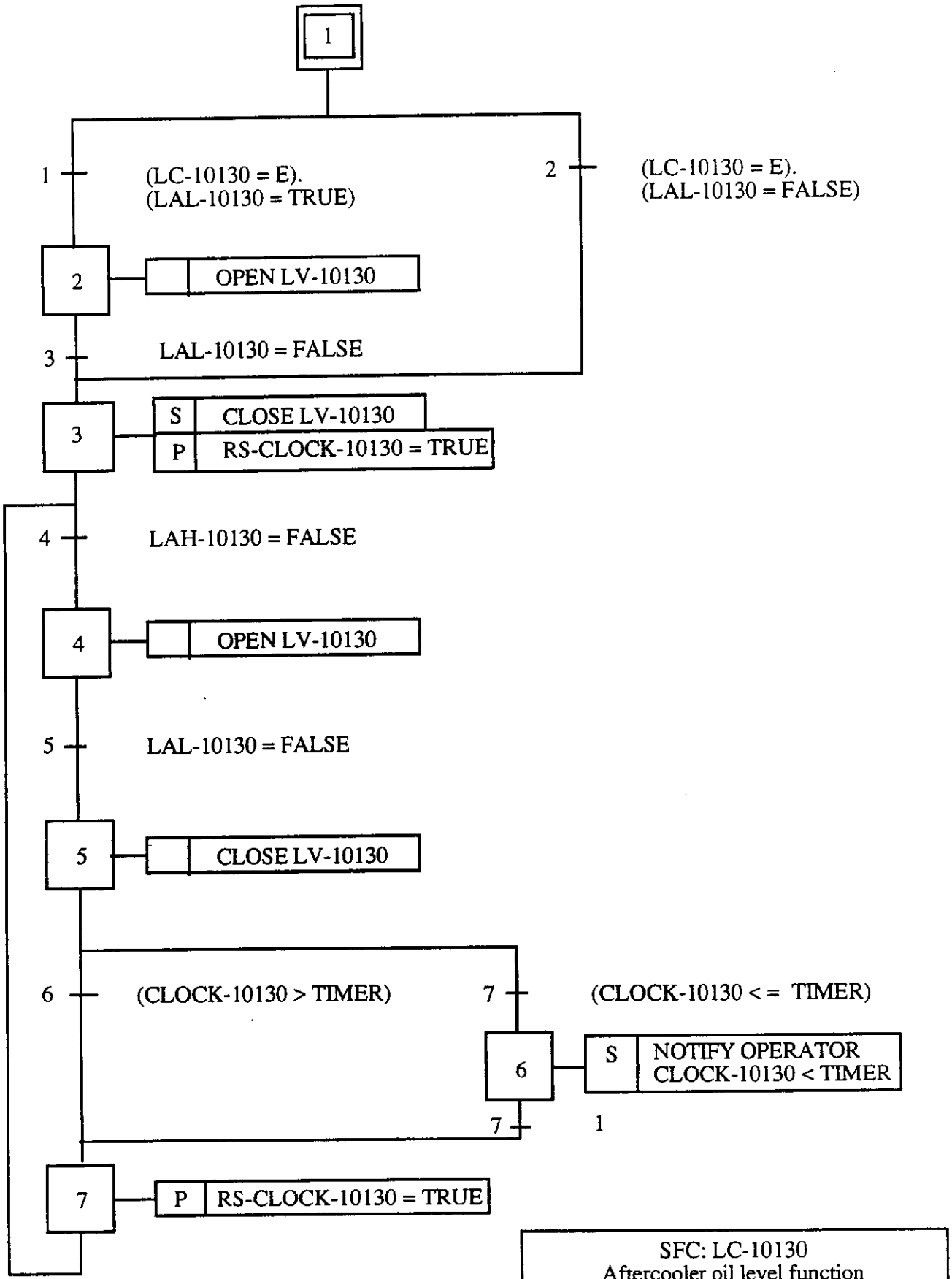
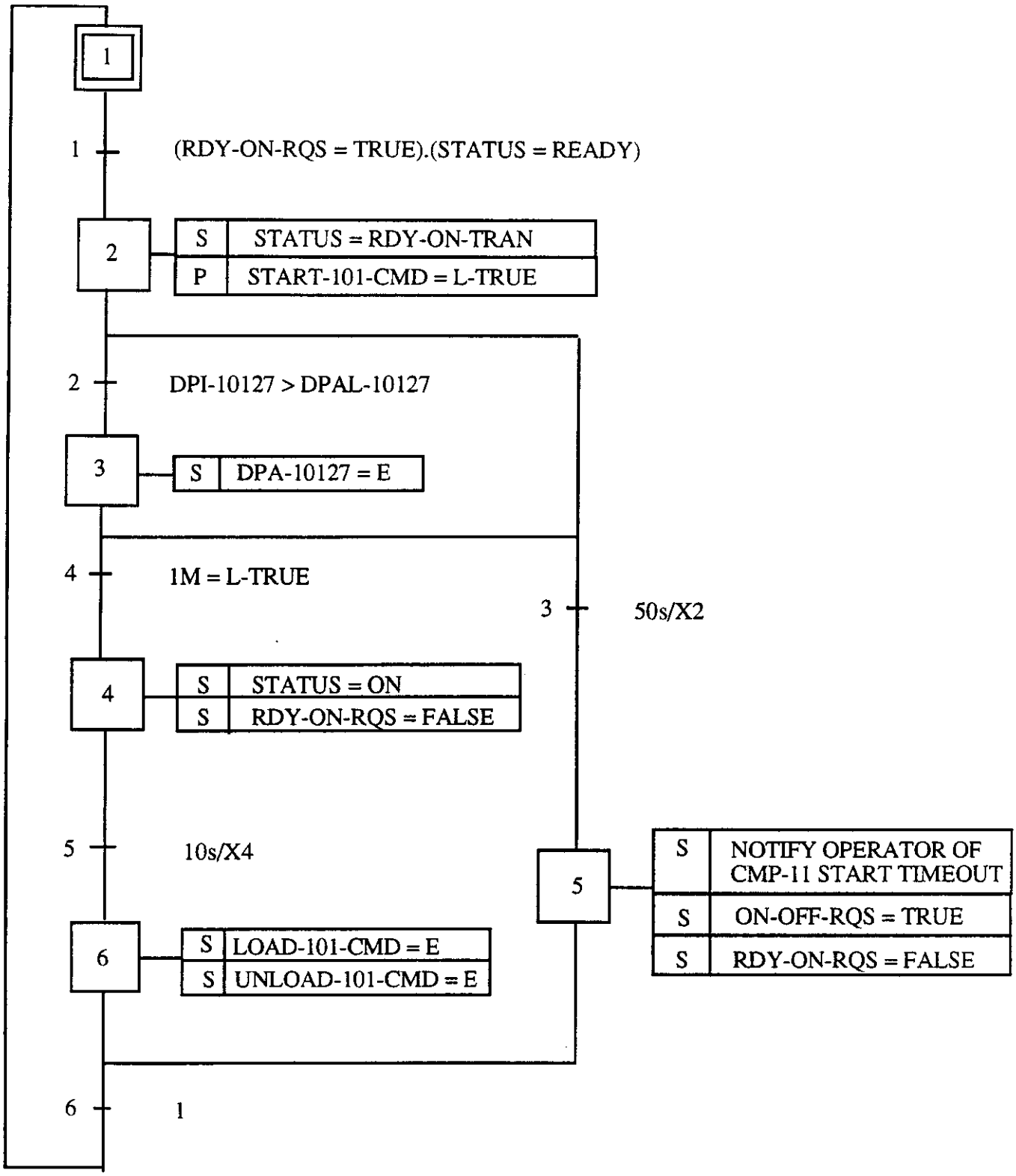
STATE AND TRANSITION DIAGRAM FOR CMP-11
FIGURE: 4



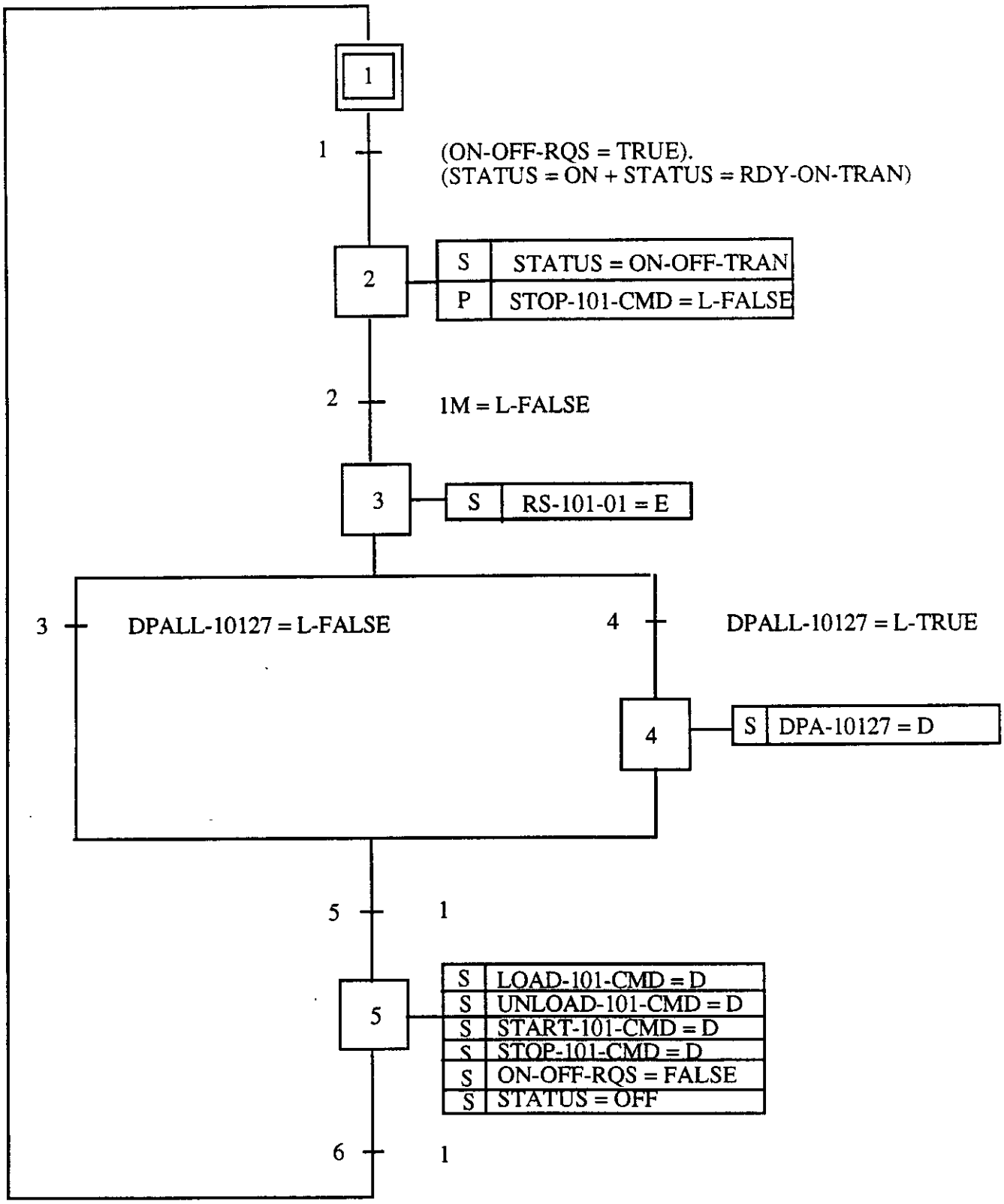
SFC: LC-10130
Aftercooler oil level function
Parameter: TIMER = 24 hours

FIGURE: 5



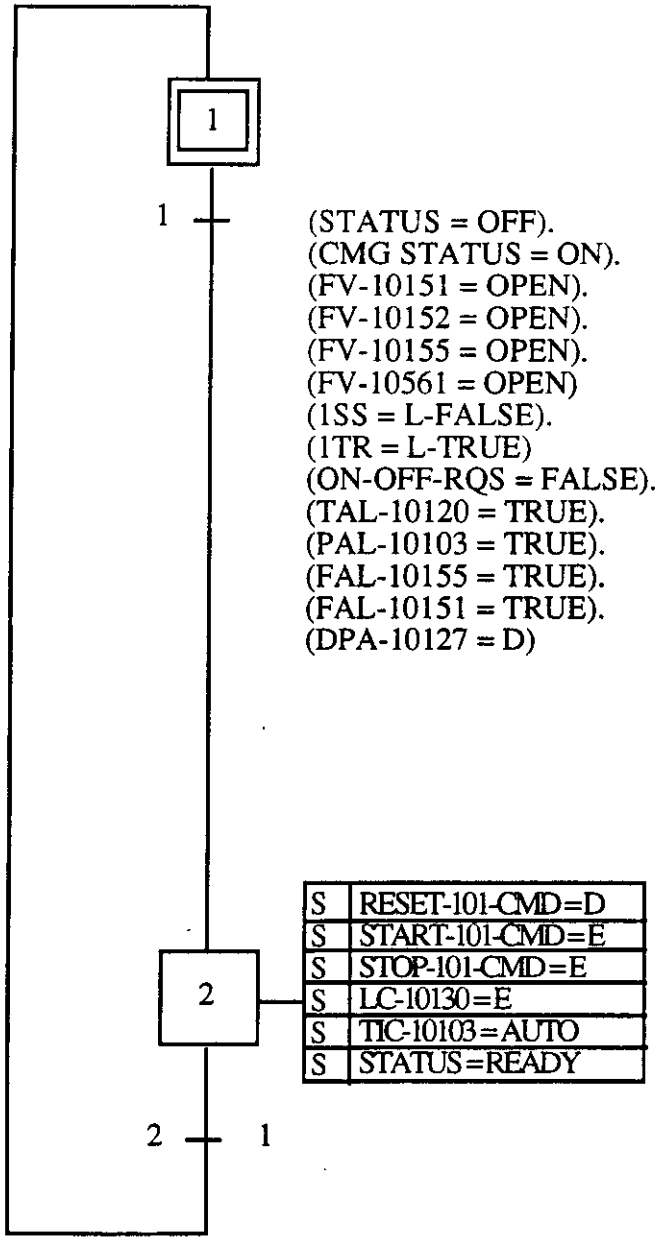
SFC: RDY to ON tran

FIGURE: 6



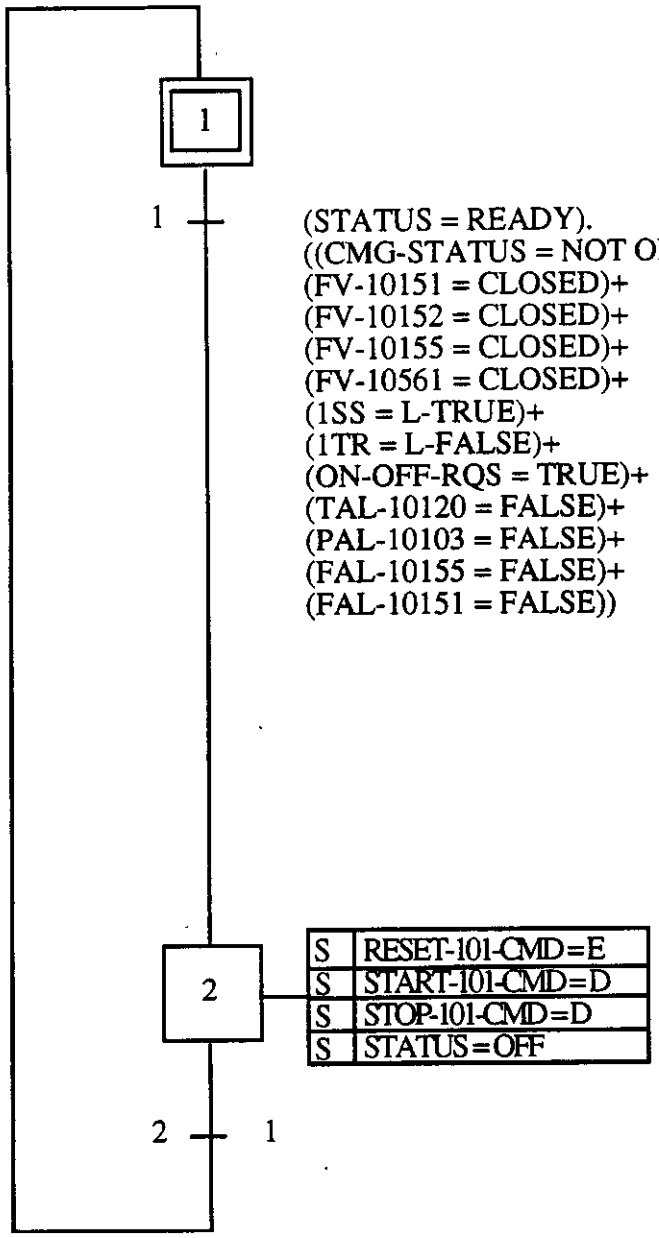
SFC: ON to OFF tran

FIGURE: 7



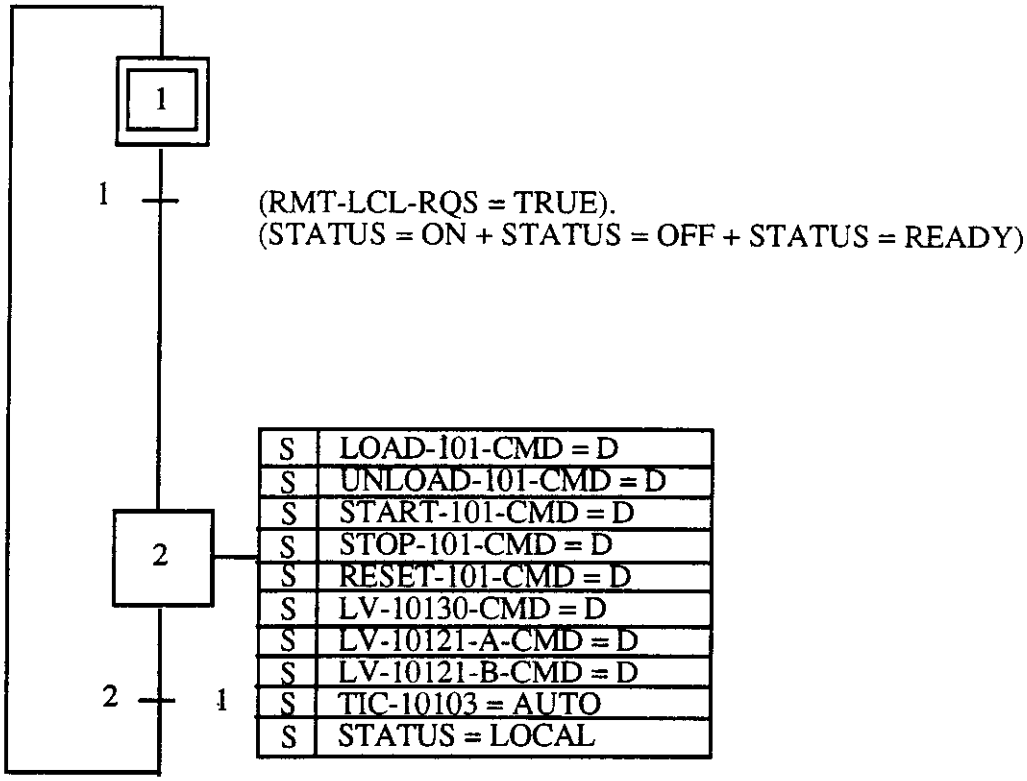
SFC: OFF to RDY tran

FIGURE: 8



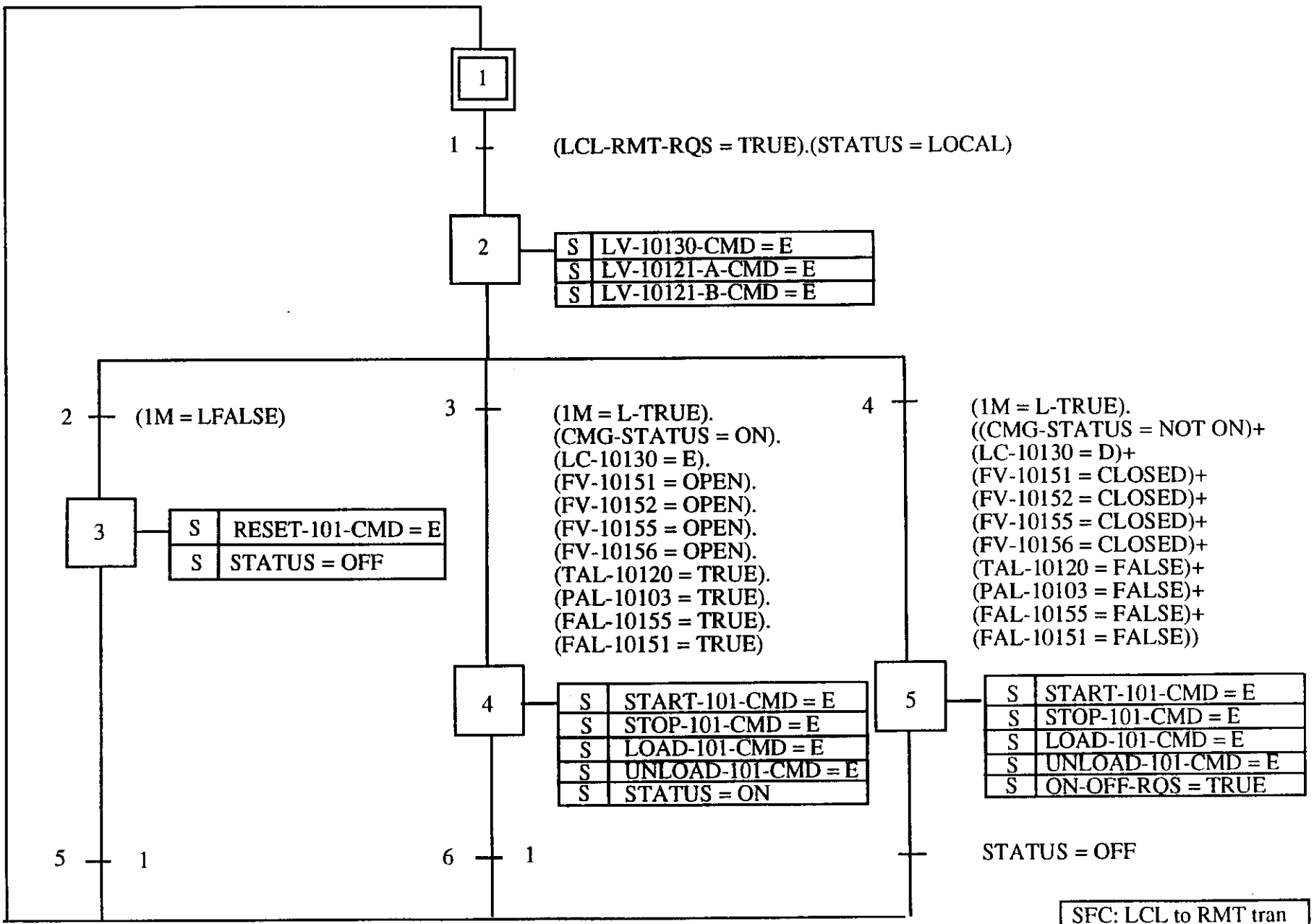
SFC: RDY to OFF tran

FIGURE: 9



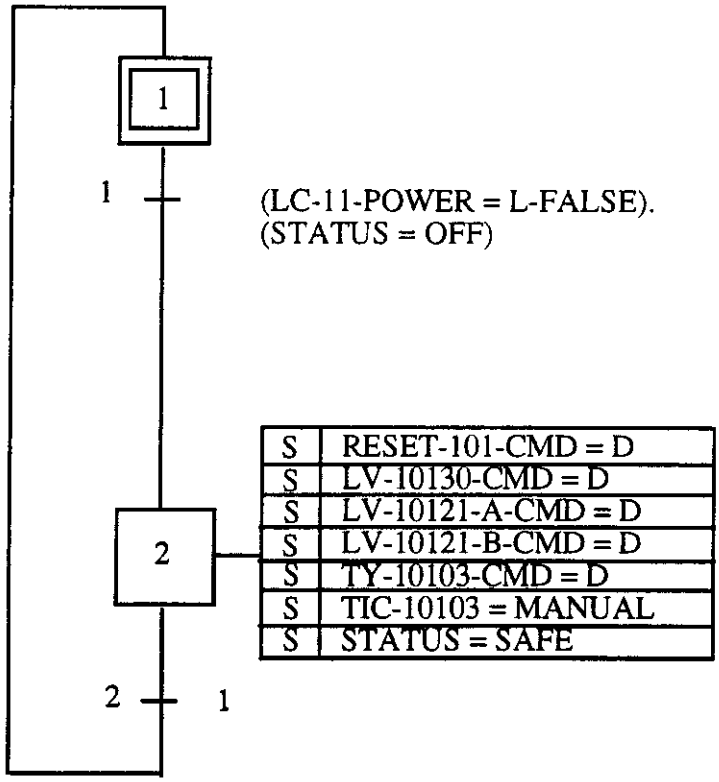
SFC: RMT to LCL tran

FIGURE: 10



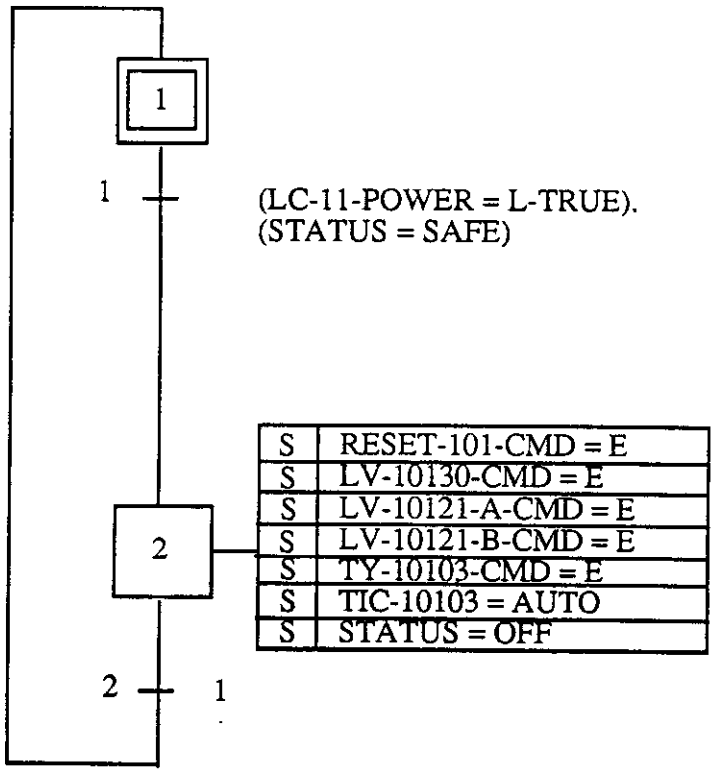
SFC: LCL to RMT tran

FIGURE: 11



SFC: OFF to SAFE tran

FIGURE: 12



SFC: SAFE to OFF tran

FIGURE: 13

TABLE 1

INSTRUMENT LIST FOR N25
OBJECT CMP-11

INSTRUMENT LIST FOR MODULE: CMP-11

TAG	DEVICE	INPUT RANGE	OUTPUT RANGE	ACCURACY	PART NUMBER	REMARKS
DPAL-10127	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 BEARING OIL DP ALARM
DPALL-10127	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 BEARING OIL DP SHUTDOWN
DPT-10101	DP TRANSMITTER	0 - 300 mbar	4 - 20 mA	±0.25%	105.1DP.316.M	CMP-11 FILTER 10101 DP
DPT-10104	DP TRANSMITTER	0 - 4 bar	4 - 20 mA	±0.25%	105.5DP.316.M	CMP-11 BULK OIL FILTER DP
DPT-10123	DP TRANSMITTER	0 - 2 bar	4 - 20 mA	±0.25%	105.5DP.316.M	CMP-11 FILTER 10123 DP
DPT-10126	DP TRANSMITTER	0 - 2 bar	4 - 20 mA	±0.25%	105.5DP.316.M	CMP-11 FILTER 10126 DP
DPT-10127	DP TRANSMITTER	0 - 4 bar	4 - 20 mA	±0.25%	105.5DP.316.M	CMP-11 OIL BEARING DP
FAL-10151	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 OIL COOLER LO WATER FLOW ALARM
FAL-10155	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 AFTERCOOLER LO WATER FLOW ALARM
FT-10151	FLOW TRANSMITTER	0 - 10 m3/h	4 - 20 mA	±1%	PD136.100.3J	CMP-11 OIL COOLER H2O FLOW
FT-10155	FLOW TRANSMITTER	0 - 5 m3/h	4 - 20 mA	±1%	PD136.50.3J	CMP-11 AFTERCOOLER H2O FLOW
JT-10102	WATT TRANSDUCER	0 - 280 kW	4 - 20 mA	±0.5%	ZW.2800.2.B2	CMP-11 COMP. MOTOR POWER
JT-10125	WATT TRANSDUCER	0 - 1.6 kW	4 - 20 mA	±0.5%	ZW.16.2.B2	CMP-11 OIL PUMP POWER
LT-10121	LEVEL TRANSMITTER	0 - 1000 mm	4 - 20 mA	±1.0%	A55.1000.02.CH5	CMP-11 BULK OIL LEVEL
LT-10130	LEVEL TRANSMITTER	0 - 400 mm	4 - 20 mA	±0.5%	PD136.50.5J	CMP-11 AFTERCOOLER OIL TANK LEVEL
PAH-10103	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. HI DISCHARGE PRESSURE ALARM
PAHH-10103	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. HI DISCHARGE PRESSURE SHUTDOWN
PAL-10101	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. LO SUCTION PRESSURE ALARM
PALL-10101	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. LO SUCTION PRESSURE SHUTDOWN
PT-10101	PRESSURE TRANSMITTER	0 - 8 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 COMP. SUCTION PRESSURE
PT-10103	PRESSURE TRANSMITTER	0 - 8 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 COMP. DISCHARGE PRESSURE
PT-10123	PRESSURE TRANSMITTER	0 - 4 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 OIL COOLER OIL OUTLET PRESSURE
PT-10126	PRESSURE TRANSMITTER	0 - 12 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 OIL PUMP DISCHARGE PRESSURE
PT-10127	PRESSURE TRANSMITTER	0 - 12 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 COMP. BEARING OIL PRESSURE
PT-10151	PRESSURE TRANSMITTER	0 - 12 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 OIL COOLER H2O INLET PRESSURE
PT-10152	PRESSURE TRANSMITTER	0 - 12 bar	4 - 20 mA	±0.5%	105.15P.316.M	CMP-11 OIL COOLER H2O OUTLET PRESSURE

TABLE 1

INSTRUMENT LIST FOR N25
OBJECT CMP-11

INSTRUMENT LIST FOR MODULE: CMP-11

TAG	DEVICE	INPUT RANGE	OUTPUT RANGE	ACCURACY	PART NUMBER	REMARKS
PT-10155	PRESSURE TRANSMITTER	0 - 12 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 AFTERCOOLER H2O INLET PRESSURE
PT-10156	PRESSURE TRANSMITTER	0 - 12 bar	4 - 20 mA	±0.5%	105.16P.316.M	CMP-11 AFTERCOOLER H2O OUTLET PRESSURE
TAH-10103	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. HI DISCHARGE TEMPERATURE ALARM
TAH-10105	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 AFTERCOOLER TEMPERATURE ALARM
TAH-10123	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 OIL INJECTION TEMPERATURE ALARM
TAHH-10103	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. HI DISCHARGE TEMPERATURE SHUTDOWN
TAHH-10123	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 OIL INJECTION TEMPERATURE SHUTDOWN
TAL-10101	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. LO SUCTION TEMPERATURE ALARM
TALL-10101	ALARM MODULE	4 - 20 mA	DRY CONTACT	±0.5%	ALARM-425K	CMP-11 COMP. LO SUCTION TEMPERATURE SHUTDOWN
TE-10101	RTD	-30 - +50 °C	88.22 - 119.4 Ohm	±0.15 °C	RTD100.A1.6.200	CMP-11 COMP. SUCTION TEMPERATURE
TE-10102A	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.111	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10102B	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.111	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10102C	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.121	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10102D	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.121	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10102E	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.121	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10102F	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.121	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10102G	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.121	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10102H	RTD	0 - 200 °C	100 - 175.84 Ohm	±0.15 °C	120.E2.153.121	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TE-10103	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.15 °C	RTD100.C5.6.150	CMP-11 COMP. DISCHARGE TEMPERATURE
TE-10105	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.15 °C	RTD100.C5.6.150	CMP-11 AFTERCOOLER TEMPERATURE
TE-10121	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.15 °C	RTD100.C5.8.300	CMP-11 BULK OIL SEP. OIL TEMPERATURE
TE-10122	THERMOCOUPLE TYPE K	0 - 500 °C	0 - 20.64 mV	±0.45%	TC.K.A0.3.50	CMP-11 BULK OIL SEP. HEATER TEMPERATURE
TE-10123	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.15 °C	RTD100.C5.6.150	CMP-11 OIL COOLER OIL OUTLET TEMPERATURE
TE-10127	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.15 °C	RTD100.C5.6.150	CMP-11 COMP. BEARING OIL TEMPERATURE
TE-10150	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.15 °C	RTD100.C5.6.150	CMP-11 COOLING H2O INLET TEMPERATURE
TE-10152	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.15 °C	RTD100.C5.6.150	CMP-11 OIL COOLER H2O OUTLET TEMPERATURE

TABLE 1

INSTRUMENT LIST FOR N25
OBJECT CMP-11

INSTRUMENT LIST FOR MODULE: CMP-11

TAG	DEVICE	INPUT RANGE	OUTPUT RANGE	ACCURACY	PART NUMBER	REMARKS
TE-10156	RTD	0 - 120 °C	100 - 146.06 Ohm	±0.5%	RTD100.C5.8.300	CMP-11 AFTERCOOLER H2O OUTLET TEMP.
TT-10101	TEMP. TRANSMITTER	88.22 - 119.45 Ohm	4 - 20 mA	±0.05%	RTDTT61.-30.A	CMP-11 COMP. SUCTION TEMP.
TT-10102A	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.200.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10102B	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.200.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10102C	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.200.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10102D	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.200.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10102E	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.200.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10102F	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.200.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10102G	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.200.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10102H	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	28.541.A.111	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10103	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	CMP-11 COMP. DISCHARGE TEMP.
TT-10105	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	CMP-11 AFTERCOOLER TEMP.
TT-10121	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	CMP-11 BULK OIL SEP. OIL TEMPERATURE
TT-10122	TEMP. TRANSMITTER	0 - 20.64 mV	4 - 20 mA	±0.05%	RTDTT61.0.500.A	CMP-11 OIL SEP. HEATER TEMPERATURE
TT-10123	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	CMP-11 OIL OUTLET TEMP.
TT-10127	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	CMP-11 COMP. BEARING OIL TEMP.
TT-10150	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TT-10152	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	COMP-11 OIL COOLER H2O OUTLET TEMP.
TT-10156	TEMP. TRANSMITTER	100 - 146.06 Ohm	4 - 20 mA	±0.05%	RTDTT61.0.120.A	CMP-11 AFTERCOOLER OUTLET TEMP.
TY-10103	I/P TRANSMITTER	4 - 20 mA	0.2 - 1 bar	±0.5%	1P50.6.3.A	CMP-11 OIL INJECTION CONTROL VALVE POSITION
VE-10102	VIBRATION SENSOR	0 - 50 m/sec2	0 - 100 mV	±1.5%	AC5.75.B7359	CMP-11 COMP. VIBRATION
VT-10102	SIGNAL CONDITIONER	0 - 100 mV	4 - 20 mA	±0.05%	LS-005	CMP-11 COMP. VIBRATION
ZE-10102	POT	0 - 100%	0 - 1000 Ohms	±1%	5J-512-1K	CMP-11 COMP. SLIDE VALVE POSITION
ZSH-10121A	LIMIT SWITCH	VALVE OPEN	DRY CONTACT	±1%	LS-005	CMP-11 BULK OIL SEP. OIL OUTLET HIGH SWITCH
ZSH-10121B	LIMIT SWITCH	VALVE OPEN	DRY CONTACT	±1%	LS-005	CMP-11 BULK OIL SEP. OIL INLET HIGH SWITCH
ZSH-10130	LIMIT SWITCH	VALVE OPEN	DRY CONTACT	±1%	LS-005	CMP-11 AFTERCOOLER TANK OIL OUTLET HIGH SWITCH

TABLE 1

INSTRUMENT LIST FOR N25
OBJECT CMP-11

INSTRUMENT LIST FOR MODULE: CMP-11

TAG	DEVICE	INPUT RANGE	OUTPUT RANGE	ACCURACY	PART NUMBER	REMARKS
ZSH-10151	LIMIT SWITCH	VALVE OPEN	DRY CONTACT	±1%	LS-005	CMP-11 OIL COOLER H2O INLET VALVE HIGH SWITCH
ZSH-10152	LIMIT SWITCH	VALVE OPEN	DRY CONTACT	±1%	LS-005	CMP-11 OIL COOLER H2O OUTLET VALVE HIGH SWITCH
ZSH-10155	LIMIT SWITCH	VALVE OPEN	DRY CONTACT	±1%	LS-005	CMP-11 AFTERCOOLER H2O INLET HIGH SWITCH
ZSH-10156	LIMIT SWITCH	VALVE OPEN	DRY CONTACT	±1%	LS-005	CMP-11 AFTERCOOLER H2O OUTLET HIGH SWITCH
ZSL-10121A	LIMIT SWITCH	VALVE CLOSED	DRY CONTACT	±1%	LS-005	CMP-11 BULK OIL SEP. OIL OUTLET LOW SWITCH
ZSL-10121B	LIMIT SWITCH	VALVE CLOSED	DRY CONTACT	±1%	LS-005	CMP-11 BULK OIL SEP. OIL INLET LOW SWITCH
ZSL-10130	LIMIT SWITCH	VALVE CLOSED	DRY CONTACT	±1%	LS-005	CMP-11 AFTERCOOLER TANK OIL OUTLET LOW SWITCH
ZSL-10151	LIMIT SWITCH	VALVE CLOSED	DRY CONTACT	±1%	LS-005	CMP-11 OIL COOLER H2O INLET VALVE LOW SWITCH
ZSL-10152	LIMIT SWITCH	VALVE CLOSED	DRY CONTACT	±1%	LS-005	CMP-11 OIL COOLER H2O OUTLET VALVE LOW SWITCH
ZSL-10155	LIMIT SWITCH	VALVE CLOSED	DRY CONTACT	±1%	LS-005	CMP-11 AFTERCOOLER H2O INLET LOW SWITCH
ZSL-10156	LIMIT SWITCH	VALVE CLOSED	DRY CONTACT	±1%	LS-005	CMP-11 AFTERCOOLER H2O OUTLET LOW SWITCH
ZT-10102	SIGNAL CONDITIONER	0 - 1000 Ohms	4 - 20 mA	±2%	SU5C.3112	CMP-11 SLIDE VALVE POSITION
ZT-10103	SIGNAL CONDITIONER	0 - 100%	4 - 20 mA	±0.05%	LVDT-120UH	CMP-11 OIL INJECTION CONTROL VALVE POSITION

TABLE 2

HARDWIRED ALARMS FOR N25
OBJECT CMP-11

TAG	LOW-LOW	LOW	HIGH	HIGH-HIGH
DPAL-10127		<3.6 bar		
DPALL-10127	<3.0 bar			
FAL-10151		<7.2 L/s		
FAL-10155		<0.95 L/s		
PAH-10103			>6.0 bar	
PAHH-10103				>7.0 bar
PAL-10101		<0.95 bar		
PALL-10101	<0.80 bar			
TAH-10103			>95 °C	
TAH-10105			>32°C	
TAH-10123			>45°C	
TAHH-10103				>105 °C
TAHH-10123				>50°C
TAL-10101		<6 °C		
TALL-10101	<0°C			

TABLE 3

N25 OBJECT INTERFACE BY SOURCE

SOURCE OBJECT NAME: CMP-11

SIGNAL	DESTINATION OBJECT	REMARKS
CMP-11-STATUS	CMG	ON, READY, OFF, LOCAL, OR SAFE STATUS
FV-10151-CMD	FV-10151	CLOSE FV-10151
FV-10152-CMD	FV-10152	CLOSE FV-10152
FV-10155-CMD	FV-10155	CLOSE FV-10155
FV-10156-CMD	FV-10156	CLOSE FV-10156
LI-10121	CMG	CMP-11 BULK OIL LEVEL
LOAD-101-CMD	LC-11-LOAD	CMP-11 REMOTE LOAD COMMAND
LV-10121-A-CMD	LV-10121-A	OPEN LV-10121-A COMMAND
LV-10121-B-CMD	LV-10121-B	OPEN LV-10121-B COMMAND
LV-10130-CMD	LV-10130	OPEN LV-10130 COMMAND
PI-10103	CMG	CMP-11 COMP. DISCHARGE PRESSURE
RESET-101-CMD	LC-11-RESET	CMP-11 REMOTE RESET COMMAND
START-101-CMD	LC-11-START	CMP-11 REMOTE START COMMAND
STOP-101-CMD	LC-11-STOP	CMP-11 REMOTE STOP COMMAND
TY-10103-CMD	TCV-10103	CMP-11 TCV-10103 POSITION COMMAND
UNLOAD-101-CMD	LC-11-UNLOAD	CMP-11 REMOTE UNLOAD COMMAND
ZSH-10121-A	CMG	LV-10130-A IS OPEN
ZSH-10121-B	CMG	LV-10130-B IS OPEN
ZSL-10121-A	CMG	LV-10130-A IS CLOSED
ZSL-10121-B	CMG	LV-10130-B IS CLOSED

TABLE 4

N25 OBJECT INTERFACE BY DESTINATION

DESTINATION OBJECT NAME: CMP-11

SIGNAL	SOURCE OBJECT	REMARKS
1M	LC-11-1M	LC-11 COMP. ON STATUS
1OL	LC-11-1OL	CMP-11 COMP. MOTOR OVERLOAD SD STATUS
1SS	LC-11-1SS	CMP-11 IN REMOTE MODE STATUS
1TR	LC-11-1TR	CMP-11 ANTI-RESTART TIMER STATUS
2OL	LC-11-2OL	CMP-11 OIL PUMP MOTOR OVERLOAD SD STATUS
2PB	LC-11-2PB	LC-11 LOCAL STOP STATUS
CMG-STATUS	CMG	CMG READY FOR CMP-11 TO OPERATE
DPALL-10127	LC-11-DPALL-10127	CMP-11 LOW BEARING OIL DP SD STATUS
DPI-10101	DPT-10101	CMP-11 FILTER 10101 DP
DPI-10104	DPT-10104	CMP-11 BULK OIL FILTER DP
DPI-10123	DPT-10123	CMP-11 FILTER 10124 DP
DPI-10126	DPT-10126	CMP-11 FILTER 10126 DP
FI-10151	FT-10151	CMP-11 OIL COOLER H2O FLOW
FI-10155	FT-10155	CMP-11 AFTERCOOLER H2O FLOW
JI-10102	JT-10102	CMP-11 COMP. MOTOR POWER
JI-10125	JT-10125	CMP-11 OIL PUMP POWER
LI-10121	LT-10121	CMP-11 BULK OIL LEVEL
LI-10130	LT-10130	CMP-11 AFTERCOOLER OIL TANK LEVEL
LV-10121-A-RQS	CMG	OPEN LV-10121-A COMMAND
LV-10121-B-RQS	CMG	OPEN LV-10121-B COMMAND
PAHH-10103	LC-11-PAHH-10103	CMP-11 HI DISCHARGE PRESSURE SD STATUS
PALL-10101	LC-11-PALL-10101	CMP-11 LOW SUCTION PRESSURE SD STATUS
PI-10101	PT-10101	CMP-11 COMP. SUCTION PRESSURE
PI-10103	PT-10103	CMP-11 COMP. DISCHARGE PRESSURE
PI-10123	PT-10123	CMP-11 OIL COOLER OIL OUTLET PRESSURE
PI-10126	PT-10126	CMP-11 OIL PUMP DISCHARGE PRESSURE
PI-10127	PT-10127	CMP-11 COMP. BEARING OIL PRESSURE
PI-10151	PT-10151	CMP-11 OIL COOLER H2O INLET PRESSURE
PI-10152	PT-10152	CMP-11 OIL COOLER H2O INLET PRESSURE
PI-10155	PT-10155	CMP-11 AFTERCOOLER H2O INLET PRESSURE
PI-10156	PT-10156	CMP-11 AFTERCOOLER H2O OUTLET PRESSURE
START-101-RQS	CMG	CMP-11 REQUEST TO START BY CMG
STOP-101-RQS	CMG	CMP-11 REQUEST TO STOP BY CMG
TAHH-10103	LC-11-TAHH-10103	CMP-11 HI DISCHARGE TEMP. SD STATUS
TAHH-10127	LC-11-TAHH-10127	CMP-11 HI BEARING OIL TEMP. SD STATUS
TI-10101	TT-10101	CMP-11 COMP. SUCTION TEMPERATURE
TI-10102-A	TT-10102-A	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TI-10102-B	TT-10102-B	CMP-11 COMP. MOTOR BEARING TEMPERATURE
TI-10102-C	TT-10102-C	CMP-11 COMP. MOTOR WINDING TEMPERATURE
TI-10102-D	TT-10102-D	CMP-11 COMP. MOTOR WINDING TEMPERATURE
TI-10102-E	TT-10102-E	CMP-11 COMP. MOTOR WINDING TEMPERATURE
TI-10102-F	TT-10102-F	CMP-11 COMP. MOTOR WINDING TEMPERATURE
TI-10102-G	TT-10102-G	CMP-11 COMP. MOTOR WINDING TEMPERATURE
TI-10102-H	TT-10102-H	CMP-11 COMP. MOTOR WINDING TEMPERATURE
TI-10103	TT-10103	CMP-11 COMP. DISCHARGE TEMPERATURE
TI-10105	TT-10105	CMP-11 AFTERCOOLER TEMPERATURE
TI-10121	TT-10121	CMP-11 BULK OIL SEP. OIL TEMPERATURE
TI-10122	TT-10122	CMP-11 BULK OIL SEP. HEATER TEMPERATURE
TI-10123	TT-10123	CMP-11 OIL COOLER OIL OUTLET TEMPERATURE

TABLE 4

N25 OBJECT INTERFACE BY DESTINATION

DESTINATION OBJECT NAME: CMP-11

SIGNAL	SOURCE OBJECT	REMARKS
TI-10127	TT-10127	CMP-11 COMP. BEARING OIL TEMPERATURE
TI-10150	TT-10150	CMP-11 COOLING H2O INLET TEMPERATURE
TI-10152	TT-10152	CMP-11 OIL COOLER H2O OUTLET TEMPERATURE
TI-10156	TT-10156	CMP-11 AFTERCOOLER H2O OUTLET TEMP.
VI-10102	VT-10102	CMP-11 COMP. VIBRATION
ZI-10102	ZT-10102	CMP-11 SLIDE VALVE POSITION
ZI-10103	ZT-10103	CMP-11 TCV-10103 POSITION INDICATION
ZSH-10121-A	ZSH-10121-A	LV-10130-A IS OPEN
ZSH-10121-B	ZSH-10121-B	LV-10130-B IS OPEN
ZSH-10130	ZSH-10130	LV-10130 IS OPEN
ZSH-10151	ZSH-10151	FV-10151 IS OPEN
ZSH-10152	ZSH-10152	FV-10152 IS OPEN
ZSH-10155	ZSH-10155	FV-10155 IS OPEN
ZSH-10156	ZSH-10156	FV-10156 IS OPEN
ZSL-10121-A	ZSL-10121-A	LV-10130-A IS CLOSED
ZSL-10121-B	ZSL-10121-B	LV-10130-B IS CLOSED
ZSL-10130	ZSL-10130	LV-10130 IS CLOSED
ZSL-10151	ZSL-10151	FV-10151 IS CLOSED
ZSL-10152	ZSL-10152	FV-10152 IS CLOSED
ZSL-10155	ZSL-10155	FV-10155 IS CLOSED
ZSL-10155	ZSL-10156	FV-10156 IS CLOSED

TABLE 5

N25 SITE TRUTH TABLE

TRUTH TABLE FOR OBJECT: CMP-11

SUB_OBJECT	ON	READY	OFF	LOCAL	SAFE
CMG-STATUS	ON	ON	-	-	-
FV-10151	OPEN	OPEN	-	-	OPEN
FV-10152	OPEN	OPEN	-	-	OPEN
FV-10155	OPEN	OPEN	-	-	OPEN
FV-10156	OPEN	OPEN	-	-	OPEN
LC-11-1M	L-TRUE	L-FALSE	L-FALSE	-	L-FALSE
LC-11-1OL	L-TRUE	L-TRUE	-	-	-
LC-11-1SS	L-FALSE	L-FALSE	L-FALSE	L-TRUE	-
LC-11-1TR	L-TRUE	L-TRUE	-	-	L-FALSE
LC-11-2M	L-TRUE	L-FALSE	L-FALSE	-	L-FALSE
LC-11-2OL	L-TRUE	L-TRUE	-	-	-
LC-11-2PB	L-TRUE	L-TRUE	-	-	L-FALSE
LC-11-DPALL-10127	L-TRUE	DISABLE	DISABLE	-	L-FALSE
LC-11-PAHH-10103	L-TRUE	L-TRUE	-	-	L-FALSE
LC-11-PALL-10101	L-TRUE	L-TRUE	-	-	L-FALSE
LC-11-POWER	L-TRUE	L-TRUE	L-TRUE	L-TRUE	L-FALSE
LC-11-TAHH-10103	L-TRUE	L-TRUE	-	-	L-FALSE
LC-11-TAHH-10127	L-TRUE	L-TRUE	-	-	L-FALSE
LOAD-101-CMD	ENABLE	DISABLE	DISABLE	DISABLE	DISABLE
LV-10121-A	LC-10121	LC-10121	-	-	CLOSE
LV-10121-B	LC-10121	LC-10121	-	-	CLOSE
LV-10130	LC-10130	LC-10130	-	-	CLOSE
RESET-101-CMD	DISABLE	DISABLE	ENABLE	DISABLE	DISABLE
RS-101-01	DISABLE	DISABLE	ENABLE	DISABLE	DISABLE
START-101-CMD	ENABLE	ENABLE	DISABLE	DISABLE	DISABLE
STOP-101-CMD	ENABLE	ENABLE	DISABLE	DISABLE	DISABLE
TIC-10103	AUTO	AUTO	-	AUTO	MANUAL
TY-10103	TIC-10103	TIC-10103	TIC-10103	TIC-10103	CLOSE
UNLOAD-101-CMD	ENABLE	DISABLE	DISABLE	DISABLE	DISABLE
ZI-10103	-	-	-	-	SCALE <0
ZSH-10121-A	-	-	-	-	L-FALSE
ZSH-10121-B	-	-	-	-	L-FALSE
ZSH-10130	-	-	-	-	L-FALSE
ZSH-10151	L-TRUE	L-TRUE	-	-	L-FALSE
ZSH-10152	L-TRUE	L-TRUE	-	-	L-FALSE
ZSH-10155	L-TRUE	L-TRUE	-	-	L-FALSE
ZSH-10156	L-TRUE	L-TRUE	-	-	L-FALSE
ZSL-10121-A	-	-	-	-	L-FALSE
ZSL-10121-B	-	-	-	-	L-FALSE
ZSL-10151	L-FALSE	L-FALSE	-	-	L-FALSE
ZSL-10152	L-FALSE	L-FALSE	-	-	L-FALSE
ZSL-10155	L-FALSE	L-FALSE	-	-	L-FALSE
ZSL-10156	L-FALSE	L-FALSE	-	-	L-FALSE
ZSSL-10130	-	-	-	-	L-FALSE

TABLE 6

N25 CAUSE AND EFFECT TABLE
OBJECT CMP-11

FUNCTION	TYPE	CAUSE OBJECT	CAUSE TAG	CAUSE STATE	CAUSE DELAY	EFFECT OBJECT	EFFECT TAG	EFFECT STATE	REMARKS
SD-101-01	I	CMP-11	TAHH-10103-R	FALSE		CMP-11	ON-OFF-RQS	TRUE	COMPUTER HI COMP. DISCHARGE TEMP. SD
TA-10103	I	CMP-11	TAHH-10103-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
TA-10103	I	CMP-11	TI-10103	>105°C		CMP-11	TAHH-10103-R	FALSE	TI-10103 SHUTDOWN SETPOINT
SD-101-02	I	CMP-11	DPALL-10127-R	FALSE	6 sec	CMP-11	ON-OFF-RQS	TRUE	COMPUTER LO COMP. BEARING OIL DP SD
DPA-10127	I	CMP-11	DPALL-10127-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
DPA-10127	I	CMP-11	DPI-10127	<3.0 bar		CMP-11	DPALL-10127-R	TRUE	DPI-10127 SHUTDOWN SETPOINT
SD-101-03	I	CMP-11	TAHH-10102W-R	FALSE		CMP-11	ON-OFF-RQS	TRUE	COMPUTER HI COMP. MOTOR TEMP. SD
TA-10102W	I	CMP-11	TAHH-10102W-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
TA-10102W	I	CMP-11	TI-10102C	>165°C		CMP-11	TAHH-10102W-R	FALSE	TI-10102C SHUTDOWN SETPOINT
TA-10102W	I	CMP-11	TI-10102D	>165°C		CMP-11	TAHH-10102W-R	FALSE	TI-10102D SHUTDOWN SETPOINT
TA-10102W	I	CMP-11	TI-10102E	>165°C		CMP-11	TAHH-10102W-R	FALSE	TI-10102E SHUTDOWN SETPOINT
TA-10102W	I	CMP-11	TI-10102F	>165°C		CMP-11	TAHH-10102W-R	FALSE	TI-10102F SHUTDOWN SETPOINT
TA-10102W	I	CMP-11	TI-10102G	>165°C		CMP-11	TAHH-10102W-R	FALSE	TI-10102G SHUTDOWN SETPOINT
TA-10102W	I	CMP-11	TI-10102H	>165°C		CMP-11	TAHH-10102W-R	FALSE	TI-10102H SHUTDOWN SETPOINT
SD-101-06	I	CMP-11	TAHH-10102B-R	FALSE		CMP-11	ON-OFF-RQS	FALSE	COMPUTER HI BEARING TEMP. SD
TA-10102B	I	CMP-11	TAHH-10102B-R	FALSE		CMP-11	ANNUNICATE	TRUE	VISUAL DISPLAY
TA-10102B	I	CMP-11	TI-10102A	>60°C		CMP-11	TAHH-10102B-R	FALSE	TI-10102A SHUTDOWN SETPOINT
TA-10102B	I	CMP-11	TI-10102B	>60°C		CMP-11	TAHH-10102B-R	FALSE	TI-10102B SHUTDOWN SETPOINT
SD-101-04	I	CMP-11	LALL-10121-R	FALSE		CMP-11	ON-OFF-RQS	TRUE	COMPUTER LO BULK OIL SEPERATOR LEVEL SD
LA-10121	I	CMP-11	LALL-10121-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
LA-10121	I	CMP-11	LI-10121	<300 mm		CMP-11	LALL-10121	FALSE	LI-10121 SHUTDOWN SETPOINT
LC-10130	I	CMP-11	LI-10130	0 - 400 mm		CMP-11			SEE FIGURE 5
TIC-10103						CMP-11			SEE FIGURE 7
LA-10130	I	CMP-11	LI-10130	<50 mm		CMP-11	LAL-10130-R	FALSE	CMP-11 AFTERCOOLER OIL LEVEL LO SETPOINT
LA-10130	I	CMP-11	LI-10130	>300 mm		CMP-11	LAH-10130-R	FALSE	CMP-11 AFTERCOOLER OIL LEVEL HI SETPOINT
LA-10130	I	CMP-11	LAL-10130-R	FALSE		CMP-11			SEE FIGURE 5
LA-10130	I	CMP-11	LAH-10130-R	FLASE		CMP-11			SEE FIGURE 5

TABLE 6

N25 CAUSE AND EFFECT TABLE
OBJECT CMP-11

FUNCTION	TYPE	CAUSE OBJECT	CAUSE TAG	CAUSE STATE	CAUSE DELAY	EFFECT OBJECT	EFFECT TAG	EFFECT STATE	REMARKS
SD-101-05	I	CMP-11	VAHH-10102-R	FALSE		CMP-11	ON-OFF-RQS	TRUE	COMPUTER HI COMP. VIBRATION SD
VA-10102	I	CMP-11	VAHH-10102-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
VA-10102	I	CMP-11	VI-10102	<???		CMP-11	VAHH-10102-R	FALSE	VA-10102 SHUTDOWN SETPOINT
PA-10101	I	CMP-11	PI-10101	>2 bar		CMP-11	PAM-10101-R	TRUE	PI-10101 MIN. PRESS. REQ'D FOR STARTUP
TA-10121	I	CMP-11	TI-10121	>30°C		CMP-11	TAH-10121	TRUE	TI-10121 MIN. TEMP. REQ'D FOR STARTUP
FA-10151	I	CMP-11	FI-10151	<7 L/s		CMP-11	FAL-10151-R	FALSE	FI-10151 ALARM SETPOINT
FA-10151	I	CMP-11	FAL-10151-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
FA-10155	I	CMP-11	FI-10155	<0.75 L/s		CMP-11	FAL-10155-R	FALSE	FI-10155 ALARM SETPOINT
FA-10155	I	CMP-11	FAL-10155-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISULA DISPLAY
SD-101-20	I	LC-11	PALL-10101	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL COMP. SUCTION SD
SD-101-20	I	LC-11	PALL-10101	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-21	I	LC-11	PAHH-10103	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL COMP. HI DISCHARGE PRESS. SD
SD-101-21	I	LC-11	PAHH-10103	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-22	I	LC-11	TAHH-10103	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL COMP. HI DISCHARGE TEMP. SD
SD-101-22	I	LC-11	TAHH-10103	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-23	I	LC-11	DPALL-10127	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL LO COMP. BEARING OIL DP SD
SD-101-23	I	LC-11	DPALL-10127	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-24	I	LC-11	TAHH-10127	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL HI BEARING OUL TEMP SD
SD-101-24	I	LC-11	TAHH-10127	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-25	I	LC-11	1OL	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL COMP. MOTOR OVERLOAD SD
SD-101-25	I	LC-11	1OL	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-26	I	LC-11	2OL	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL OIL PUMP MOTOR OVERLOAD SD
SD-101-26	I	LC-11	2OL	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-27	I	LC-11	2PB	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL STOP SWITCH
SD-101-27	I	LC-11	2PB	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
SD-101-28	I	LC-11	1M	L-FALSE		CMP-11	ON-OFF-RQS	TRUE	LOCAL COMP. MOTOR STARTER AUX CONTACT
SD-101-28	I	LC-11	1M	L-FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY

TABLE 6

N25 CAUSE AND EFFECT TABLE
OBJECT CMP-11

FUNCTION	TYPE	CAUSE OBJECT	CAUSE TAG	CAUSE STATE	CAUSE DELAY	EFFECT OBJECT	EFFECT TAG	EFFECT STATE	REMARKS
FU-101-01	CM	CMP-11	MMI-101-01	TRUE		CMP-11	RDY-ON-RQS	TRUE	COMPUTER OPERATOR STARTUP FROM CMP-11
FU-101-02	CM	CMG	START-101-RQS	TRUE		CMP-11	RDY-ON-RQS	TRUE	STARTUP FROM CMG
FU-101-03	CM	CMP-11	MMI-101-02	TRUE		CMP-11	ON-OFF-RQS	TRUE	COMPUTER OPERATOR SHUTDOWN FROM CMP-11
FU-101-04	CM	CMG	STOP-101-RQS	TRUE		CMP-11	ON-OFF-RQS	TRUE	SHUTDOWN FROM CMG
FU-101-05	CM	LC-11	1SS	L-TRUE		CMP-11	RMT-LCL-RQS	TRUE	SWITCH TO LOCAL CONTROL
FU-101-06	CM	LC-11	1SS	L-FALSE		CMP-11	LCL-RMT-RQS	TRUE	SWITCH TO REMOTE CONTROL
FU-101-09	CM	CMP-11	MMI-101-05	TRUE		CMP-11	RESET-101	TRUE	COMPUTER OPERATOR RESET
RS-101-01	CM	CMP-11	RESET-101	TRUE		LC-11	RESET-101-CMD	TRUE	COMPUTER RESET OF LOCAL SD
RS-101-01	CM	CMP-11	RESET-101	TRUE	2 sec.	CMP-11	ON-OFF-RQS	FALSE	RESET ON_OFF_CMD TO FALSE
RS-101-01	CM	CMP-11	RESET-101	TRUE		CMP-11	TAHH-10103-R	TRUE	RESET COMPUTER TAHH-10103 SD FUNCTION
RS-101-01	CM	CMP-11	RESET-101	TRUE		CMP-11	DPALL-10127-R	TRUE	RESET COMPUTER DPALL-10127 SD FUNCTION
RS-101-01	CM	CMP-11	RESET-101	TRUE		CMP-11	TAHH-10102-R	TRUE	RESET COMPUTER TAHH-10102 SD FUNCTION
RS-101-01	CM	CMP-11	RESET-101	TRUE		CMP-11	LALL-10121-R	TRUE	RESET COMPUTER LALL-10121 SD FUNCTION
RS-101-01	CM	CMP-11	RESET-101	TRUE		CMP-11	VAHH-10102-R	TRUE	RESET COMPUTER VAHH-10102 SD FUNCTION
RS-101-01	CM	CMP-11	RESET-101	TRUE		CMP-11	DPA-10127	DISABLE	DISABLE LO OIL DP ALARM/SHUTDOWN
FU-101-07	CM	CMP-11	MMI-101-03	TRUE		LC-11	LOAD-101-CMD	TRUE	COMPUTER LOAD COMP. COMMAND
FU-101-08	CM	CMP-11	MMI-101-04	TRUE		LC-11	UNLOAD-101-CMD	TRUE	COMPUTER UNLOAD COMP. COMMAND
TR-10130	CM	CMP-11	1M	L-TRUE		CMP-11	CLOCK-10130	START	START CLOCK 10130
TR-10130	CM	CMP-11	1M	L-FALSE		CMP-11	CLOCK-10130	STOP	STOP CLOCK 10130
TR-10102	CM	CMP-11	1M	L-TRUE		CMP-11	CLOCK-10102	START	START CLOCK 10102
TR-10102	CM	CMP-11	1M	L-FALSE		CMP-11	CLOCK-10102	STOP	STOP CLOCK 10102
RS-101-02	CM	CMP-11	RS-CLOCK-10130	TRUE		CMP-11	CLOCK-10103	RESET	RESET CLOCK 10130
DPA-10123	I	CMP-11	DPI-10123	>2.0 bar		CMP-11	DPAH-10123-R	FALSE	DPI-10123 HI SETPOINT
DPA-10123	I	CMP-11	DPAH-10123-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
DPA-10126	I	CMP-11	DPI-10126	>2.0 bar		CMP-11	DPAH-10126-R	FALSE	DPI-10126 HI SETPOINT
DPA-10126	I	CMP-11	DPAH-10126-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
DPA-10101	I	CMP-11	DPI-10101	>0.25 bar		CMP-11	DPAH-10101-R	FALSE	DPI-10101 HI SETPOINT

TABLE 6

N25 CAUSE AND EFFECT TABLE
OBJECT CMP-11

FUNCTION	TYPE	CAUSE OBJECT	CAUSE TAG	CAUSE STATE	CAUSE DELAY	EFFECT OBJECT	EFFECT TAG	EFFECT STATE	REMARKS
DPA-10101	I	CMP-11	DPAH-10101-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
DPA-10104	I	CMP-11	DPI-10104	>0.5 bar		CMP-11	DPAH-10104-R	FALSE	DPI-10104 HI SETPOINT
DPA-10104	I	CMP-11	DPAH-10104-R	FALSE		CMP-11	ANNUNCIATE	TRUE	VISUAL DISPLAY
ON-OFF-TRAN	SFC	CMP-11	ON-OFF-RQS	TRUE		CMP-11			SEE FIGURE 7
RDY-ON-TRAN	SFC	CMP-11	RDY-ON-RQS	TRUE		CMP-11			SEE FIGURE 6
RMT-LCL-TRAN	SFC	CMP-11	RMT-LCL-RQS	TRUE		CMP-11			SEE FIGURE 10
LCL-RMT-TRAN	SFC	CMP-11	LCL-RMT-RQS	TRUE		CMP-11			SEE FIGURE 11
OFF-RDY-TRAN	SFC	CMP-11				CMP-11			SEE FIGURE 8
RDY-OFF-TRAN	SFC	CMP-11				CMP-11			SEE FIGURE 9
OFF-SAFE-TRAN	SFC	CMP-11				CMP-11			SEE FIGURE 12
SAFE-OFF-TRAN	SFC	CMP-11				CMP-11			SEE FIGURE 13

TABLE 7

PID LOOP LIST

PID LOOPS FOR SOURCE OBJECT: CMP-11

LOOP TAG	CONTROLLED VARIABLE	PROCESS VARIABLE	SETPOINT	MINIMUM SETPOINT	MAXIMUM SETPOINT	SAMPLE TIME	DEADBAND	REVERSE ACTING	ENERGIZE TO CLOSE	TYPE	REMARKS
TIC-10103	TY-10103	TI-10103	92°C	87°C	97°C	1 sec	1°C	N	Y	PI	CMP-11 COMP. TEMPERATURE REGULATION

APPENDIX 1

Naming Conventions for CMP-11 Example

Equipment tag numbers

The tag numbers follow the ISA S5.1 identification system. The first three digits of the loop number follow the naming convention defined in the SRS Technical Specification appendix B (e.g., **101** for CMP-11). The last two digits are selected according to the following rules:

- One number per process point (e.g., **TI-10101** and **PI-10101** for suction temperature and suction pressure, respectively)
- The numbering sequence follows the process stream.
- The stream priorities are as follows: first, the helium stream; second, the oil stream; third, the water stream. A block of numbers is reserved between streams for additions.

I/O signal names:

All output signals from the SRC to the SRS have the extension CMD (command). All command signals within SRC have the extension RQS (request).

Analog input (AI)

The AI signal name is the same as the indication tag number (e.g., **TI-10101** is the signal name for suction temperature). The AI signal source name is the signal transmitter tag number (e.g., **TT-10101** for TI-10101).

Analog output (AO)

The AO signal name is the I/P transmitter tag number followed by the CMD extension (e.g., **TY-10103-CMD**). The AO signal destination name is the I/P transmitter tag number (e.g., **TY-10103** for TY-10103-CMD).

Discrete input (DI)

The DI signal name for limit switches is named with the limit switch tag number (e.g., **ZSH-10130**). The DI signal source name for limit switches is the limit switch tag number (e.g., **ZSH-10130**).

DI signals for other devices are named with the tag number of the corresponding electrical elementary (e.g., **1PB**), and the DI source name is the device name.

Discrete output (DO)

The DO signal name for ON/OFF valves is the valve tag number with the CMD extension (e.g., **LV-10130-CMD**). The DO signal destionation name for ON/OFF valves is the valve tag number (e.g., **LV-10130**).

DO signals for other devices are named with a functional description and the CMD extension (e.g., **START-101-CMD**), and the DO signal destination name is the device name.

General naming convention for computer tags

Software alarms setpoints are specified in the cause and effect table, and the function name for each alarm block is TA followed by the loop number (e.g., **TA-10101**).

Shutdown functions are named with SD followed by a number (e.g., **SD-101-01** is shutdown function number 01 of object 101).

Reset functions are named with RS followed by a number (e.g., **RS-101-01** is reset function number 01 of object 101).

Miscellanous functions are named with FU followed by a number (e.g., **FU-101-01** is miscellanous function number 01 of object 101)

The name for computer operator interface tags such as CRT push-buttons is MMI (man-machine-interface) followed by a number (e.g., **MMI-101-01** is operator interface tag 01 of object 101)

The name for transitions is "INITIAL STATE-FINAL STATE-TRAN" (e.g., **RDY-ON -TRAN**)

The name for transition trigger commands is "INITIAL STATE-FINAL STATE-RQS" (e.g., **RDY-ON-RQS**)

L-TRUE means logic-true (a 24 V dc signal)

L-FALSE means logic-false (a 0 V dc signal)

Alarm tags are TRUE when conditions are normal, and FALSE when conditions are not normal (e.g., **TAH-10101 = FALSE** means TI-10101 has a high alarm condition)

E means ENABLED

D means DISABLED