TECHNICAL SPECIFICATION

CONTROL SYSTEM AND INSTRUMENT PROTECTIVE FUNCTIONS FOR FIRED EQUIPMENT - System for an automatically started, gas fired, natural draught, multi-burner furnace, safeguarded by pilot burners (S 24.033)

DEP 32.24.20.33-Gen.

December 1998

DESIGN AND ENGINEERING PRACTICE

PREFACE

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The Hague, The Netherlands,

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TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and gives recommendations for control systems and instrumented protective functions for an **automatically started, gas fired, natural draught, multi-burner furnace, safeguarded by pilot burners.** This DEP shall not be used for any other equipment or firing configuration.

This DEP contains a control and IPF narrative and logic diagrams and refers to a standard specific process engineering flow scheme.

This DEP shall be used together with Standard Drawing S 24.033.

This DEP is written for systems which use DCSs for control and monitoring and PLC or Solid State / magnetic core type Instrumented Protective Functions. Accordingly, more use has been made of inverted signals than would have been the case for relay type IPFs.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP and SIEP, the distribution of this DEP is confined to companies forming part of or managed by the Royal Dutch/Shell Group, and to Contractors nominated by them (i.e. the distribution code is "C", as defined in DEP 00.00.05.05-Gen.).

This DEP is intended for use in oil refineries, chemical plants, gas plants, onshore and offshore exploration and production facilities, and supply/marketing installations.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS AND ABBREVIATIONS

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Principal** is the party which initiates, and ultimately pays for, the project. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant, authorised to act for the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Furnace	Includes both furnaces and boilers
Instrumented protective function (IPF)	A function comprising the Initiator function, Logic Solver function and Final Element function for the purpose of preventing or mitigating Hazardous Situations.

NOTE: The term "safeguarding" is not widely used in this DEP because safeguarding relates not only to instrumented protective functions but also to protective equipment of a mechanical nature such as non-return valves, relief valves and bursting disks.

1.3.3 Abbreviations

ARWU	Anti reset wind-up
DCS	Distributed control system
IPF	Instrumented protective function
PEFS	Process engineering flow scheme
PLC	Programmable logic controller
SRF	Standard refinery fuel
TSOV	Tight shut off valve

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (5).

2. GENERAL

This DEP shall be used as the basis for the control systems, IPFs, narratives, functional logics diagrams and PEFS for the installation for which it has been specified by the Principal.

The Contractor shall prepare installation-specific narratives based on this DEP, and shall add relevant tag numbers, set points, controller configurations, etc. The installation-specific narratives shall not contain general information which is not relevant to the specific installation.

Similar to this DEP, the narrative shall contain a functional description including operational aspects and a detailed technical description.

3. FUNCTIONAL (OPERATIONAL) DESCRIPTION

3.1 LOAD CONTROL

The output of the furnace outlet temperature controller is cascaded to the main fuel gas pressure controller.

Minimum burner load is ensured by a minimum stop pressure controller, which guarantees a minimum burner load, independent of the number of burners in operation.

In addition to the minimum stop fuel pressure controller, the fuel gas control valve is provided with a mechanical minimum stop.

The stop is adjusted to correspond with minimum load with only one burner in operation, and act as a pre-set valve position for start-up of the first burner.

3.2 START-UP

The system is equipped with a ''purge'' timer, which allows start-up of the pilot burners only after a certain time (typically 5 minutes) has elapsed.

This waiting time does not guarantee that no explosive mixture is present. The waiting time can be used by the operator, to carry out a gas test.

If, on any main burner or any common header a TSOV closing failure is detected, no burner can be started before the closing failure is corrected.

After the purge time has elapsed and other conditions are healthy, pilot burners can be started by activating the pilot burner start buttons.

The main burner can be operated any time, as long as the pilot burner is in operation, and provided other trip conditions are healthy.

Starting and stopping of the main burner can be done by activating the individual main burner start/stop buttons, or via a logic system, e.g. via signals from a sequence controller in regeneration gas systems.

Prior to start-up of the first burner, the fuel gas main - and burner TSOVs are closed, the fuel gas vent TSOV is open, and the fuel flow controller as well as the master TRC are automatically set to "manual" with zero output. The minimum stop pressure controller will sense the fuel supply pressure, and drive the fuel control valve to the mechanical minimum stop setting (set for minimum load of one burner).

Upon starting the first main burner, the header TSOV and burner TSOV open simultaneously and the vent valve closes. As the control valve is on its mechanical minimum stop, fuel flow to the first burner will be at minimum burner load.

Upon stopping the last main burner, the header TSOVs and the burner TSOV close, and the vent TSOV is opened.

NOTE: The vent TSOV only acts as a bleed, i.e. it only releases the pressure when header and burner TSOVs are closed.

In order to prevent serious uneven firing, the furnace can only be released from minimum firing if more than N/2 burners are in operation, where N is the total number of burners.

4. TECHNICAL DESCRIPTION

4.1 IMPLEMENTATION CONSIDERATIONS

The minimum fuel gas pressure controller (PIC-1) shall be locked in auto mode. The operator may be given limited control over the setpoint of the minimum pressure controllers (PIC-1) up to 2 times the minimum pressure. The latter flexibility is sometimes useful to prevent flame loss due to too low a pressure when manipulating burners.

The minimum pressure controllers (PIC-1) shall be fast-acting (similar to compressor anti-surge controllers).

If the normal fuel gas pressure controller PIC-2 is forced to manual with 0% output (minimum stop) the operator shall not be able to change mode or output.

For furnaces with 3 or more burners equal percentage valves shall be used so that the performance of the (minimum stop) pressure controller is independent on the number of burners in operation.

The interfacing between the instrumented protective system and the DCS shall be hard-wired for those connections which are safety related (no serial link). This applies for example to the force to minimum stop. Although the latter is classified as IPF class II, a delay (related to the serial link) may finally result in another trip initiator to initiate a total furnace trip.

The Anti Reset Wind-Up (ARWU) to the fuel PICs is present to ensure bumpless transfer when one controller overrides another.

ARWU protection shall also be implemented on the master temperature controller TRC-1.

4.2 LOCATIONS OF ALARMS, SWITCHES ETC.

The system is designed such that remote starting and stopping of burners is possible. I.e. all pilot and main burner start/stop switches are located in a DCS panel in the main control room.

The above philosophy is reflected in Standard Drawing S 24.033.

If specified by the Principal the fuel gas start/stop buttons shall be located on the local panel (reasons for this may be to standardize with other furnaces or to comply with local regulations). In this case status indications shall be installed on the local panel as well as in the DCS.

4.3 DESCRIPTION OF INSTRUMENTED PROTECTIVE FUNCTIONS

The IPFs are described by the functional logic diagrams (Appendix 1) and by the IPF narrative given below.

The functional logic diagrams are set up in a modular structure. This section follows the same structure but only describes the main modules. Assisting modules such as the "general trips" module are not described separately. Their functionality is described in the modules where they are relevant.

4.3.1 Safe atmosphere module

The function of this module is to continuously check for, and if necessary re-establish by purging, a safe atmosphere for firing the furnace.

If:
- i. no flame is detected (start condition only); and
- ii. the fuel gas header TSOVs, the pilot header TSOV and the individual main burner TSOVs are closed; and
- iii. burner TSOV testing is not in progress; and
- iv. the local and panel trip switches are in the healthy position; and
- v. the level in the fuel gas KO drum is not high; and

vi. the “no purge required signal” from the pilot header module is healthy;

vii. the PZA-LL is indicating <LL; and

viii. the "safe conditions" signal is not present; then

the purge timer starts automatically.

If there were no interruptions to the above conditions and after the timer has run out, a “safe conditions” indication is given.

The “safe conditions” signal remains healthy as long as conditions iv to vi remain healthy.

4.3.2 Minimum stop module

The purpose of this module is to control the set and release of the fuel minimum stops.

If: i. the "not minimum firing" signal from the process is present (where applicable) and

ii more than N/2 burners are in operation (in which N is the total number of installed burners); and

iii. the fuel gas pressure is not above "high-high"; and

iv. the module is not set to minimum by the sequence controller (optional); then

the main fuel gas pressure controller (PIC-1) can be taken into operation by activating the gas minimum firing reset in the control room, or, via an external signal from e.g. a sequence controller.

If, 30 seconds after a trip to minimum firing, the fuel gas pressure is not below twice the set pressure of the minimum stop, the module produces a "failure trip to minimum firing" signal to the fuel gas header module.

An alternative to the reset button is that the “force to manual”, zero output remains on until conditions (i) through (iv) are healthy.

4.3.3 Pilot header module

The function of this module is to monitor all the conditions required to open and close the pilot header TSOV and to control this valve.

If: i. the safe atmosphere module produces the "safe conditions" signal; and

ii. pilot gas pressure is above LL (to be healthy within 10 seconds after opening of the TSOV); and

iii. at least one of the pilot burner modules produce a “open pilot burner header” signal; then

the pilot header TSOV will remain open.

Upon closing the pilot header TSOV, the “no purge required” signal disappears for a short period.

If the header TSOV proximity switch (GBSA-04) does not indicate the valve being closed within 15 seconds after initiating the valve to close, a “TSOV not closed” alarm is given.

4.3.4 Fuel gas header and vent module

The function of this module is to monitor all the conditions required to open and close the fuel gas header and vent TSOVs and to control these valves.

There are two parallel TSOVs to facilitate tightness testing during operation. By means of a selector switch either gas header A or gas header B can be selected to be in operation.

If: i. the safe atmosphere module produces the "safe conditions" signal; and

ii. other process conditions (process trips) are healthy; and

iii. the stop gas firing switch is not activated; and

iv. the fuel gas pressure is not below LL, or the burner TSOVs are closed; and

v. the "(NOT) failure to minimum stop" signal is healthy; and

vi. the fuel gas control valve is in the start position or any burner TSOV is open; then

the gas header module produces a "healthy for gas firing" signal for the gas burner modules.

If the gas header module receives at least one "open gas header" signal from the gas burner modules the pre-selected gas header is automatically opened and the vent TSOV is automatically closed.

If one of the above conditions fails to exist the gas header TSOV closes, the vent TSOV opens and the "healthy for gas firing" signal disappears. If all "open gas header" signals from the gas burner modules disappear the gas header TSOV closes also.

If the vent TSOV proximity switch (GBSA-09) does not indicate the valve being closed within 15 seconds after initiating the valve to close, an alarm is given.

If the header TSOV proximity switch (GBSA-02/03) does not indicate the valve being closed within 15 seconds after initiating the valve to close, an alarm is given.

If, after all main gas burners are stopped, the control valve is not in its start position within 15 seconds, a "control valve not in start position" alarm is given.

4.3.5 Pilot burner modules

Each pilot burner is equipped with its own pilot burner module.

The function of these modules is to monitor all the conditions required to fire the individual pilots and to control the pilots.

If: i. the module receives a ‘safe conditions’ signal; and

ii. the pilot burner stop button is not activated; then

the pilot can be started by activating the pilot start button.

The module than produces the following signals:

a. open pilot header

b. open pilot TSOV

c. ignition spark signal for a period of 10 seconds.

After the flame stabilisation timer has run out (after 15 seconds) the pilot flame shall be detected by the ionisation rod, and a "pilot flame present" signal is sent to the respective main burner module.

If the pilot start trial was unsuccessful, restart is inhibited for a period dictated by the pilot restart inhibit timer (about 30 seconds).

4.3.6 Gas burner modules

Each burner is equipped with its own gas burner module.

The function of these modules is to monitor all the conditions required to open and close the gas burner TSOVs and to control their actions.

If: i. the gas burner module receives a "healthy for gas firing" signal; and

ii. the gas burner stop button is not activated; and

iii. the module receives a "pilot on" signal; then

the gas burner can be started by activating the main burner start signal. The gas burner module produces the following signals:

a. Open gas burner TSOV.

b. "Open gas header" signal to the fuel gas header module.

If: i. the "healthy for gas firing" signal remains present; and

ii. the gas burner stop button is not activated (or no external stop signal is produced); and

iii. the “pilot flame present” signal remains healthy; then

the module produces a "gas flame on" signal.

If one of the above conditions fails to exist the gas burner TSOV is closed and the "open gas header" signal disappears. If no other gas burner modules produce an "open gas header" signal the gas header TSOV is closed and the vent TSOV opened.

If the gas burner TSOV proximity switch (GBSA-14-N4) does not indicate the valve being closed within 15 seconds after initiating the valve to close, an alarm is given.

4.3.7 Burner TSOV tightness test module

To be able to test the tightness of the individual burner gas TSOVs during shutdown or when firing only oil, the gas header TSOV can be opened for a short period by pressing HS-9.

Pressing this button will only result in opening of the header TSOV if:

i. All gas burner TSOVs are confirmed closed; and

ii. Neither the "purge ready" signal, nor the "purge in progress" signal is present.

If these conditions are valid and HS-9 is activated, the header TSOV is opened for about 5 seconds. The vent is closed at the same time and kept closed during the test. During the whole testing period starting is interlocked via the "inhibit start" signal to the safe atmosphere module.

After the testing period has expired (normally about 5 minutes) the vent is opened and the "inhibit start" signal disappears.

4.3.8 Waste gas firing module

The function of the waste gas firing module is to monitor all conditions required to open and close the waste gas TSOV(s) and to control this (these) valve(s).

Two configurations are possible, dependent on the anticipated heat input of the waste gas:

4.3.8.1 Waste gas heat input not more than 15% of design

If the anticipated waste gas flow represents less than 15% of the total design heat input of the furnace, the waste gas to all burners is supplied via one common TSOV.

If: i. the module receives a "furnace NOT on minimum stop" signal; and

ii. there is no high level in the waste gas KO drum (if applicable); and

iii. the module receives an "all burners in operation" signal; and

iv. the waste gas firing stop button is not activated; then

the waste gas TSOV to the furnace can be opened by activating the waste gas reset button. Usually the waste gas TSOV to the furnace is operated in conjunction with a vent TSOV (i.e. the vent TSOV is automatically opened if the furnace TSOV is closed).

The individual burners are equipped with manually operated valves. If short-term venting to atmosphere cannot be accepted (e.g. when burner guns are being cleaned), the manual valves shall be equipped with proximity switches which can be used to override the relevant flame detector signal (i.e. if the waste gas cock on a burner is detected closed, the waste gas TSOV is not tripped when this burner is taken out of operation).

4.3.8.2 Waste gas heat input more than 15% of design

If the anticipated waste gas flow represents more than 15% of the total design heat input of the furnace, the burners are equipped with individual waste gas TSOVs in addition to the common waste gas TSOV.

A. Common waste gas TSOV module

If: i. the module receives a "furnace NOT on minimum stop" signal; and

ii. there is no high level in the waste gas KO drum (if applicable); and

iii. the waste gas firing stop button is not activated; then

the module produces a "healthy for waste gas firing" signal to the individual waste gas burner modules.

If at least N/2 waste gas burner TSOVs are opened the common TSOV can be opened by activating the waste gas firing reset button.

If any of the conditions i to iii fail to exist or if the "at least N/2 waste gas burner TSOVs open" signal disappears, the common TSOV closes again.

Usually the common waste gas TSOV to the furnace is operated in conjunction with a vent TSOV (i.e. the vent TSOV is automatically opened if the furnace TSOV is closed).

B. Burner waste gas TSOV module

If: i. the module receives a "healthy for waste gas firing" signal; and

ii. the module receives a "main burner on" signal; and

iii. the waste gas burner stop switch is not activated; then

the TSOV can be opened by activating the start waste gas burner reset button.

4.4 IPF CLASSIFICATION AND CAUSE AND EFFECT DIAGRAM

The Instrument Protective Functions discussed in 4.3 have been classified and implemented in accordance with DEP 32.80.10.10-Gen. The classification results are indicated in the cause and effect diagram (Table 1).

Table 1 Cause and effect diagram

Initiators		Actions [1]						
TAG	Service	Abort/ Inhibit start sequence	Header fuel gas TSOVs close	Vent fuel gas TSOV open	Trip to minimum firing fuel gas	Header pilot TSOV close	Main fuel gas burner TSOV close	Pilot burner TSOV close
PZA-04-LL	Pilot gas	-	III	II	0	II	0	0
PZA-01a-HH	Fuel gas	-	-	-	II	-	-	-
PZA-01b-H	Fuel gas	III	III 3)	II 3)	0 3)	-	0 3)	-
PZA-03-LL	Fuel gas	-	III	0	-	-	0	-
HZA-01/02	Manual trips	0	III	II	0	III	0	0
LZA-01HH	Fuel gas KO drum	-	III	II	0	II	0	0
GBSA-01-S	Fuel gas control valve in start position	III	-	-	-	-	-	-
GBSA-02/03-C	Fuel gas header TSOVs closed	III	-	-	-	-	-	-
GBSA-04-C	Pilot gas header TSOV closed	III	-	-	-	-	-	-
Process I	General process trips 2)	-	-	-	II	-	-	-
Process II	General process trips	-	III	II	0	0	0	0
GBSA-14-C	Vent TSOV closed	-	-	-	-	-	-	-
XZA-11-n1	Pilot flame detection	-	-	-	0	0	IV	II
GBSA-14-n4-C	Gas burner TSOV closed	III	-	-	-	-	-	-
> N/2 burners lit	Burner count	-	-	-	III 4)	-	-	-

NOTES:

1) - = No action

0 = Unclassified, but serves purpose in sequence control

II = IPF class II

III = IPF class III

IV = IPF class IV

2) It is assumed that if the (process I) trip to minimum firing does not effectuate, a process II trip is automatically initiated (e.g. if an outlet temperature remains too high for too long a period).

3) High fuel pressure only initiates a total trip in case of failure of trip to minimum firing.

4) Trip to minimum firing implemented as IPF class II, however, in case of failure of this trip, a total trip (implemented class III) will follow.

5. REFERENCES

In this DEP, reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

SHELL STANDARDS

Classification and implementation of Instrumented Protective Functions	DEP 32.80.10.10-Gen.

STANDARD DRAWING

Fuel-gas system for an automatically started natural draught multi-burner furnace.	S 24.033

APPENDIX 1 Functional logic diagrams for an automatically started, gas fired, natural draught, multi-burner furnace

Furnace safeguarding logics for a gas fired, natural draught, multi-burner furnace.

References:

S24.033:
Fuel gas system for a natural draught, multi burner furnace.

Sheets:

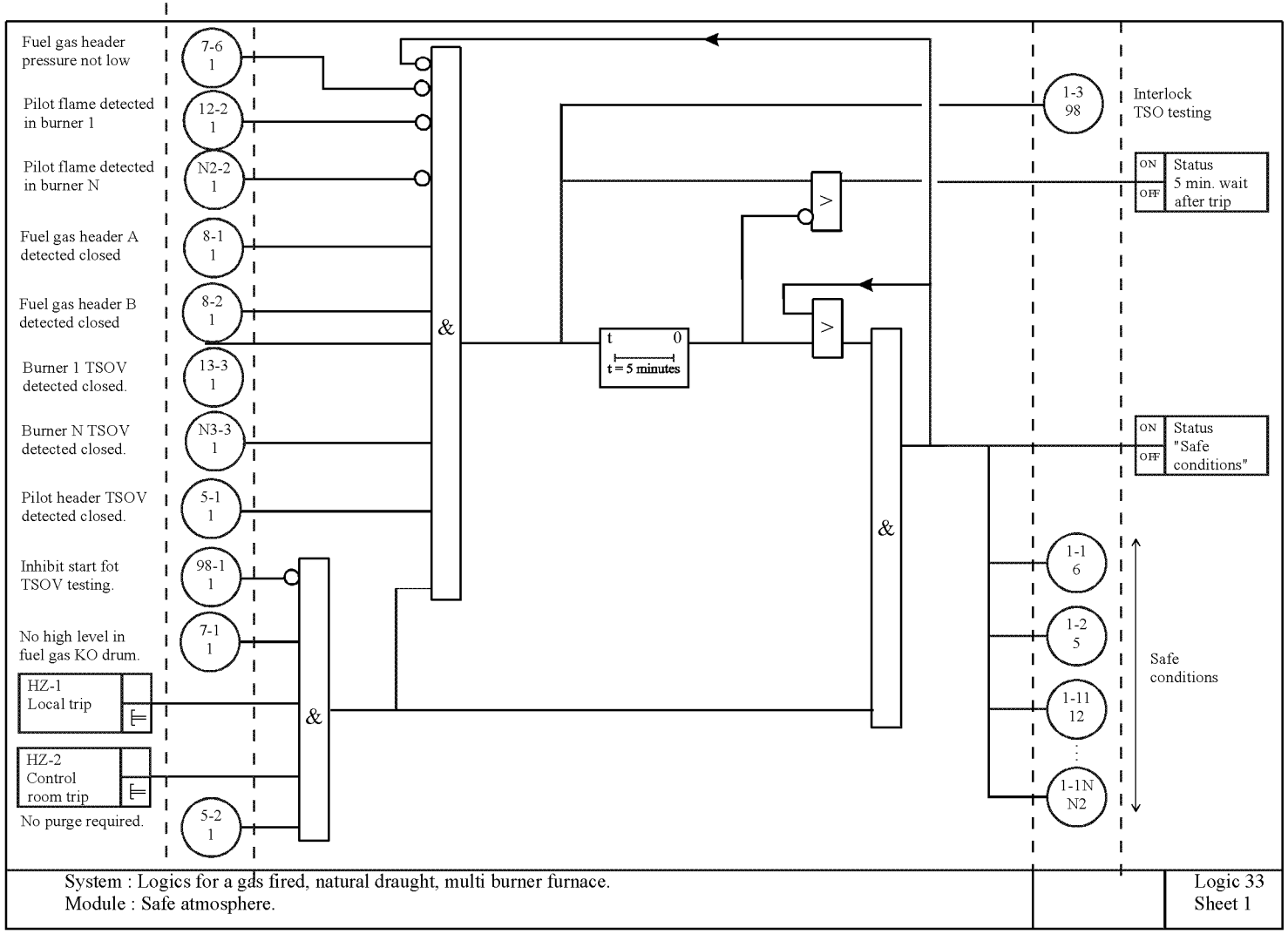
1. Safe atmosphere
4. Minimum stop
5. Pilot header
6. Fuel gas header + vent
7. Gas firing trips
8. Fuel gas TSOV selection

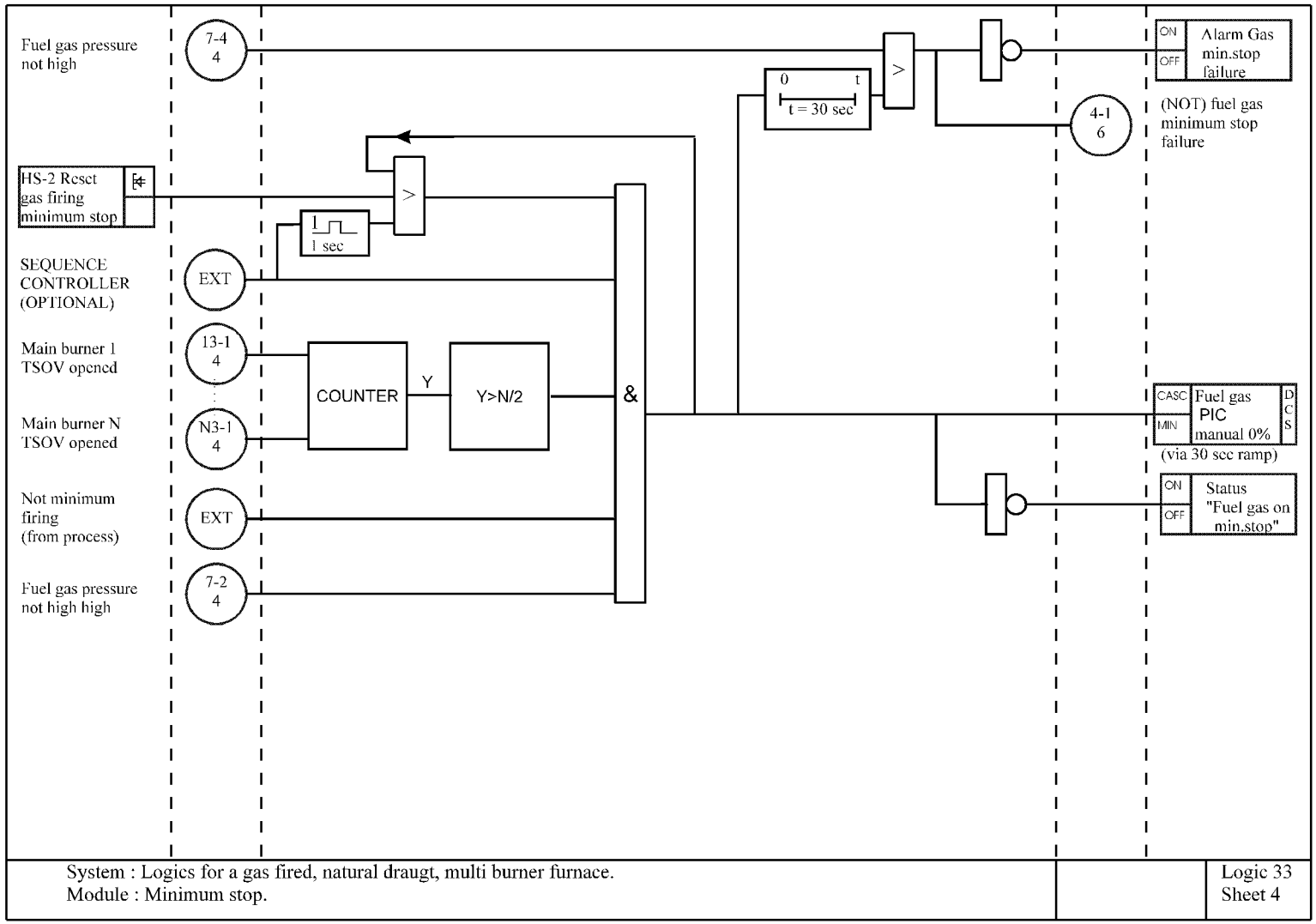
12. Pilot burner 1
13. Fuel gas burner 1

98. Burner TSO test
99. Status indications, alarms, switches

FURNACE SAFEGUARDING LOGICS

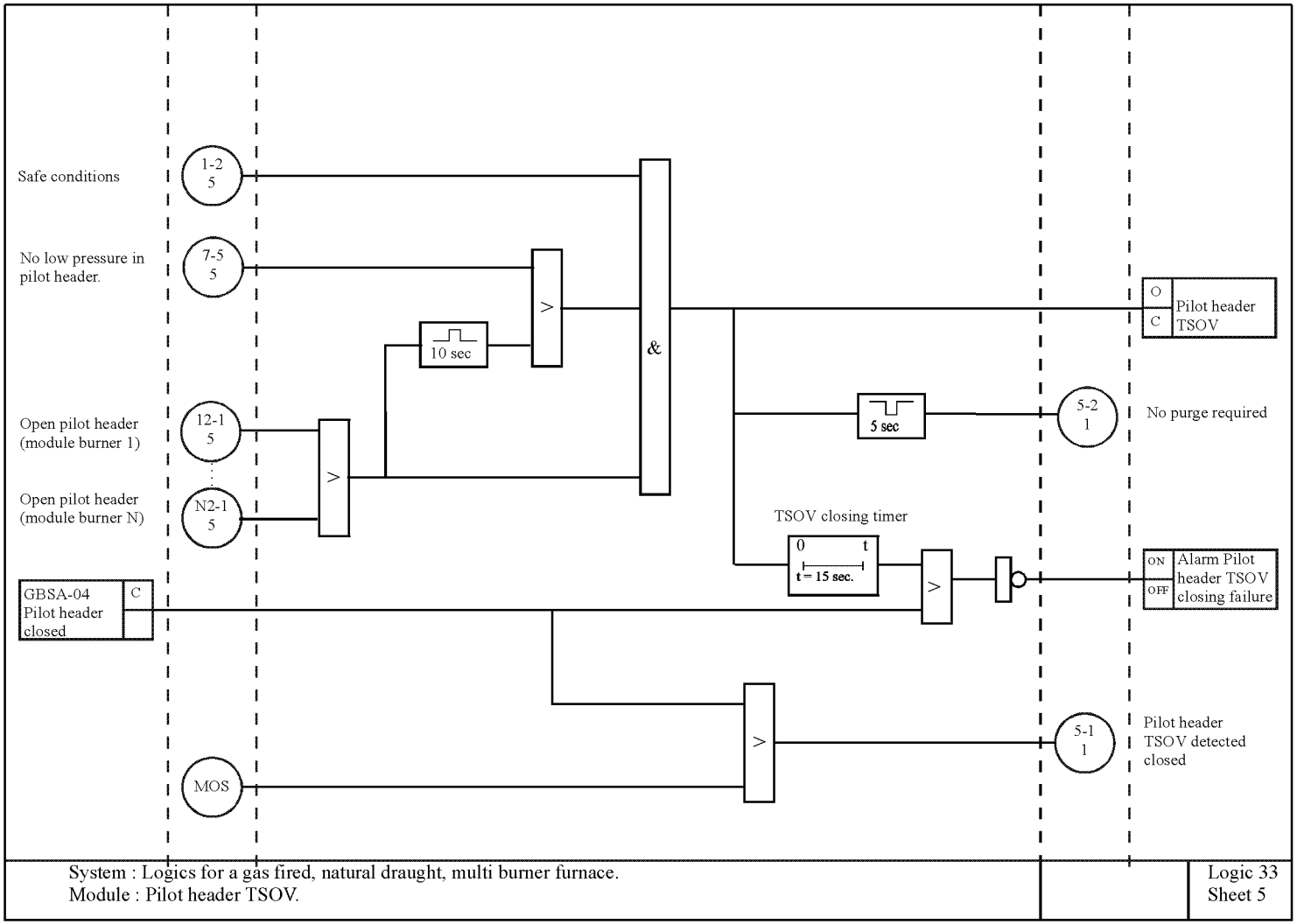
Logics 33
Sheet 0

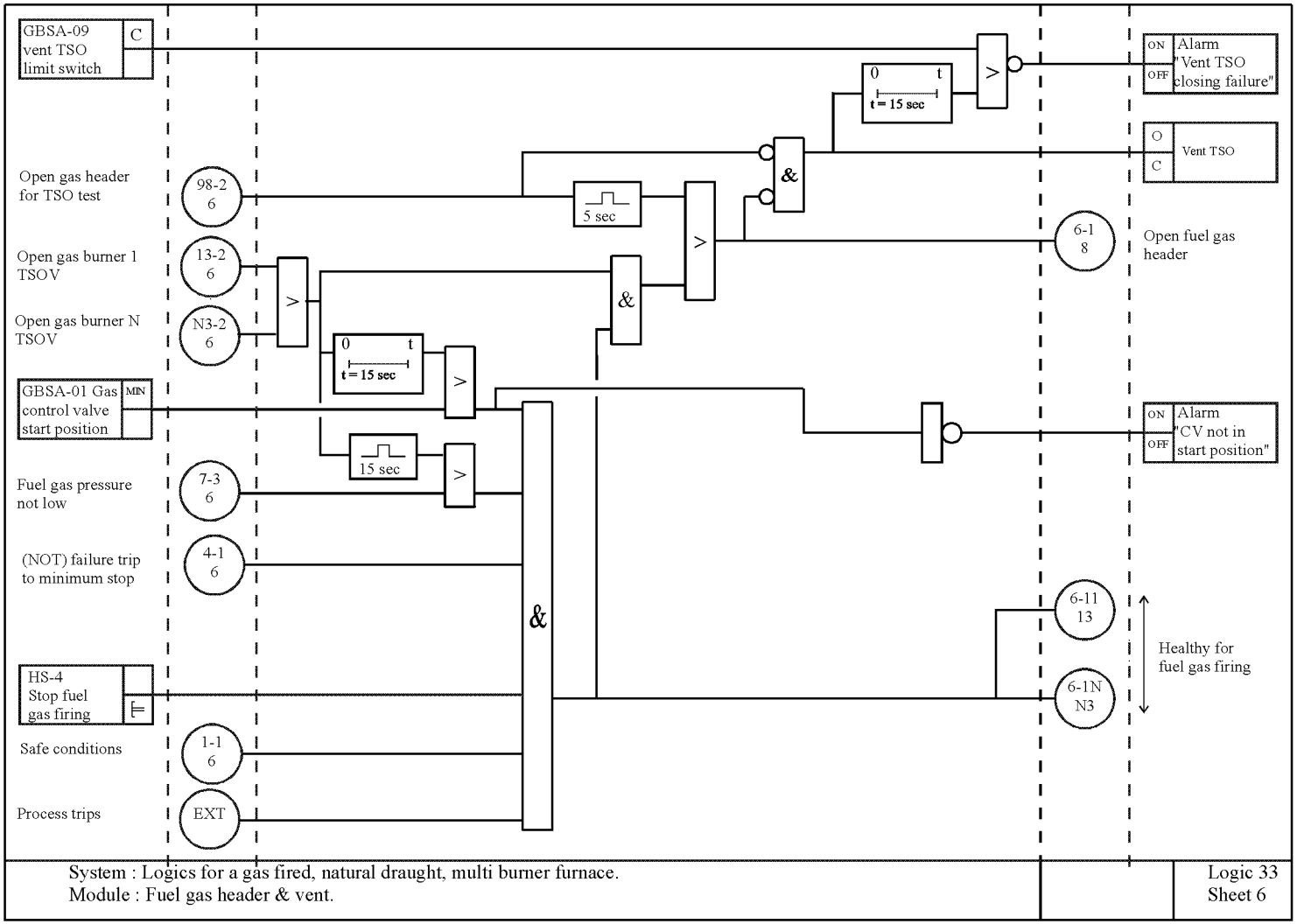

Fuel gas header pressure not low
7-6 1
Pilot flame detected in burner 1
12-2 1
Pilot flame detected in burner N
N2-2 1
Fuel gas header A detected closed
8-1 1
Fuel gas header B detected closed
8-2 1
Burner 1 TSOV detected closed.
13-3 1
Burner N TSOV detected closed.
N3-3 1
Pilot header TSOV detected closed.
5-1 1
Inhibit start fot TSOV testing.
98-1 1
No high level in fuel gas KO drum.
7-1 1
HZ-1 Local trip
HZ-2 Control room trip
No purge required.
5-2 1
&
&
&
t 0
t = 5 minutes
>
>
1-3 98
Interlock TSO testing
ON
OFF
Status 5 min. wait after trip
ON
OFF
Status "Safe conditions"
1-1 6
1-2 5
1-11 12
1-1N N2
Safe conditions
System : Logics for a gas fired, natural draught, multi burner furnace.
Module : Safe atmosphere.
Logic 33
Sheet 1



System : Logics for a gas fired, natural draugt, multi burner furnace.
Module : Minimum stop.

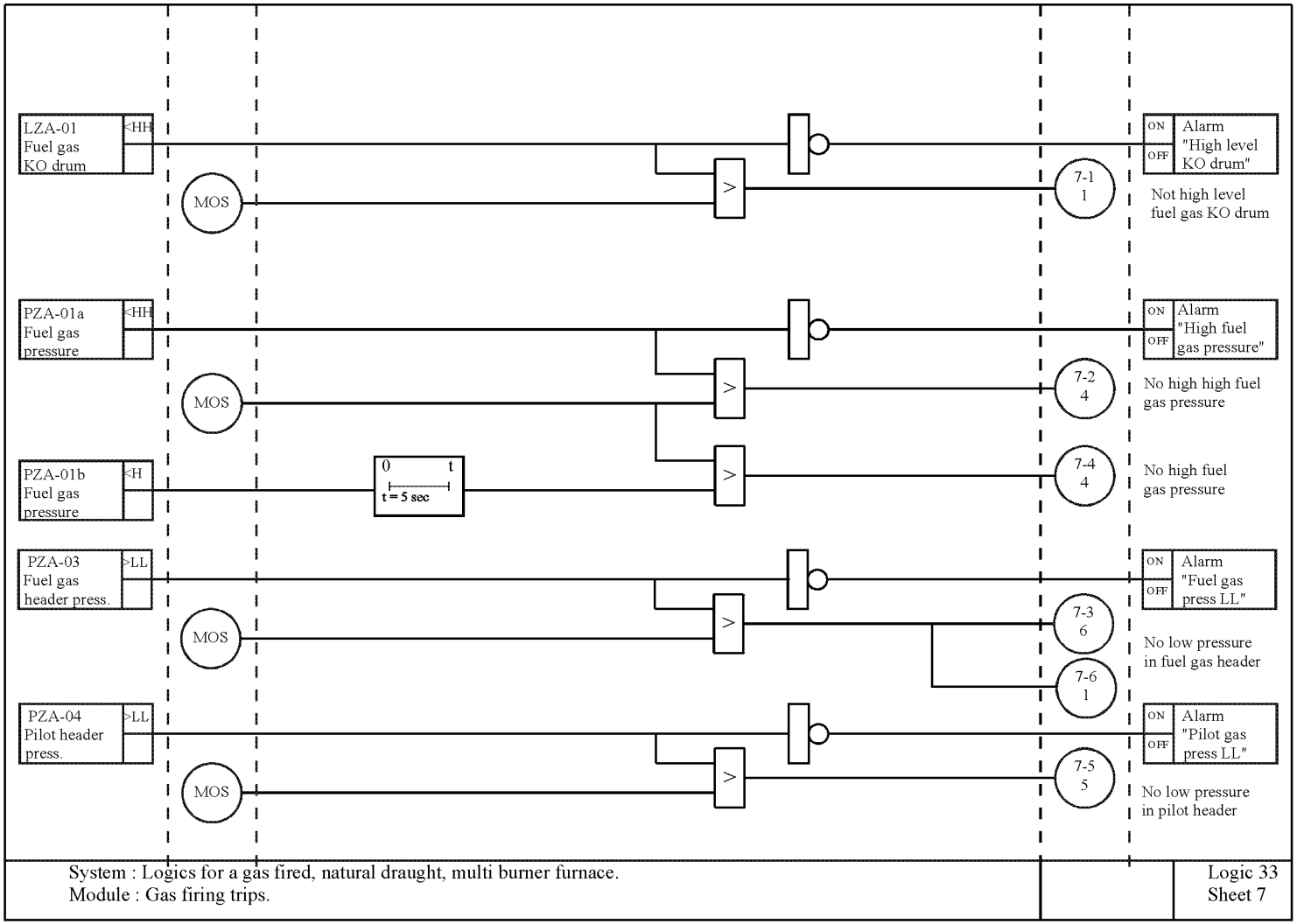
Logic 33
Sheet 4


Safe conditions
1-2
5
No low pressure in pilot header.
7-5
5
10 sec
>
&
O
C
Pilot header TSOV
Open pilot header (module burner 1)
12-1
5
Open pilot header (module burner N)
N2-1
5
>
5 sec
5-2
1
No purge required
TSOV closing timer
0
t
t = 15 sec.
>
ON
OFF
Alarm Pilot header TSOV closing failure
GBSA-04 Pilot header closed
C
>
MOS
5-1
1
Pilot header TSOV detected closed
System : Logics for a gas fired, natural draught, multi burner furnace.
Module : Pilot header TSOV.
Logic 33
Sheet 5



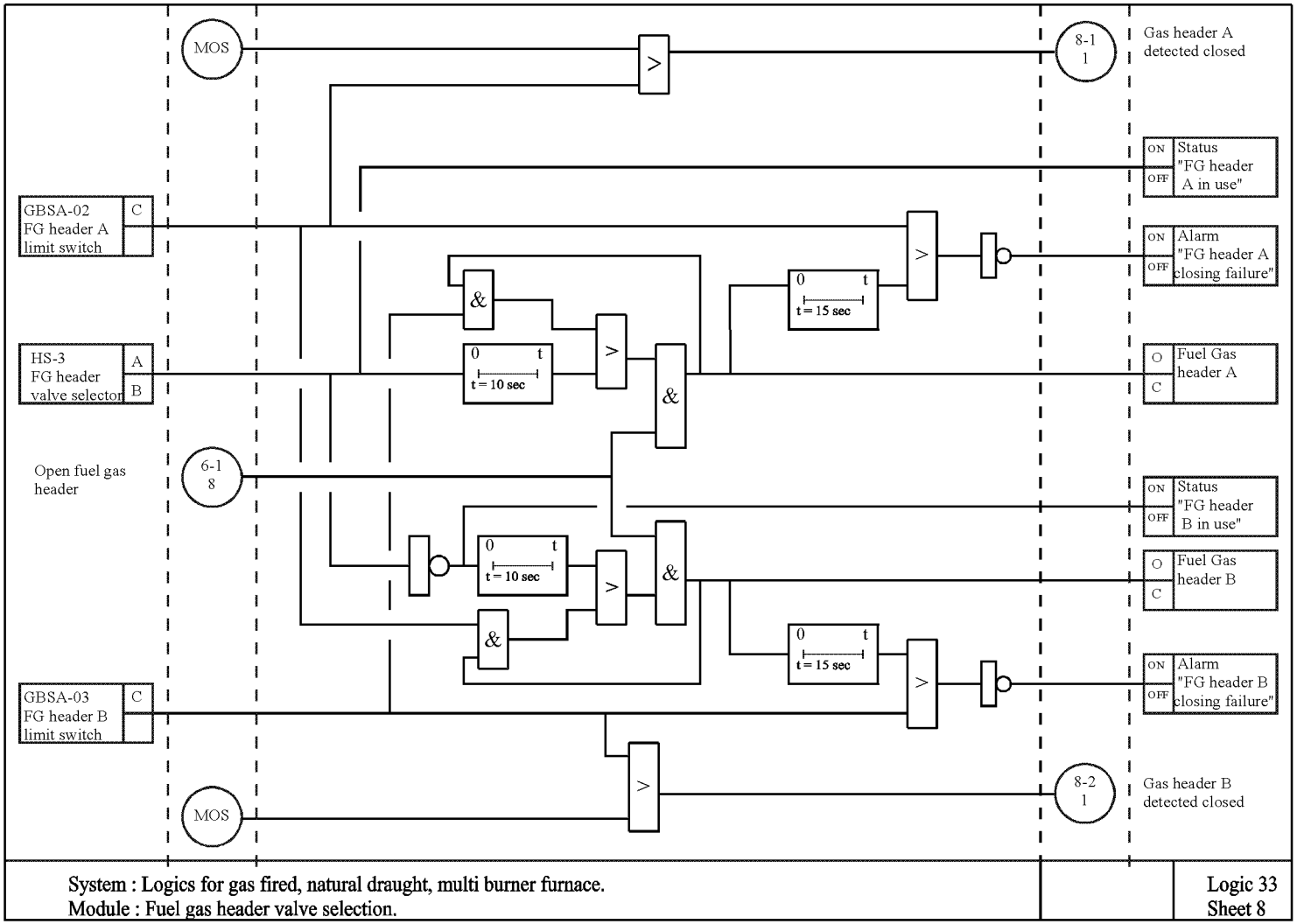
System : Logics for a gas fired, natural draught, multi burner furnace.
Module : Fuel gas header & vent.

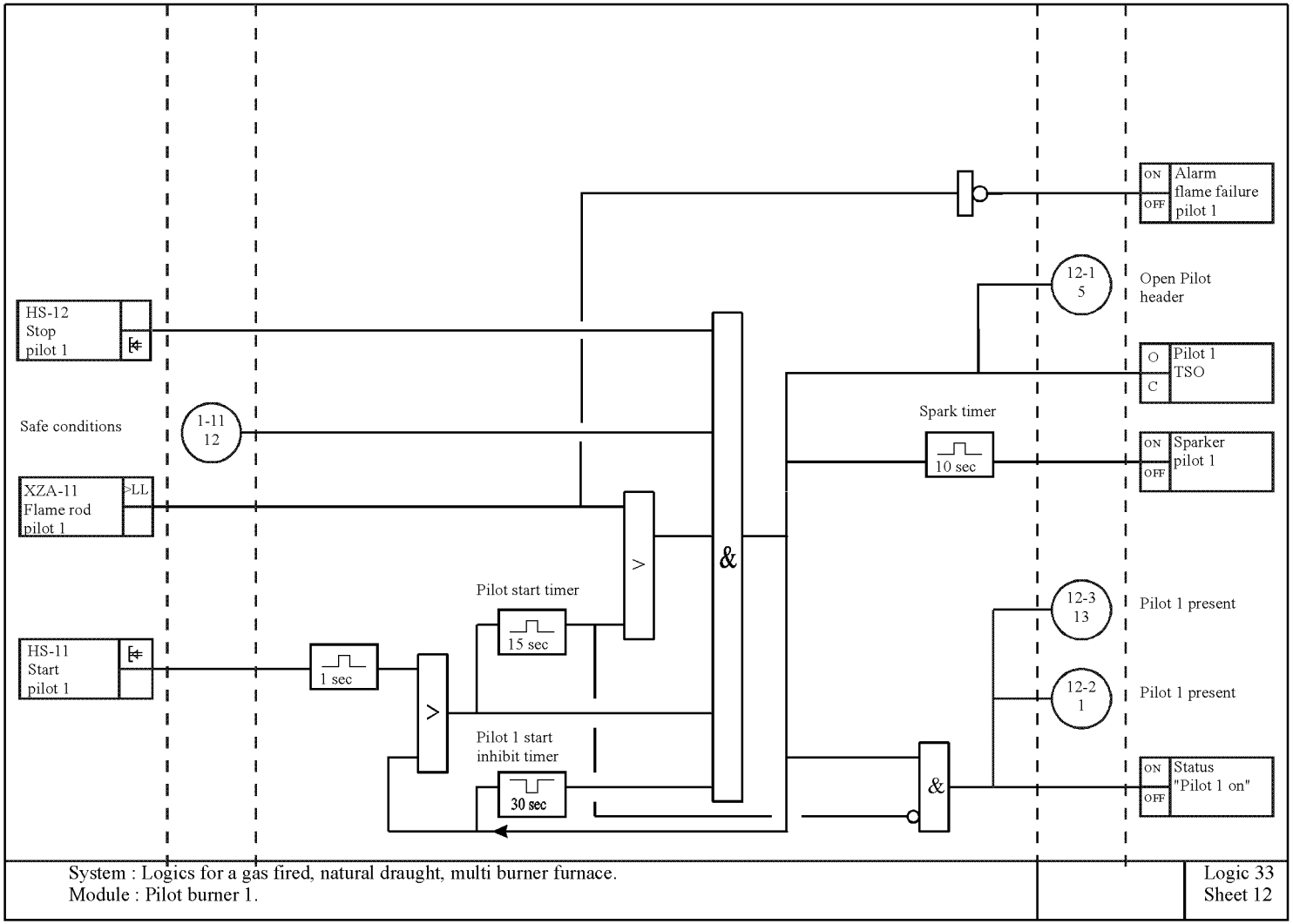
Logic 33
Sheet 6

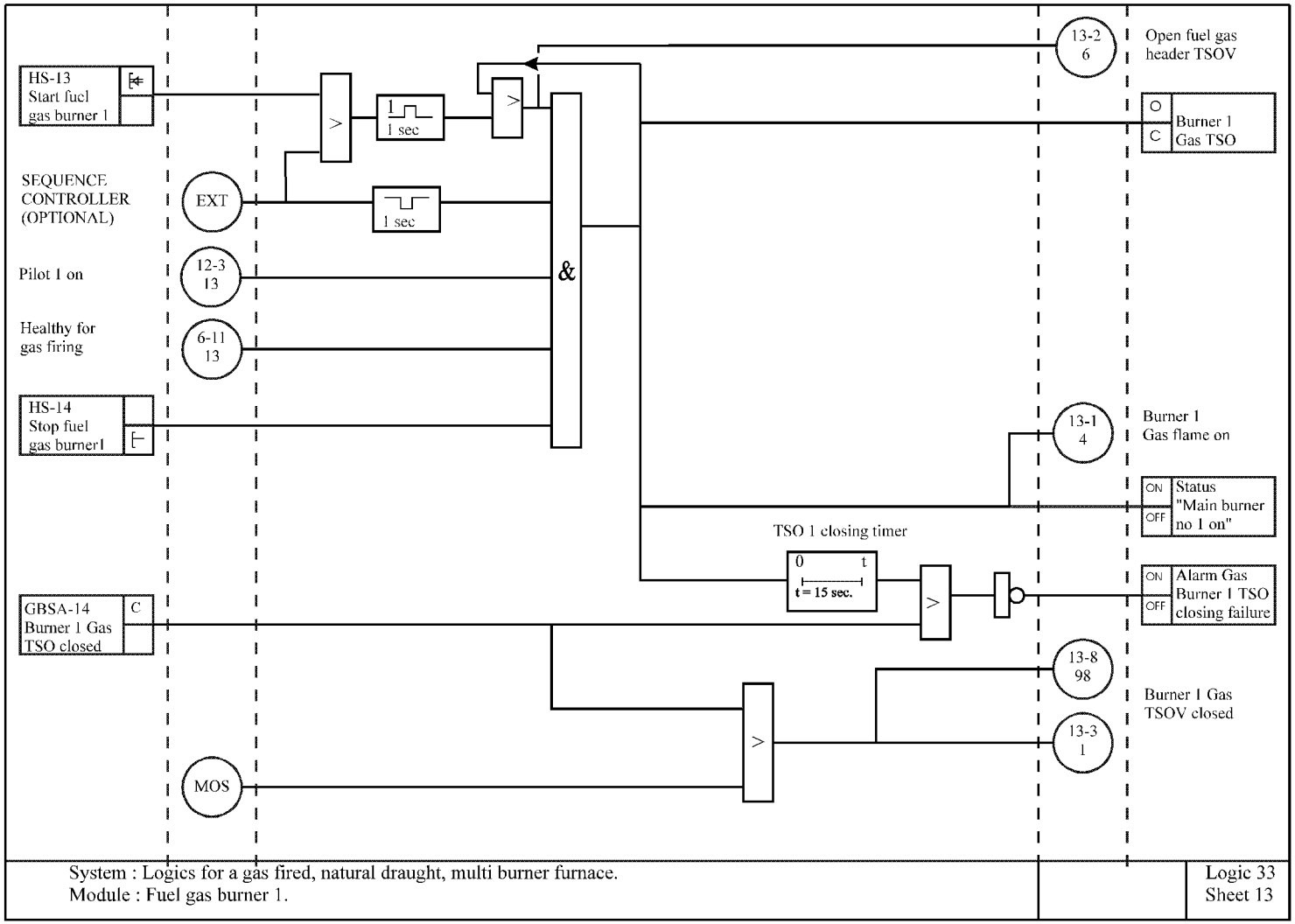


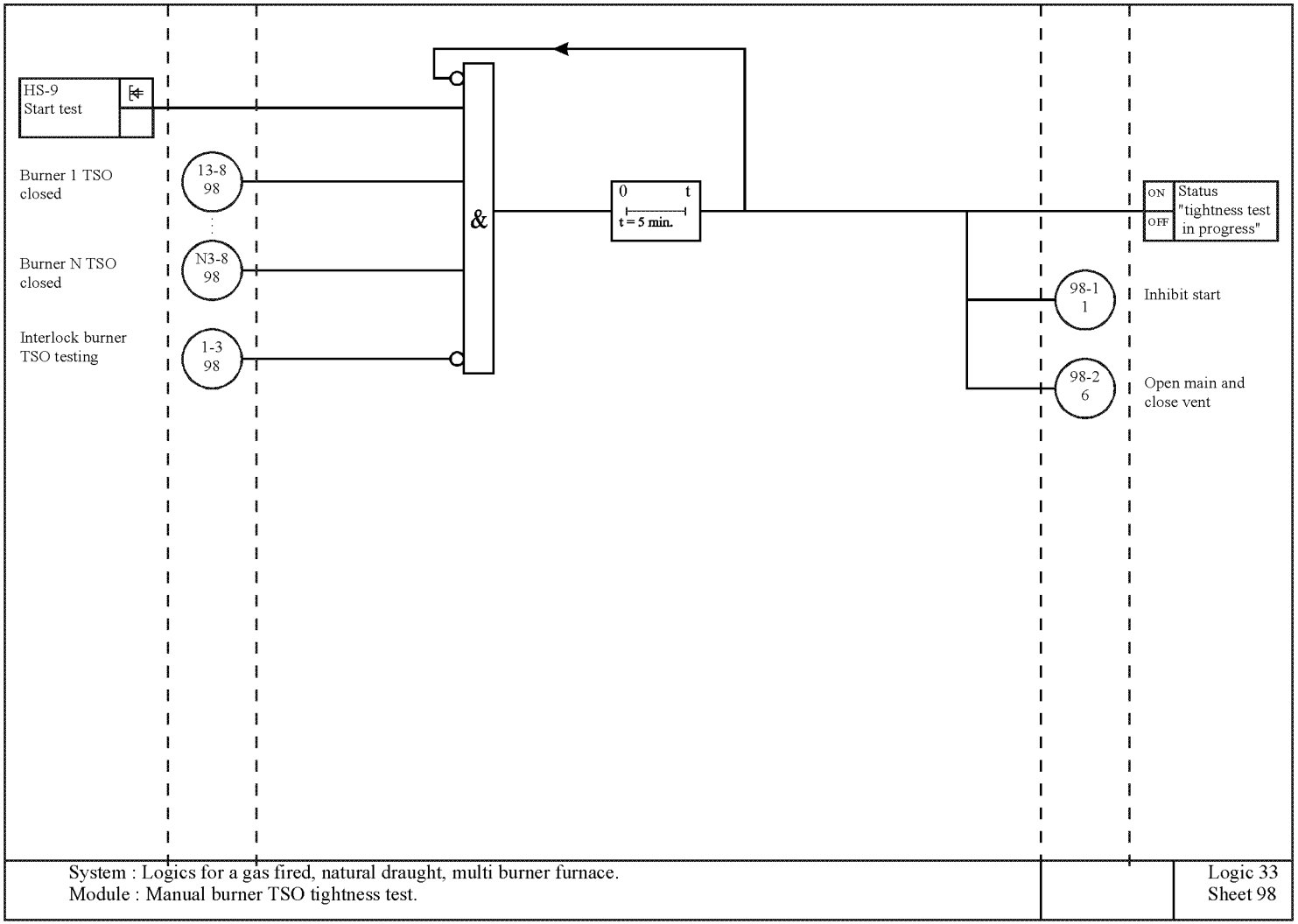
System : Logics for a gas fired, natural draught, multi burner furnace.
Module : Gas firing trips.

Logic 33
Sheet 7


MOS
8-1
1
Gas header A
detected closed
ON
OFF
Status
"FG header
A in use"
GBSA-02
FG header A
limit switch
C
&
0 t
t = 15 sec
>
ON
OFF
Alarm
"FG header A
closing failure"
HS-3
FG header
valve selector
A
B
0 t
t = 10 sec
O
C
Fuel Gas
header A
Open fuel gas
header
6-1
8
ON
OFF
Status
"FG header
B in use"
O
C
Fuel Gas
header B
GBSA-03
FG header B
limit switch
C
ON
OFF
Alarm
"FG header B
closing failure"
8-2
1
Gas header B
detected closed
MOS
System : Logics for gas fired, natural draught, multi burner furnace.
Module : Fuel gas header valve selection.
Logic 33
Sheet 8

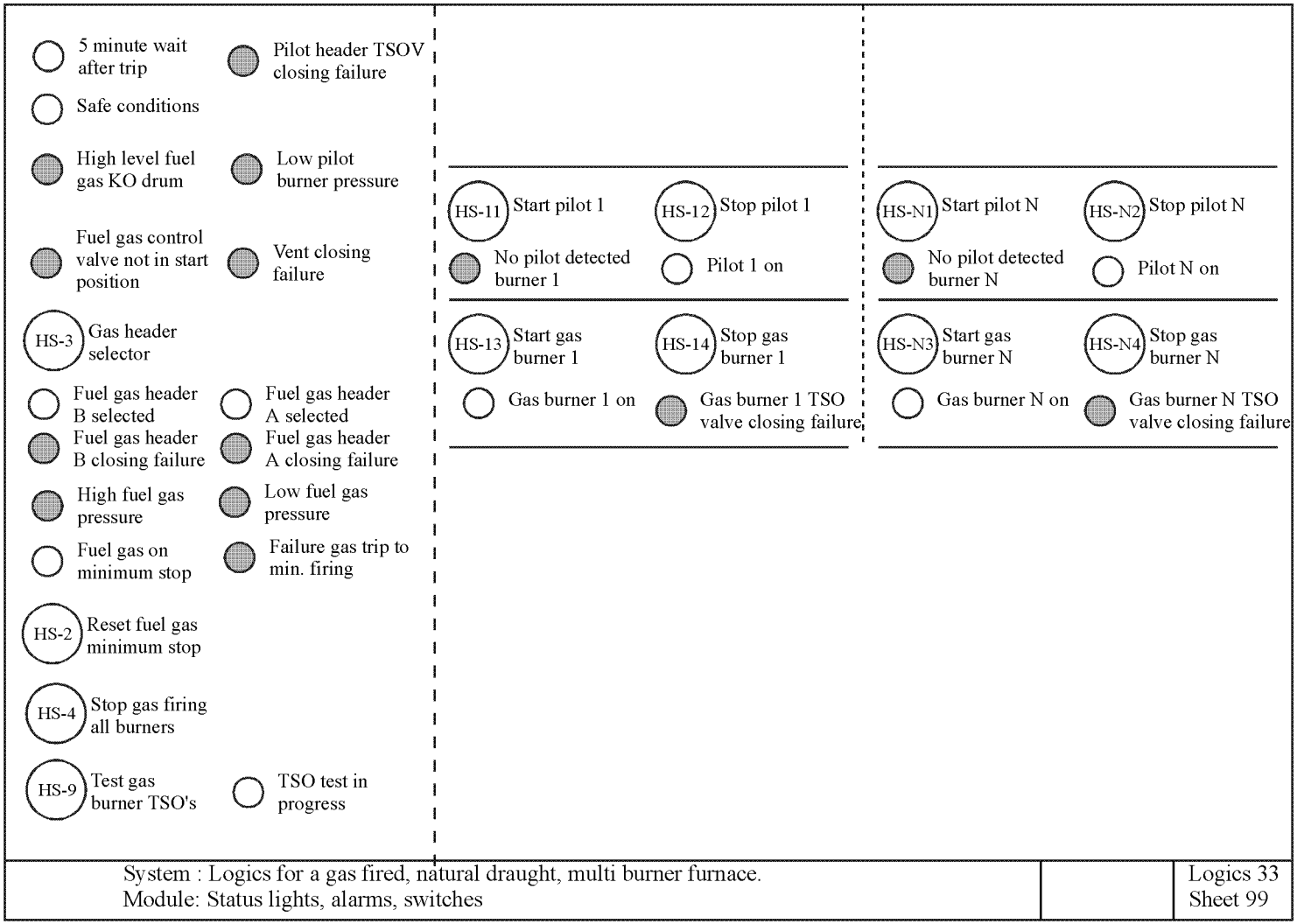

HS-12
Stop
pilot 1
Safe conditions
1-11
12
XZA-11
Flame rod
pilot 1
>LL
HS-11
Start
pilot 1
1 sec
>
Pilot start timer
15 sec
>
&
Pilot 1 start
inhibit timer
30 sec
ON
OFF
Alarm
flame failure
pilot 1
12-1
5
Open Pilot
header
O
C
Pilot 1
TSO
Spark timer
10 sec
ON
OFF
Sparker
pilot 1
12-3
13
Pilot 1 present
12-2
1
Pilot 1 present
&
ON
OFF
Status
"Pilot 1 on"
System : Logics for a gas fired, natural draught, multi burner furnace.
Module : Pilot burner 1.
Logic 33
Sheet 12


HS-13
Start fuel
gas burner 1
SEQUENCE
CONTROLLER
(OPTIONAL)
EXT
1 sec
1 sec
Pilot 1 on
12-3
13
Healthy for
gas firing
6-11
13
&
HS-14
Stop fuel
gas burner1
GBSA-14
Burner 1 Gas
TSO closed
C
MOS
13-2
6
Open fuel gas
header TSOV
O
C
Burner 1
Gas TSO
13-1
4
Burner 1
Gas flame on
ON
OFF
Status
"Main burner
no 1 on"
TSO 1 closing timer
0
t
t = 15 sec.
ON
OFF
Alarm Gas
Burner 1 TSO
closing failure
13-8
98
13-3
1
Burner 1 Gas
TSOV closed
System : Logics for a gas fired, natural draught, multi burner furnace.
Module : Fuel gas burner 1.
Logic 33
Sheet 13



System : Logics for a gas fired, natural draught, multi burner furnace.
Module : Manual burner TSO tightness test.

Logic 33
Sheet 98



System : Logics for a gas fired, natural draught, multi burner furnace.
Module: Status lights, alarms, switches

Logics 33
Sheet 99