

GENERAL REQUIREMENTS

FOR

INDUSTRIAL INCINERATORS

FIRST EDITION

FEBRUARY 2005

This standard specification is reviewed and updated by the relevant technical committee on Oct. 2014. The approved modifications are included in the present issue of IPS.

FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS is based on internationally acceptable standards and includes selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

Standards and Research department

No.17, Street14, North kheradmand

Karimkhan Avenue, Tehran, Iran.

Postal Code- 1585886851

Tel: 021-88810459-60 & 021-66153055

Fax: 021-88810462

Email: Standards@nioc.ir

GENERAL DEFINITIONS:

Throughout this Standard the following definitions shall apply.

COMPANY:

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER:

Means the "Company" where this standard is a part of direct purchaser order by the "Company", and the "Contractor" where this Standard is a part of contract documents.

VENDOR AND SUPPLIER:

Refers to firm or person who will supply and/or fabricate the equipment or material.

CONTRACTOR:

Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR:

Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR:

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:

Is used where a provision is mandatory.

SHOULD:

Is used where a provision is advisory only.

WILL:

Is normally used in connection with the action by the "Company" rather than by a contractor, supplier or vendor.

MAY:

Is used where a provision is completely discretionary.

CONTENTS:	PAGE No.
1. SCOPE	1
2. REFERENCES	1
3. UNITS	2
4. PROCESS DESIGN CONDITIONS	2
5. PROCESS DATA	2
6. DESIGN	3
6.1 General	3
6.2 Burners	3
6.3 Furnace Accessories and Attachments	4
6.4 Furnace Observation Ports and Instrument Connections	4
6.5 Pilots	4
6.6 Piping	5
6.7 Refractory	5
6.8 Platform and Ladder Assembly	5
6.9 Instrumentation	5
7. FABRICATION REQUIREMENTS	5
7.1 General	5
7.2 Welding	5
7.3 Noise Limits	6
7.4 Painting	6
7.5 Nameplates	6
7.6 Explosion Precautions	6
7.7 Weatherproofing	6
7.8 Warning Plates	6
8. INSPECTION	7
9. PREPARATION FOR SHIPMENT	7
10. GUARANTEES AND WARRANTIES	7
10.1 General	7
10.2 Requirements	7
10.3 Tools	8
10.4 Spare Parts	8
10.5 Assistance at Site	8
11. INFORMATION REQUIRED WITH QUOTATIONS	8
11.1 General	8
11.2 Schedule of Vendor's Documentation	8
12. DOCUMENTATION AND INFORMATION REQUIRED AFTER CONTRACT AWARD	9
APPENDICES:	
APPENDIX A TYPICAL ARRANGEMENT OF INCINERATOR	10
APPENDIX B PROCESS DATA	11
APPENDIX C REFRACTORY DATA	12

1. SCOPE

This Standard specification covers the minimum requirements for material, design, fabrication and preparation for shipment and guarantee of the incinerators, for use in petroleum and gas refineries, as well as in petrochemical plants and oil industry applications.

Note 1:

This is a revised version of the standard specification for incinerators, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on Oct. 2014. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No. 432 on Oct. 2014. These modifications are included in the present issue of IPS.

2. REFERENCES

Throughout this Standard the following dated and undated standards / codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this Standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date, shall be mutually agreed upon by the Company and the Vendor: For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

ASME B 31.3 "Process Piping"

ASME Sec. IX "Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operator"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

C 20 "Standard Test Methods for Apparent Porosity, Water Absorption, Apparent Specific Gravity, and Bulk Density of Burned Refractory Brick and Shapes by Boiling Water"

C 410 " Standard Specification for Industrial Floor Brick"

C 573: 1993 "Methods for Chemical Analysis of Fireclay and High-Alumina Refractories"

C 583 "Standard Test Method for Modulus of Rupture of Refractory Materials at Elevated Temperature"

IPS (IRANIAN PETROLEUM STANDARDS)

[IPS-C-TP-102](#) "Construction Standard for Painting"

[IPS-E-EL-110](#) "Engineering Standard for Hazardous Area"

[IPS-E-GN-100](#) "Engineering Standard for Units"

[IPS-E-PI-221](#) "Engineering Standard for Piping Material Selection (On-Plot Piping)"

[IPS-E-PI-221](#) "Engineering Standard for Piping Material Selection (On-Plot Piping)"

- [IPS-E-SF-400](#) "Engineering Standard for Industrial Stairs, Ladders, Platforms and Scaffolds"
- [IPS-G-SF-860](#) "General Standard for Air Pollution Control"
- [IPS-M-IN-280](#) "Material Standard for Miscellaneous Items"
- [IPS-G-SF-900](#) "General Standard for Noise Control and Vibration"

3. UNITS

This Standard is based on International System of Units (SI), as per [IPS-E-GN-100](#) except where otherwise specified.

4. PROCESS DESIGN CONDITIONS

4.1 Incinerators are required to totally incinerate the waste, solids, oily liquids and gases produced in regenerator acid gas and absorber flash gas together with the disulfide oil effluent from the gas refinery plants and units. Separate burners are required for each service.

4.2 Combustion air is preferred to be induced by the natural draught of the incinerator and stack.

4.3 Incineration is to take place such that sufficient fuel gas and air are used to burn all sulfur bearing compounds to sulfur dioxide and to dilute the incinerated products such that the concentration of sulfur dioxide in the incinerator exit gas does not exceed 800 ppm (volume).

4.4 Incinerator shall be capable of burning either individually or in combination solid, liquid or gaseous wastes such as sulfur plant tail gas, sour water stripper gas, asphalt plant overhead gases and etc.

4.5 All sulfur compounds shall be completely burned to SO₂; Unburned H₂S shall be less than 10 ppm in the stack gas.

4.6 No credit may be taken for the heating value of the combustibles in the sulfur plant tail gas when calculating the amount of fuel gas required.

4.7 Negative pressure shall be maintained throughout the natural draught incinerator.

4.8 The incinerator shall be provided with proper furnace volume for complete combustion of the gases and sufficient furnace length to prevent flame impingement on the inlet tube sheet of the waste heat boiler.

4.9 The incinerator shall be provided with a combination burner designed to burn refinery gas during start-up operation; burn all of the sour gas, burn part of the acid gas and pass all of the combustion air through the burner resulting in excess air burner operation for normal operation.

The remainder of the acid gas shall enter the incinerator through a semi-tangential auxiliary acid gas nozzle, mix and burn with the hot burner products and reduce the excess air operation of the flue gases to stoichiometric conditions before leaving the furnace. The combination burner shall be capable of operation with or without refinery gas or sour gas. The burner furnished by the furnace manufacturer shall be of a proven design and suitable for this type of service.

5. PROCESS DATA

The physical characteristics and design maximum and minimum flow rates shall be given by the Purchaser as shown in Appendix B of this Standard.

Note that a large turndown is required and consequently multiple burners will probably have to be provided.

6. DESIGN**6.1 General**

6.1.1 A typical sketch showing the major features of the incinerator and stack is given in Appendix A of this Specification.

6.1.2 The incinerator shall be designed to maintain external furnace metal temperature above the dew point of the furnace gases.

6.1.3 All material and component shall be fabricated and provided by manufacturer and installed at site.

6.1.4 The natural draught incinerator shall be complete with burners, burner fittings, burner controls, recording temperature controller, stainless steel refractory anchors and other required materials.

6.1.5 The Vendor shall provide external shielding and/or insulation to maintain inner steel shell temperatures above the flue gas dew point and to prevent injury to personnel.

6.1.6 Stack shall be designed for a maximum flue gas velocity of 15.2 meter per second using 50% excess air.

6.1.7 Stack shall be provided with:

- A rain shield for entire length of stack.
- Trolley ring for access to inside and outside.
- Access ladder (depending on the height of the stack).

6.1.8 The burner panel shall be fully protected against the effects of dust storms, rain storms and ambient and sun temperature extremes.

6.1.9 A suitable personnel shield shall be fitted around the burner panel to protect operators from the weather extremes described in Clause 6.1.8.

6.1.10 Observation windows shall be provided in the burner panel to permit the maximum practical view of the incinerator interior.

6.1.11 Two sample points should be provided below and above the damper in stack for sampling the gas for analyzers and draught gauges if required.

6.2 Burners

6.2.1 A separate burner or set of burners may be provided for each fluid handled.

6.2.2 The disulphide oil burner(s) shall be of the atomizing type and shall be supplied complete with a flanged connection for atomizing medium.

6.2.3 The burners shall be fitted with both primary and secondary air inlets such that each burner may be operated independently.

6.2.4 The burner panel shall be provided with louvered air inlet panels to supply secondary air for the fuel gas burners and for oxidations of the combustibles in the feed gases plus the excess air requirements.

6.2.5 The burner shall be provided with a flame scanner.

6.3 Furnace Accessories and Attachments

Each furnace shall be provided with the following accessories and attachments:

6.3.1 One burner wind box, steel plate welded construction, complete with flanged combustion air inlet connection and shop mounted on front head of furnace.

6.3.2 One removable, bolted type, steel burner front plate for mounting burners and accessories, and providing access in to the inside of furnace.

6.3.3 One center fired acid gas burner with Type 316 L, 317 stainless steel or hastelloy nozzle with elbow and connection flange (PN20 (Class 150) raised face) for inlet gas connection.

6.3.4 At least one ring type refinery gas/natural gas burner, with pipe fittings and PN20 (Class 150) raised face flange for inlet gas connection, all constructed of Type 316 L stainless steel materials.

6.3.5 One spark-ignited, refinery gas pilot with Type 316 L stainless steel nozzle. Pilot shall be complete with electrode, ignition cable, ignition transformer and local push button station. Pilot assembly shall be arranged with forged steel gate valve and packing gland so that pilot may be removed without causing furnace shutdown.

6.3.6 One burner peephole assembly with purge air connection arranged for cleaning or replacing peephole glass without causing furnace shutdown.

6.3.7 One scanner mounting assembly with purge air connection arranged for removing and replacement of scanner without causing furnace shutdown.

6.3.8 One special burner throat tile form for use in replacing high temperature castable throat tile in field.

6.3.9 One special acid gas burner nozzle with butt welded inlet connection. Nozzle shall be constructed of Type 316 L, 317 stainless steel or hastelloy material and shop welded to furnace shell.

6.4 Furnace Observation Ports and Instrument Connections

6.4.1 Two observation ports shall be shop installed in the outlet transition section of the furnace. The observation ports shall be of the type furnished for the combination burner per Paragraph 6.3.6.

6.4.2 The following PN20 (Class 150), R.F. welding necks with blind flanges, for instrument connections, shall be provided on the furnace. Location and sizes will be given during furnace drawing approval:

- a) Two thermocouple connections.
- b) Two sampling connections.
- c) One furnace pressure connection.

6.5 Pilots

6.5.1 Each burner shall be provided with a fixed gas pilot. The pilots must be easily visible in normal operation and be sized to remain alight under maximum incinerator drought conditions.

6.5.2 Each pilot must have its own lighting port independent of any viewing ports. The lighting ports shall be freely accessible and suitable for portable electric igniter.

6.6 Piping

6.6.1 All piping and fittings material shall be in accordance with [IPS-E-PI-221](#) "Engineering Standard for Piping Material Selection". Flexible hoses shall not be used.

6.6.2 Pipework shall be arranged to allow ready removal of main and pilot burners for cleaning.

6.7 Refractory

6.7.1 Refractory shall be supplied in accordance with Appendix C of this Standard. Refractory anchor studs shall be of the "Y" type and welded to the burner panel on a 150 mm square pitch arrangement. The anchors shall extend to 19 mm below refractory face.

6.7.2 The combustion chamber refractory lining shall consist of a 150 mm thickness of firebrick with a maximum thermal conductivity of 1.0 W/m.^{°K}.

6.8 Platform and Ladder Assembly

Platforms shall be a minimum of 1000 mm wide and shall provide ample work space at the burners panel elevation. Platforms adjacent to incinerators should be self-supporting from the incinerator steel. Platforms, stairways, and ladders shall be provided to allow access to all relief valves, stop-check valves, sample valves, gas pressure gages, manholes and peepholes.

Platforms shall be designed for a live load of 250 kg/m². The incinerators will be spaced side-by-side at distances recommended by the incinerator manufacturer for adequate maintenance, repair, erection and operation.

All structural parts for each incinerator shall be of bolted construction and shall be shop assembled and matched marked before shipment.

All stairs, platforms and walkways shall be adequately safeguarded with handrailing and toe plates, as per [IPS-E-SF-400](#) "Engineering Standard for Industrial Stairs, Ladders, Platforms and Scaffolds".

6.9 Instrumentation

6.9.1 The instrumentation technology employed shall be based on Single Loop Digital Controllers or Process Control System (PCS) as indicated in the purchase order.

6.9.2 The instrumentation system shall be in accordance with [IPS-M-IN-280](#): Part 1 "Packaged Equipment Instrumentation".

7. FABRICATION REQUIREMENTS

7.1 General

7.1.1 The incinerator shall be designed and fabricated in accordance with the requirements of this specification. Items of design, construction, fabrication, inspection and special requirements not specifically stated herein shall be in accordance with the applicable IPS standard specifications, unless otherwise specified.

7.1.2 The incinerator shall be complete with: Outlet transition section, internal refractory lining, combination burner with wind box, auxiliary burner nozzle, observation doors, instrument connections, lifting lugs and saddle supports.

7.2 Welding

Joints shall be made by welding wherever possible, unless otherwise specified. All pipework shall be suitably prepared for welding where welding is required. The connections shall be in accordance with ASME Code B 31.3 "Process Piping"(Clause 328.5.4 Welded Branch Connection).

All welding shall be done by qualified welders. Qualification tests for welders and welding procedures shall comply with ASME Section IX "Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing operators" or any other code stated by the Company.

7.3 Noise Limits

Unless otherwise specified, the maximum allowable sound pressure level shall be 85 dB(A) in the work area i.e., any position accessible to personnel not less than 1 m from equipment surfaces. If the equipment produces impulsive and/or narrow band noise, the above limit shall be taken 5 dB(A) more stringent, thus 80 dB(A). Other requirements shall be in accordance with [IPS-G-SF-900](#) "General Standard for Noise Control and Vibration".

7.4 Painting

All support brackets, etc., shall be painted in accordance with the requirements of [IPS-C-TP-102](#) "Construction Standard for Painting" after the installation work has been completed. Surfaces which will be inaccessible afterwards shall be painted before installation with at least two coats of primer. Plant-mounted instruments and stainless steel impulse lines shall not be painted. Painting shall not jeopardize the proper operation of moving parts such as linkages on control valve positioners, etc., or foul threaded connections.

7.5 Nameplates

All plant-mounted instruments shall be provided with name plates. Where necessary, the fixing facilities shall be made locally. Tapping points for analyzer on/off valves, sequential control valves, ROV's, Motor Operated Valves (MOV's) shall also be fitted with nameplates.

If not otherwise specified, the Vendor shall make proposals, for approval by the Company at an early stage in the project, on how to fix the instrument name plates.

Note: When impulse lines are very long and the tapping points are not visible from the instrument location, a nameplate shall be fitted at these "tapping points" with the same tag number as the corresponding instrument, to facilitate identification during installation, operation and maintenance to avoid mistakes. Examples of such tapping points are; for draught gages on large furnaces, analyzer, impulse lines, etc.

7.6 Explosion Precautions

All electric/electronic instruments which may operate in gas hazardous atmospheres shall be installed in accordance with specified requirements for preventing ignition of flammable vapors. Reference is made to [IPS-E-EL-110](#) "Engineering Standard for Hazardous Area".

7.7 Weatherproofing

All plant-mounted instruments shall be weatherproof after installation. Where necessary the instruments shall be provided with protective shades.

7.8 Warning Plates

Warning plates, when required, shall be attached to the incinerator in a prominent position as follows:

7.8.1 Stress Relieved incinerator "WARNING-DO NOT BURN, WELD, CHIP, GRIND, OR ALLOW ARC STRIKES ON THIS EQUIPMENT".

7.9 Nocturne flasher lights on the top of stack to be installed.

8. INSPECTION

8.1 Fabrication and testing of all equipment is subject to inspection by the Company or his representative. Such inspection does not relieve the Vendor of this responsibility to meet the requirements of this specification and the purchase order.

8.2 Purchaser's inspector shall have free access to check all materials and fabrication and witness all tests.

8.3 The Vendor shall have full responsibility for inspection of materials. The Purchaser shall have the right, upon request, to inspect all materials at source.

8.4 All materials and work including the work of sub-suppliers shall be subject to inspection as indicated in the conditions of contract.

8.5 Quality control system shall be made available for the inspector by the manufacturer.

9. PREPARATION FOR SHIPMENT

9.1 All unpainted exterior surfaces shall be coated with rust preventative grease. Interior metal surfaces shall be sprayed with a suitable rust preventative.

9.2 All openings shall be provided with substantial wooden or metal closures, securely fastened and suitable for long exposure prior to final installation. All tapped openings shall be plugged with solid steel pipe-plugs.

9.3 Equipment must be suitably crated, packaged and weather protected to guard against damage during transportation. All pieces of equipment and spare parts shall be identified by item number and services, and boxes shall be suitably marked.

10. GUARANTEES AND WARRANTIES**10.1 General**

The conditions and period of guarantee shall be as shown on the Purchase order.

10.2 Requirements

10.2.1 The vendor shall guarantee all materials and workmanship to be free of defects.

10.2.2 The Vendor shall guarantee that the equipment meets the performance requirements described in this specification. In particular, the Vendor shall guarantee that:

- All combustibles will be incinerated to their standard combustion products, such as., sulphur dioxide, carbon dioxide and water.
- The disulphide oil mixture will be totally atomized and incinerated at all flow rates between the maximum and minimum quoted in Appendix 2 (company's data sheet).
- The burner(s) will have sufficient capacity to ensure that the products of combustion which leave the incinerator contain less than 800 ppm of sulphur dioxide.
- The incinerator meets the relevant Iranian Environmental Standards and Regulations.
- The utility consumption of the incinerator meets the design requirements.

10.2.3 The Vendor shall confirm that the design and construction of the equipment complies with the health and safety requirements in accordance with [IPS-G-SF-860](#).

10.3 Tools

Special tools required for maintenance and operation shall be provided. These furnished tools are to be used only for purchaser's maintenance. Any other special tools required for carrying out normal maintenance, should be specified and provided.

10.4 Spare Parts

Vendor shall include with his quotation a list of recommended spare parts, necessary for two years of operation. He shall warranty the availability of parts at least for 10 years.

10.5 Assistance at Site

10.5.1 In the event of failure or malfunction of the equipment within the guarantee period, for any reason, the Vendor shall provide the Company with immediate and comprehensive assistance at the Company's jobsite.

10.5.2 The temporary repair or modification of any equipment at site shall not necessarily release the Vendor from his obligation to replace defective and/or inadequate parts/equipment in accordance with the provision of Para's 10.2.1 to 10.2.3 (inclusive).

11. INFORMATION REQUIRED WITH QUOTATIONS**11.1 General**

All documents and correspondences shall be in English language. The supplier shall provide all drawings, design details, operation and maintenance manuals, and other information necessary for the design assessment, erection, operation and maintenance of the installation.

All information, especially the manuals for operation and maintenance shall be clear and not open to misinterpretation and shall apply specifically to the installation supplied.

11.2 Schedule of Vendor's Documentation

The following documentation and information shall be given by supplier.

a) Drawings of:

- dimensioned general arrangement, front and side elevations of complete installation showing incinerator burners, galleries and ladders, ducting and stack;
- dimensioned front and side sectional elevation of incinerator showing, furnace, burners, access and observation ports. The furnace in particular shall be fully dimensioned including burner center lines.

b) Description of:

- extent of shop fabrication;
- general description of installation;
- incinerator indicating site fabrication required;
- furnace;
- refractory ,insulation, stack lining;
- burners;

- mountings, valves and fittings, including safety valves;
- control schemes and description of all controls, especially combustion control scheme.

12. DOCUMENTATION AND INFORMATION REQUIRED AFTER CONTRACT AWARD

The following shall be submitted after the contract has been awarded:

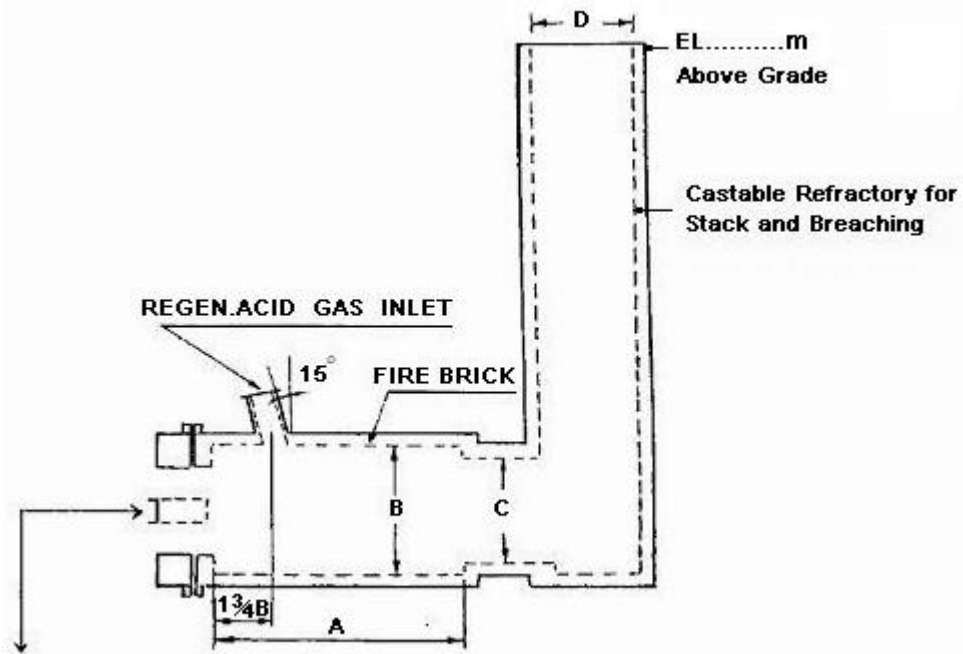
- Detailed calculations of furnace dimensions and accessories and materials for parts of them.
- All necessary information on mass, moments, location of foundation bolts, etc., for the design of the foundation. Supplier shall approve the foundation drawings.
- Mounting and foundations of fans, pumps and drives.
- Resistance characteristics on the air and the flue gas side over the whole installation.
- Characteristic of the combustion air flow-metering system.
- List of manufacturers of all major equipment.
- List of all spare parts, including list of initial spare parts necessary for start-up and two years of operation, with detailed prices and time of delivery.
- List of all tools necessary for operation, maintenance, inspection and cleaning insofar as not normally found in a refinery workshop.
- Six copies of the operation and maintenance manuals.
- Final book

APPENDICES

APPENDIX A

TYPICAL ARRANGEMENT OF INCINERATOR

Burner Panel with Separate Burners for:



- 1) Absorber Flash Gas.
- 2) Disulphide Oil.
- 3) L.P. Fuel Gas.
- 4) Pilots

Dimensions:

A = Combustion chamber length m

B = Combustion chamber I.D m

C = Breaching see Note 1

D = Minimum I.D of stack lining at top m

Notes:

- 1) minimum cross sectional area of breaching to be m²
- 2) provide slip joints for expansion in breaching.
- 3) normal operating temperature is°C
- 4) maximum operating temperature for 15 minutes duration is°C
- 5) refractory to be in accordance with Appendix C.

APPENDIX B

PROCESS DATA

The physical characteristics of the disulphide oil at operation conditions will be:

Average mol. weight

Vapor pressure mm Hg at 150°C (decomposes between 150°C and 200°C)
 mm Hg at 50°C

Density..... Kg/m³

Heat of combustion Kcal./kg

Chemical analysis wt % Hydrogen

. wt % Carbon

..... wt % Sulfur

Combustion Air Characteristics

Temperature max. °C

Temperature min. °C

Maximum water content mol%

Pressuremil bar approx. equivalent to elevation of meters above sea level.

Minimum flow rate.....m³/h

Maximum flow rate.....m³/h

Incineration is to take place such that sufficient air fuel (if required) is used to burn the sulfur components of the feed gases to sulfur dioxide. The products of combustion at the breaching will be maintained at 700°C to burn all combustibles to their standard combustion products viz. carbon dioxide, water and sulfur dioxide.

APPENDIX C**REFRACTORY DATA****Description:**

High strength normal weight castable, suitable for cast or pneumatic application.

All Data Based on Cast Samples

- Chemical analysis (%) shall be in accordance with ASTM-C 573: 1993 (Limits).
- Physical properties (Limits) shall be in accordance with ASTM-C 410 Service Limit 1370°C Min.
- Bulk density (after drying at 105°C) shall be in accordance with ASTM-C 20 (kg/m³).
- Modulus of rupture shall be in accordance with ASTM-C 583.