Sub: Invitation For Investment Opportunities

The Ministry of Industry and Minerals / Republic of Iraq has the pleasure to announce several Investment Opportunities to rehabilitate and modernize its selected factories in different industrial sectors.

Specialized International Companies, Businessmen, and Financers are invited to participate in these Opportunities that may achieve economic feasibility and create rapid positive revenues.

The concept is that the investor and his supporting team shall rehabilitate and manage the plant on his account against a share of production achieved for a negotiated period of time.

The strength points of these opportunities are:-

1- **High local demand of the products.**
2- **Availability of trained and experienced manpower.**
3- **Availability of local raw materials.**
4- **Adequate investment legislations and favorable terms for agreement.**
5- **Fast return on investment.**

The Ministry expresses its willingness to assist you with all the necessary clarification as well as facilitating necessary visits to the factories (if required).

You are kindly requested to submit your offers within the indicated validity (Tuesday, June 5,2007) :-

Contact Details
Tel: 00964 1 8162006 Ext. 3127 , 3122
E-mail :invest@industry.gov.iq
Mobile: 00964 7901 371 867
Address: Ministry of Industry / Investment Department .
Nidhal Street
Baghdad – Iraq

Republic of Iraq
Ministry of Industry & Minerals
Investment Department

Investment file

For Rehabilitation of Abu-AL-Khaseeb Fertelizer plant .

Index :

I- Investment Opportunity.
II- General Conditions.
III- Data & Scope of Work.

Appendixes

I- INVESTMENT OPPORTUNITY

Investing The Urea Fertilizers plant in Abu Al-khasib/ Basrah South of Iraq

The Ministry of Industry and Minerals (MIM) / Investment Department invites international Competent Companies and Investors to invest in Nitrogen Fertilizer plant (Urea) located at Abu Al-khasib (25KM) south of Basrah – (South of Iraq) through implementing and Financing the rehabilitation and reconstruction activities , manage and operate , the plant at the investor account against share of product accomplished.

Brief history of the project

The plant was implemented by the Japanese firm "MHI" as main Contractor during the period 1973-1976 at a design capacity of 420 000 ton Urea /year. As a result of Military hostilities between 1980-1988 the plant suffered heavy damages. In 1993 a limited reconstruction and rehabilitation work was performed (detailed record of this work is available attached to the Investment file) .

The plant located on the coast of shat Al- Arab river near Abu- floos river, south of Abu Al-khasib town , river dock yard is available to load bagged Urea for export.

The plant consumes at its design capacity 40 million standard cubic feet of natural gas per day.

The plant consists of the following main units :-

- **Ammonia Unit.**
- **Urea Unit .**
- **Industrial utility Units .**
- **General services (Administration , stores, workshop buildings … etc).**

Strength point of the project

1- **The plant is located at an area where low cost labor is available,**
2- **Secured and safe area.**
3- **Availability of Natural gas up to plant site .**

4- Availability of infra-structure such as roads, power transmission and distribution network

-5 Availability of river dock yard for the purpose of exporting Urea Fertilizer directly from the plant .

Guide line for Investment requirements

1. **The investor should perform a study on site and plant condition in details , suggesting recommendations for the required measures for revamping and rehabilitations activities, Investment required and detail of Implementation program.**

2. **The investor should have a plan about reconstruction , new installations , replacement and rehabilitation of all the plant, targeting operation with the design capacity or higher according to a technical – economical feasibility study on the Investor account.**

3. **To present the investors consideration and suggestions for the formula of profit sharing , product sharing or partnership in capital , in addition to the partnership duration.**

4. **the Investor may (before or after purchasing the investment file) visit the plant to conclude detailed idea about equipments status , documents and for any clarifications necessary .**

5. **The investor should present his plans and philosophy of how to operate and manage the plant according to the newest techniques also his views to market Urea inside Iraq and for Export , also his plans for training and qualifying the Iraqi staff .**

6. **The Investor shall take into consideration to make electricity power supply available to meet the plant requirements .**

Concept and Evaluation Criteria

The evaluation criteria for selecting the investor shall be :-

1- The share of MIM as a percentage of production offered by the Investor, (not less than the production quantity of year 2002 as a minimum).

2- Rehabilitation plan and scope of work .

3- Obligation of the Investor/ group of investors to install electrical generation unit with capacity capable to operate all plant production & utilities during and after rehabilitation activities .

4- **Obligation of the Investor/ group of investors to keep all current plant personnel, paying their salaries & incentives, yearly increments in salary & any increase obtained according to Iraqi laws, in addition to incentives on increase in production.**
5- **The period planned to implement the rehabilitation activities to conclude the targeted production capacity of the plant.**
6- **The least period of the investment contract.**
7- **Maximum production capacity obliged to be fulfilled by the Investor.**
8- **The Investor Financial Capability to fulfill his under-taking to rehabilitate the plant supported by :-**
    - **Financial statements for the last three years.**
    - **Supporting letter from banks and financial houses show the Investor financial capabilities.**
    - **Documents on the financial capabilities of the investor partners or the Supporting parties.**
    - **Documents on financial facilities that banks may grant to the investor.**

9- **The technical and managerial capacity of the investor and his supporting partners to achieve the rehabilitation works (Engineering Companies , Vendors, Site work Contractors) , operate and manage the plant after completion of rehabilitation, organizational structure of the investor/group of investors to be provided .**
10- **Similar experience of the investor and his supporting companies in similar works with documental reference.**

The Investor Obligations:

***1st*: It is important to the interested investor, before and after purchasing the investment file, to visit the plant to have detail information on site condition, the prevailing conditions of the plant, look at any necessary drawings, and present any request for clarification and questions to the specialized team at the address mentioned below. According to detailed investigation, in addition to the information's and general conditions, The Investor might Submit his investment offer which should contain detailed suggested rehabilitation works, expected investment amount, rehabilitation duration, rehabilitation procedures, intermediate & final targeted production capacities, investment package agreement period, percentage of product share, philosophy and detail procedure for managing & operating the factory before and after completion of rehabilitation activities until the end of investment agreement.**

2 ". The investor should consider the followings according to the investment file conditions:

1. **The investment package should assure the installation of electric generation unit with a capacity capable to operate all factory units, buildings and utilities.**
2. **The investment package should include obligation to keep & getting use from the current available factory employee and assure the payment of their salaries & incentives.**
3. **The rehabilitation package should be fulfilled all factory production units, utilities, other facilities & Quarry equipment.**
4. **It is preferable for the interested investors to arrange seminar for the project team and the related staff, to show his qualification experience and points of view for the Rehabilitation approach.**

Measures

1. **The Interested investor may send his authorized representative to the:**
   1-1:Ministry of Industry & Minerals (MIM)/ Investment Dept.
   Al-Nidhal street, Baghdad \Iraq
   1-2: State Company for Fertilizers / Basrah-Iraq

To purchase the investment file against an amount of 250 US$ (only two hundred and fifty US$) or equivalent in Iraqi currency ;starting on 15/4/2007

2-A specialized team from the Iraqi side shall study all proposals and select the best among them.

3-Negotiation will be held with the investor of the best proposal(offer)to finalize and sign the agreement.

4-The investor shall present his proposal \offer on or before the day 5\6\2007 to the Ministry of Industry & Minerals .

5-For clarifications, contact the following address:
-Ministry of Industry & Minerals\Investment Department,
Al-Nidhal Street- Baghdad |Iraq
Tel : 009641 8162006 \ ext.3127
Mobile: 00964 790137867
e-mail : invest@industry.gov.iq

Investment Department

II- *General Conditions:*

(For Plant's Rehabilitation Agreement)

1- Scope of rehabilitation works:

The "investor" shall undertake, according to the agreement, to rehabilitate and develop all production units and utilities in a manner to guarantee achieving the targeted capacity within a certain period. He may reach the targeted capacity in stages. The "investor" shall in his proposal, specify the target capacity of each stage according to his action plan.

2- The Agreement concept:

The core concept of the "investment Agreement" is that the "investor" shall perform all rehabilitation works in accordance with the terms of the investment file, and to undertake management and operation of the plant throughout the period of rehabilitation and afterwards on the agreed upon capacity, including supply and transport of raw material, operational and secondary materials, cost of water, fuel, electricity etc, additionally to pay the salaries and allowances of personnel(staff) (including labors) working at the state company during the rehabilitation period, and afterwards, all at his own expenses against having a share of the production.

3- Action plan:

The "investor" shall submit, within two months from signing the "Agreement" a detailed action plan and a detailed time schedule on the implementation of the rehabilitation works, taking into consideration stoppage of production units, for necessity only, for limited time in order to keep the continuity of production as much as possible during the rehabilitation period.

4- Maximum Use of Employee during Rehabilitation Agreement:

A- The "investor" shall, within two months from signing the Agreement, in coordination with the plant management, submit a plan on maximum use of the plant Employee in access to the

production activities requirements in the rehabilitation works which he performs or in other projects he may establish in Iraq.

B- The "investor" shall keep all the employees pay their salaries and annual allowances according to prevailing rates of their colleagues at the Ministry of Industry and Minerals, pay incentives in accordance with an incentive system based on achieving the target capacities to be agreed upon before singing the 'Agreement"

5- Penalty on Delay & non-achieving Production Guaranteed capacities:

A: The investor shall undertake to supply the Ministry of Industry and Minerals /State Company with its share of the targeted stages capacities, regardless of achieving or not that targeted capacity on the contractual date.

B: The Penalty in (A) above shall continue for (3 months) only, starting from the contractual date for achieving that stage capacity. The investor shall be considered failed to complete the work if he couldn't achieve the contractual target capacity at the expiry date of the above mentioned period.

In case the investor succeeds in achieving the targeted production capacity within this (grace) period, this period shall not be a reason or part of request to extend the timing of the succeeding target capacities. Timing schedule should be respected as stated in the Agreement.

C: In case the investor failed to achieve the FINAL targeted capacity (at the end of the rehabilitation period), for a shortage not exceeding than 10% of the targeted FINAL capacity, he shall be liable to supply- as a Penalty- a quantity of production amounting to one ton of production for each one ton shortage.

In case this shortage is more than (10%). The investor should take, within six month, any necessary measures to rectify the situation to reach the contractual targeted capacity on his account. The investor during this period (6 months) shall continue to supply the Ministry

of Industry and Minerals/State Company with the quantity of production mentioned above.

In case the investor fail at the end of this period to achieve the targeted production capacity, he shall be considered completely failed to fulfill his contractual obligations and the Agreement shall be considered terminated without any right to the investor to claim for any compensation on actual cost or expenses he has borne for his activities of this "Agreement"

6- Insurance:

The "investor" shall be obliged after signing the "investment Agreement" to get an "All risks insurance" policy for the plant and to insure all plant personnel against work accidents and risks.

7- Abide to labor laws::

The "investor" shall abide to all labor laws and the Iraqi instruction safety rules.

8- Letter of Guarantee:

The "investor" shall, on signing the "Agreement" submit on unconditional letter of Guarantee issued by a recognized Bank amount agreed upon later, The Letter of Guarantee shall be released after the expiry date of the "Agreement" and hand - over the plant.

The Ministry of Industry and Minerals shall have the right to, without court warning or judgment, confiscate the amount of the letter of guarantee in case of regress or failure of fulfillment of the investor obligations.

9- Electricity Generation unit:

The "investor" shall undertake to assure the availability of Electricity generation of a capacity sufficient to meet plant and services requirement of electric power at full production capacity.

10- Plant Management:

The "investor" shall present his work program containing the way he intends to manage the plant, technically and administratively to insure a smooth operation and best performance to achieve the

agreed upon production capacity in a continuous way during the period of rehabilitation and afterwards.

11- Property of executed rehabilitation works:

All supplied and executed works of rehabilitation in accordance with the investment Agreement, after the expiry date of the agreement shall remain in the plant and will be within its property. This does not include personal materials used by the staff of the "investor" personnel, for which he can re-export after listing quantity and type.

12- Continuous Maintenance during Agreement period:

The investor, after completion of rehabilitation works shall continue to achieve agreed upon capacity by performing continuous necessary maintenance during the "Agreement" period and undertake to handover the plant after the expiry date of the Agreement in good technical condition able to produce at the same production rate agreed upon.

13- Letting of Agreement:

The "investor" shall not be allowed to letting the whole Agreement or part of it to a third party without a written approval from the Ministry of Industry & Minerals.

14- Materials used in rehabilitation:

All materials, equipment, machines and their spare parts to be used for rehabilitation should be brand new, reliable and genuine.

15- Monthly Report:

The "investor" shall submit a monthly report to the Ministry of industry & Minerals / technical committee, showing the progress of rehabilitation works and discuss the report to facilitate any obstacles he may meet.

16- Exemption of custom duties:

All equipment, materials, apparatus and their parts imported by the investor for the purpose of rehabilitation works which shall be part of permanent work certified by the Ministry/ state company

shall be exempted from custom duties. The investor may ask for other exemptions and privileges in accordance with prevailing laws, in his proposal.

17- Inventory materials at plant stores:

All inventory materials owned by the state company should be listed and priced by the Ministry / State Company. The investor have the option to buy all or part of these materials in case he needs them for the rehabilitation work.

18- Security:

In due time, the investor shall coordinate with the state company management to organize the guard and security of the plant. In such a way that the responsibility of the security and safety inside the plant lay on the investor responsibility, and out side the plant on the relevant Governmental authorities responsibility.

19- Laws and regulation:

The investor shall abide with terms of prevailing Iraqi laws and regulations when performing his obligations of the "Agreement" with out jeopardize to his privileges of the "Agreement".

20- Agreement Period:

The investor, in his proposal, shall specify the minimum Agreement period he finds it necessary. At the end of this period the Agreement shall be ended unless the two parties agree on extension.

21- Entry/ exit visa and Residence permits:

The Ministry/ State Company shall support the investor to obtain Entry/ Exit visa and Residence permits for his Employees according to prevailing Rules and Regulations.

22- Force Majors:

The "Agreement" shall contain "Force Major" clause and the rights and obligations of each party on this case. The prevailing conditions at the time of signing the Agreement will not be considered a force major case.

23- Dispute settlement:

The disputes between the parties shall be settled amicably. In case of failure to reach an amicable settlement the parties may apply the Arbitration procedures of the prevailing laws in Iraq.

The Iraqi courts , only , shall have the jurisdiction to look in disputes.

24- Care of works:

The "investor" throughout his work in rehabilitation and development shall take due care of the plant, its machines, equipment and facilities, etc. paying utmost care to safety regulations during the Rehabilitation Agreement period.

25- Good Implementation

In case it appears to the Ministry of Industry/ technical committee, that a work is done inadequately, or using improper material or by unqualified labors or in a way endangering other equipment or facilities, the investor should agree to the MIM/ technical committee written request to stop the work and remedy the situation through an action to be agreed upon in a joint meeting.

26- Product Marketing:

The "investor" shall have the right to sell his share locally at the price he finds suitable and export the excess abroad.

27- Secrecy:

The "investor" undertake to keep the informations contained in the "Investment Agreement" confidential. He has no right to disclose or transmit the informations to other parties (except his partners) before he gets a written approval from the Ministry.

28- The "investor" legal entity registration:

The "investor" or the investing group shall establish a legal entity to perform the activities of the Agreement which should be registered at the Companies Registrar office in accordance with the Iraqi Ministry of Trade regulations and terms of companies law No. 21 for the year 1997 and its amendments.

29- Final Report:

The investor, at the end of the "investment period" shall hand over to the Ministry / state company a detailed report targeting to help the Ministry / state company to keep the smooth efficient operation and maintenance of the plant (operation manual, maintenance manuals, inquiry and ordering Manuals and Inventory records etc).

30- Common services:

The investor and the Ministry / state company shall coordinate to control and run the facilities which serve other parties-such as water supply in a-way that such requirements of other parties shall be ensured.

31- Previous liabilities and Obligations:

The investor shall not be part or responsible of any liabilities and Obligations on the Ministry / state company before signing the Agreement concerning the activities of the state company/ Plant The same applies on the other parties liabilities and obligations towards the Ministry or the company or the plant.

32- Termination:

In case this Agreement is Terminated by the Ministry of Industry for no reason related to the failure of the investor to fulfill his contractual obligations, the Ministry shall compensate the "investor" for the actual expenses he spent to Implement his activities according to this Agreement.

33- Present Production:

The "investor" under take to sell to the Ministry at cost the present quantity produced during the period of running the plant parallel to the rehabilitation activities until the end of the first year from the Agreement validity.

In Case the whole quantity received by MIM at prevailing rate, before the end of the year, then the sharing formula shall be applied according to the agreement.

34- Site handover and effective dates:

The periods agreed upon in the Agreement for achieving targeted production stages and final production capacities, shall be counted starting from the date of handing over the plant to the investor to be within three months from the date of signing the Agreement otherwise the terms of clause (8) of this Agreement shall be applied.

1- Introduction :

The construction of Abu-ALkhaseeb fertilizer plant started on 1973 and was completed on 1976 at a design capacity of (420000) metric ton /year of Prilled urea . The main contractor was the Japanese Company Mitsubishi heavy industries (MHI) . The plant owner is the Ministry of Industry and Minerals (MIM) .

The plant is situated on shat – Alarab river bank adjacent to Abu floos river near Abu-Alkhasseeb town , (25 KM) south of Basrah city (South of Iraq) . (see map enclosed) .

The plant was operated on 1977 , it was running until 22/9/1980 , when stopped due to the Iranian – Iraqi war outbreak . the plan suffered during the war severe damages .

Rehabilitation work commenced 1993 by Iraqi companies under the supervision of the state company for industrial design and consultancy Ministry of Industry (SIDCCO) . The first step was to clear the districted structure .

. A comprehensive inspection of the status was prepared by a team of Engineers from (SIDCCO) .

On the basis the that a plan for rehabilitation was organized and started . According to the evaluation of (SIDCCO) 60% of work was completed . However the Rehabilitation work stopped due to lack of foreign Financial resources and the economical embargo imposed on Iraq during that period .

2- The Investment targeted :

Interested company or group of companies (The Investor) shall be required to do the following :-

*** Rehabilitate and reconstruct all the units of the plant , in order to get a plant working at the design capacity at the end of the Rehabilitation work .**

*** depute a team of technical experts to inspect the site , test and evaluate the scope of work needed to reach the design capacity (or higher) with the specification required of the product . The plant administration shall make available to the investor team all technical data , drawings , spec . to enable the investor to perform an effective site inspection .**

*** The Investor shall prepare a technical report showing his proposal for the work to be done , which shall be discussed with the Ministry technical team for the purpose of preparing the final "Technical Report" .**
*** The Investor shall take into consideration to provide his own generation of Electric power at a capacity sufficient for the plant requirement .**
*** The Investor is expected to arrange with partners of financial capacity to finance the rehabilitation work , Competent Engineering Company , Competent Construction Company to reconstruct the plant , operation , running , and management of the plant according to the following :-**
*** present his proposal "Technical and Commercial" showing his suggested share in profit /or production based on his estimate of Invested money , his proposal on method of partnership in management and running the plant , marketing of the product (Local and Export) , and any other conditions he finds it necessary .**

The Ministry shall negotiate the Investor of the best proposal to reach a final Agreement .

3- General description of the plant and process :

The plant consists of Ammonia Unit , Urea Unit , Utilities and Offsite facilities .
General spec . of these units are included in part (1) of the investment file .
Prevailing status of the plant components are also available in a separate report .
Interested Investors may Familiarize themselves with the design and construction drawings of the original project in order to evaluate the scope of work needed and its relevant cost .

4- Prevailing condition of the plant :

The prevailing status of the plant is explained in part (2) of the investment file . the SIDCOO evaluation of the scope of work needed is given in part (3) .

5- Raw material (Feed stock) :

Natural gas

A. Quantity of natural gas (40) million cubic feet /day .

Chemical Analysis mole % .

	average (%mole)	range of variation (%mole)
Methane	**75.5**	**80.5 – 70.5**
Ethane	**13**	**11 - 15**
Propane	**5.4**	**3.8 - 7**
N – Butane	**2**	**1 - 3**
ISO – Butane	**0.7**	**0.6 – 1.8**
N – Pentane	**0.5**	
SO_2	**1.6**	**2.9 or less**
Ar	**zero**	
N_2	**1.3**	

B- Impurities

Sulfur Content	**PPm (size)**
Non organic sulfur	**5.0 PPm**
organic sulfur	**5.0 PPm**
Total sulfur content	**10.0 PPm**
Low calorific value at 25	**10-600 Kcal**

Conditions at boundary limit of the plant

Temp. **4-5 C**

Pressure **38.7 Kg / cm^2 gauge Max**

28.7 Kg /cm^2 gauge Min

6- product specification :

A. Ammonia

State : liquid

Ammonia content / 99.7 % weight min .

Humidity : 0.3% weight max .

Oil content : 5 ppm weight max .

B- Urea

Physical properties

Shape : free solid prills .

Color : white min

Grain size : 90% min of prills of . . 1-2.5 MM DIA

Melting point : 132.7 C

Specific gravity : 1.335 at 20 C

Density : 0.75 ton / M^3

Solubility : quickly soluble in water .

Chemical Properties

Total Nitrogen : 46% weight max .

Birett content : 1% weight max .

Humidity : 0.3% weight max .

Iron : 2 ppm weight max .

Color : 10 Degrees (Hazen)

7- Local Market Demand :

There are now tow plant owned by the Ministry of Industry producing Urea fertilizer at a total design capacity of 1.5 million metric ton/year . However the plants nowadays are working at a very low production rate due to many technical problems . There is a plan for rehabilitation to improve their production capacity .

Local production and demand as follows :-

A. Total Urea production year 2004	**338121 m. ton**
Total production estimated after rehabilitation year 2007	**1060 000 m. ton**

B. Local demand

prevailing demand	**1071 000 m. ton / year**
Expected year 2007	**1360 000 year**
Expected 2012	**1812 000 m. ton /year**

8. Human Resources :

Iraq possess trained skilled and semi-skilled manpower , plus technicians graduated from colleges , technical schools and Industrial Institutes .

Fertilizer Industry started (35) years ago , and so , groups of Engineers and technicians gained wide accumulative experience through out these years .

Additionally the Investor may hire specialists and experts from outside Iraq for certain period in accordance with the guide line given in the item "Investors obligations" below .

9- Environmental Requirements and standards :

The investor obliged to fulfill (ISO-14000) and the following Environmental requirements:-

a-The investor must present an environmental impact assessment (EIA) certified by the ministry of Environment, and must include:

1- The environmental impact evaluation and the positive and negative effect of the project on environment.
2- The suggested methods to avoid pollution control methods are to comply with the environmental enforcements and regulations.
3- The expected accidental pollutions and the precautions that must be taken.
4- the use of the alternative applicable cleaner technology and minimization use of resources.
5- Waste minimization and recycling or reuse.

6- Assessing the costs of merits and demerits resulting out of the project.

b- Treatment of the industrial waste water according to the Iraqi river regulation standard.

c- The availability of pollution monitoring instruments and providing the ministry of Environment with the pollution monitoring data. In case of the unavailability of the monitoring instrument the investor (factory) must do the monitoring by a reliable consultants and laboratories.

d-The solid wastes must be transferred to special locations in coordination with the relevant authorities.

e-Construct and update an environmental database concerning environment protection and pollution level caused by the factory.

f- Treatment of gas pollution according to international standards .

g-The investor is responsible for the efficiency of him design and performance to meet all the above regiment the same applies during operation of the plant .

The implementation of the environmental requirements and standards mentioned above and others will not eliminate the job of the ministry of Environment to make field inspection to check implementing the environmental requirements and that the factory is applying the environmental law No.3 year 1997.

10- Legal Framework

1. **The Ministry shall negotiate with the Investor presenting the favorite proposal to reach a contractual legal Agreement based on profit or production sharing against the Rehabilitation work and other services to be presented by the Investor .**
2. **The Investor shall propose the duration of the Agreement based upon profit or product sharing .**
3. **Dispute settlement : Dispute between a foreign Investor and the Ministry or a third party related to his investment in Iraq shall be resolved in accordance with rules of Arbitration stipulated in Iraqi laws . Iraqi courts shall have Jurisdiction on all disputes , amicable settlement , or settlement by Arbitration .**

11- Investor Privileges

1. **Right to establish trade representation offices and branches in Iraqi, such offices and branches shall be registered at the Iraqi Registrar of companies office\Ministry of Trade .**
2. **Right to establish a business entity jointly with an Iraqi Investor.**
3. **In case the agreement is concluded or basis or product sharing, the Investor shall have the right to sell his share in local market at the price he define or export the product .**
4. **Investor may collaborate with Iraqi partners.**
5. **Right to possess, use, dispose his invested money in Iraq in accordance with central bank regulations.**
6. **Use feely convertible currencies or Iraqi legal Tender . right to transfer money into and out side Iraq in accordance with Central Bank regulations .**
7. **The Ministry shall put at the disposal of the eventual investor the site (Plant) to enable him to fulfill him obligations, Including existing equipment to implement modifications – rehabilitation, adequate storage space .**
8. **Insure the plant at an Iraqi or foreign Insurance company according agreement with the Ministry .**
9. **The imported fixed assets shall be exempted from all taxes and duties provided that these are brought to Iraq within three years from the**

date of Agreement . This period may be extended or reduced by the Ministry , if found necessary .

10. **Imported spare parts for the plant shall be exempted from taxes and duties for three years from date of purchase provided that the value of spare parts shall not exceed 20% of the value of the fixed assets .**

11. **Imported fixed assets necessary for extension or development of the plant shall be exempted from taxes and duties if it results in increase of production capacity of the plant .**
12. **Selling of product is not subjected to any price restriction .**
13. **The Investor shall enjoy any additional privileges that may be issued in the future .**

12- The Investor obligations :

1. **The Investor , his supporting technical entity should possess sufficient experience and qualifications to construct (rehabilitate) Urea fertilizer plants .**
2. **The Investor should obtain quality certificate (ISO 9000) and abide to Urea spec. (see Article 6) .**
3. **Agree to engage Iraqi labors to operate the plant and insure them against risks , supply safety equipment and requirement . He may engage foreign employees for leading technical positions for not more 10% of the total labors force , except during the trail Run period of max 6 months .**
4. **Abide to Health and safety regulations and Instructions issued by world Health organization (WHO) and International labors organization (I.L.O) and abide to Emission standards criteria callable at the Ministry of labors and social Affairs .**

13- Interested Investor :

The Ministry of Industry and Minerals Invite investors with experienced companies in this field who are willing to invest in the project to express their interest in writing to the following address :

Ministry of Industry
Al- Nidhal street _ Baghdad – Iraq
Tel: 00964 1 8162006 / Ex 3127 ,3122
Tel and Fax 009641 8166040
E.mail:invest@industry.gov.iq

The Expression of Interest letter should Include detailed information's on the Interested Investor , Nationality , Supporting technical cooperation's , Qualifications and experience in investment as required in (Form) enclosed .

14- Further clarifications :

The Ministry and its Companies shall provide information's assistance and clarifications to the investor questioners to enable them to take the proper investment decision .

15- Course of Action to be followed by the Investor :

1. **The interested Investor shall express interest in investment in the Urea fertilizer plant on basis of profit or production sharing to the Ministry of Industry Investment office .**
2. **The company or groups of Companies (The Investor) shall present two separate proposals one technical showing scope of work and other contractual on terms and conditions of implementing the work , timing , financing , running the plant , marketing the product and any other contractual terms including the following :-**
   - **Percentage of profit or production sharing .**
   - **Period of agreement (Investment – Period) .**
   - **Estimation of amount invested .**
   - **Plan for implementation .**
   - **Rights and obligations of each party .**
   - **Suggested procedure for management after rehabilitation and during implementation .**

3. **A team of specialists of the Ministry shall study the proposals of the investors to select the best proposal .**
4. **The Ministry shall get final approval from concerned authorities to conclude the agreement and provide any necessary assistance to implement the work .**

Ministry of Industry & Minerals

Data Form

- **Project Name: Abu-AL-Khaseeb Fertilizer plant**
- **Interested Company Name :**
- **Company legal entity (share holding co , limited , etc) , attach copy of establishment certificate and names of shareholders who have 30% share and above :**
- **Registered Capital :**
- **Company or Firm legal representative :**
- **Identification :**
- **Nationality :**
- **Applicant address in Iraq :**
- **Contact details in Iraq and outside Iraq and outside Iraq :**
- **Suggested Production Capacity *:**
- **The Applicant must abide by the Technical, Financial and Legal terms stated in the file , clarify how to fulfill *: Indicate reservations if any**
- **Technical Supporters with confirming documents * :**
- **Name of the financing group / s with his / their Reference / s , Latest Financial report :**
- **Technical Expertise * :**
- **Similar Implemented and under construction projects (References) *:**

Signature:
Name:
Position in the company:
Stamp:

Details for articles pointed by (*)
To be given separately according to the enclosed forms

FORMS

Suggested production capacity
(Use all the space as required)

Undertaking to abide to the Technical , contractual , and legal requirements of this file and way to fulfill .

(Use all the space as required)

Technical Supporters with confirming documents

(Use all the space as required)

Names of financing group with Reference / latest Financial Report .

(Use all the space as required)

Technical Expertise

(Use all the space as required)

---

similar implemented or under construction (References)

(Use all the space as required)

Appendix No.(1)

Existing Plant Configuration and General Process Description

1- Plant Configuration:-

1-1Ammonia Unit

Capacity: 800 MTPD of liquid ammonia
Stream days: 330 Days per year
Process configuration for ammonia unit:-
Technology used: Topso for Reforming Section, Catacarb for CO2 Removal Section and Chemco for Synthesis Converter.

1-2 Urea Unit

Capacity: 1300 MTPD of prilled urea
Stream days: 330 days per year
Process configuration for ammonia units: -
Technology used: Snam projetti

1-3 Utility Facilities

1- Intake water pumping station
2- Raw water treatment
3- Demienerlized water treatment
4- Polisher
5- Package boilers **4 lines**
6-Cooling Tower

New Facilities

1. **R/O Unit**
2. **Waste Water Treatment**

1-4 Offsite Facilities

1- Flare System
(1) Flare stack **1 set as flare gas**

2- Ammonia Storage System
(1) Liquid Ammonia Storage atmospheric Tanks **8000 ton operated at –32C,**

(2) Reliquefaction unit 1 set

(3) Transfer pumps to the urea units 2 sets

3- Urea Storage and Handling System

(1)Conveyors from prilling tower 1 line
To the bulk storage

(2) Bulk urea storage to the bagging 1 line

(3) Bulk urea storage

(4) Bagging 8 lines

(5) Truck Loading 8 lines

(6)Ship loader 2 lines

4- Reception of Feedstock

Natural Gas pipeline 1 line

5- Instrument Air Facilities 1 line

6- Nitrogen Unit

7-Power generation system 1line

Notice: Detail engineering for the plant done by MHI

2- General Process Description :-

2-1 Ammonia Plant :

The plant is designed to produce 800 metric tons of liquid anhydrous ammonia per stream day of normal operation and 23300 Nm3 of carbon dioxide gas per hour of normal operation as a by-product. The process of Ammonia plant is designed on the basis of a single train with high-speed centrifugal compressors, and consists of the following major steps.

1- Synthesis Gas Preparation

The basic raw material, natural gas, is desulfurized by preheating and then absorption of the sulfur compounds on zinc oxide. The desulfurized gas mixed with steam and preheated before being introduced into heated catalyst filled tubes of the primary reformer. In this reforming furnace the natural gas reacts with steam to form hydrogen and carbon oxides.

The heat for this endothermic reaction is provided by burning natural gas fuel.

The hot, partially reformed gas from the primary reformer is mixed with hot compressed air in the Secondary Reformer to give the required ratio of three hydrogen to one-nitrogen molecules in the final makeup gas. Heat of reaction for further reforming in this vessel is provided by the combustion of a small portion of the processed gas with the oxygen in the air.

2- Purification

The first stage of the reformed gas purification is in the CO converters where the catalytic reaction of carbon monoxide and steam, known as water-gas shift reaction produces hydrogen and carbon dioxide.
Most of the heat content of the gas streams leaving the Secondary Reformer and CO converters is recovered in waste heat boilers, which produce steam for plant and process use.

The converted gas passes through the second stage of purification, the CO2 removal section, where the CO2 content is reduced by absorption in catacarb solution. Regeneration of the catacarb solution releases the CO2, which is as a by-product.

The CO2 removal section includes the necessary equipment to absorb the CO2 and regenerate the catacarb solution as heat exchangers to attain optimum process control and heat conservation.

After CO2 removal the gas passes to the final stage of purification, the Methanator, where residual carbon oxides are reacted catalytically with part of the hydrogen content of the process gas stream to form additional methane before being sent to the compression section.

3- Compressions

The compression section includes the following three compressors.
1-Synthesis Gas Compressor and Circulator.
2-Process Air Compressor.
3-Natural Gas Compressor.
The Synthesis Gas Compressor compresses the reformed, purified gas from 19Kg/cm2G to the synthesis reaction pressure of 239 Kg/cm 2G and Circulator boosts back the unreacted synthesis gas to reaction pressure.
The process Air Compressor provides the nitrogen content in the form of air added to the Secondary Reformer.

The Natural Gas Compressor boosts up the process natural gas to feeding pressure for the primary reformer.
All compressors are steam turbine driven.

4- Ammonia Synthesis

In the synthesis section, the recycle gas is initially cooled with some ammonia condensing without separation .the cooled stream is combined with the make-up gas and is further cooled with more ammonia condensing. After separation of the condensed ammonia, the gas is reheated and passed into the Ammonia

Converter. In the Converter, part of the hydrogen and nitrogen react exothermically in the presence of a catalyst to from ammonia. After passing the converter a portion of the ammonia content is condensed outlet gas returned to the recycle stage of the synthesis gas compressor.

5- Refrigeration

Liquid ammonia is used as a coolant in the synthesis section for condensing the gaseous ammonia in the recycling synthesis gas stream. Ammonia liquid is vaporized in the Ammonia cooled condenser, compressed by the refrigeration compressor, cooled and liquefied for further use.

Vent and purge gas from the synthesis section is also cooled by liquid ammonia to condense the gaseous ammonia content before using the non-condensable gas as fuel gas in the package boiler burners.

6- Steam

The steam is used as main power source for driving all compressor turbines and most pump turbines in the plant. Apart of the high pressure steam is obtained from two process waste heat boilers where high temperature steam is cooled and heat is recovered. The rest of the high-pressure steam is generated by package boilers where all purge gas and make-up natural gas will be used as fuel gas. The steam system includes four different pressure levels for various uses. The steam condensed in the turbine condensers is treated in the mixed bed polisher before being returned as make-up to the boiler feed water system.

2-2 Urea Plant

The plant is designed to produce 1300 metric ton of prilled urea per stream day and consists of the following major steps .

1- Urea Synthesis high pressure recovery

Urea is produced by the chemical reaction of liquid ammonia and gaseous carbon dioxide at about 150 kgcm2G and 185 C.
The liquid ammonia from storage is pumped into a holding tank in the Urea Unit.

From the holding tank the ammonia at near ambient temperature is pumped to the urea reactor using reciprocating pump. The stripping ammonia is pumped and vaporized before entering the stripper.
Carbon dioxide is compressed to reaction pressure, and most of it is fed directly to the reactor.

The heat of formation of carbamate from the entire carbon dioxide make-up stream is in excess of that required to sustain the overall reaction, therefore a small portion of the carbon dioxide by-passes the reactor to be pre-reacted in the carbamate condenser.
The urea-carbamate mixture is heated slightly and stripped with gaseous gaseous ammonia to remove the bulk of the carbon dioxide contained in the solution.

The urea solution leaving the stripper with low residual carbon dioxide content is flashed into the high pressure decomposes, which is the first stage of the purification section.
The overhead vapors from the stripper mixed with the by-passed CO2 enter the high-pressure carbamate condenser, in which the ammonia and carbon dioxide are recovered as liquid carbamate. Except for a small stream of inert gases passing overhead from the condenser, essentially all the feed is recovered and recycled to the reactor.
Condensing the reactants at high pressure and temperature permits the production of steam in the carbamate condensers, thus reducing the cost of utilities for operating the unit.
The high-pressure carbamate solution leaving the condenser is recycled to the reactor via an ejector in which the motive fluid is the compressed liquid ammonia fed to the reactor.
The ammonia pressure drop through the ejector supplies the necessary driving force.
This patented design has many advantages.
The main recycle stream returns to the reactor with minimum capital investment and operating cost.
The difficulties encountered with expensive carbamate pumps in traditional urea plants have been eliminated by a system, which requires less maintenance and is more reliable. The reactor outlet control valve, which does handle urea solution. Is designed for a low-pressure drop with negligible flashing. The high ammonia content in both stripper and high-pressure cabamate condensers reduces corrosion in this equipment.
Corrosion is also reduced in the purification section because less carbon dioxide reaches that section, thus reducing the amount of carbamate to be handled.
The high ammonia content throughout the unit also reduces the biuret formation and actually permits reduction of biuret in the stripper.

Reducing the quantity of low pressure solution recycle and producing steam in the process reduces considerably operating requirements and costs.
Reaction and stripping conditions have been optimized to obtain the most economical design.

2- Purification and Low Pressure Recovery

The Purification section consists of low stages of decomposition in series. Each stage takes place at a successively lower pressure. The first stage occurs at about 18 kglcm2G and the second stage at about 2.5 kglcm2G.

The two stages require heat to remove the excess ammonia and residual carbon dioxide from the urea solution. The concentration of the urea solution becomes successively higher as the mixture passes through the various let down stages until a solution containing approximately 80 percent wt. Of urea is produced.

The vapors released from the solution in each decomposer are condensed and recycled to the reactor the 80 percent wt. Of urea solution is sent to the finishing section.

The recovery of the vapors leaving the first and second decomposition steps.

The recovery is essentially a two-step condensation and absorption of ammonia and carbon dioxide to obtain a concentrated solution of ammonium carbonate, which is recycled to the reactor through the high-pressure carbamate condenser. The solution leaving the loe pressure condenser is sent to the high-pressure absorber, in which it contacts the overhead gases coming from the high-pressure carbamate condenser. The over-head vapor from the high-pressure absorber is a pure ammonia stream, which is condensed and collected in the holding tank. The ammonia and carbon dioxide fed to the urea unit contain small quantities of inert gases. These gases are released from the reaction products in the various decomposition steps, and are vented from the condenser associated with the high-pressure absorber. Collected in receiver, and then is treated in a distillation column in which NH3-CO2 are stripped and urea in completely hydrolyzed.

The vapors leaving the top of the column are recovered by condensation in L.P. condenser and the purified water, containing only few ppm of free ammonia, is sent to the battery limit. Besides the advantages of NH3 and CO2 recovery, the most important question is the elimination of pollution problem owing to the effluents.

Appendix No.(2)

PLANT STATUS

1- Civil, Building and Structural Works:

Most of the Building, civil and structural works were damaged. Re – construction, repairing of several buildings and structural works had been done, and others still required reconstruction or repairing.

2- Mechanical Works

This is the discipline where most of the damage had occurred and therefore extensive amount of work is required.

2-1Ammonia unit:

This area had been subcontracted to Iraqi contractors .The work had been started. Some equipment (vessels, heat exchangers, Reactors) was repaired at site. Some other equipment was repaired at the workshop outside the plant and some others were newly manufactured. The major requirement needed as fellows:

1. **High pressure equipment are damaged (such as Reformer Gas Waste Heat Boiler, CO2 Absorber, CO2 Regenerator, Ammonia Synthesis Converter) and shall be fabricated and transported as one piece for each one.**
2. **All rotary machinery in this unit are damaged or missing and shall be supplied together with their drivers (excluding synthesis compressor, air compressor, refrigeration compressor which are existing at the site).**
3. **Special material and parts such as pig tails, governors, refractory bricks and cement, packing material for towers, insulation, sprig hangers, etc.**
4. **Part of the Piping and fittings above ground are damaged or missing such as: alloy steel, stainless steel, carbon steel with different sizes and thickness are damaged.**
5. **Strategic spare Rotors and other spare for Main Compressors and Turbines are damaged and to be supplied.**
6. **The condition of underground piping system is not know**

2-2 Urea plant

This plant is severely damaged and mostly effected part of the whole complex . Most of the equipment (Vessels, heat exchangers etc.) is damaged few equipment were repaired and some other equipment were fabricated as new.
All rotary machineries with their drivers are missing or damaged.
All piping and fittings (stainless steel and carbon steel with different sizes and thickness) are damaged.
All special material are damaged or missing.
Most of the equipment are damaged including the Urea Reactor , Urea stripper … etc

2- 3 Utility System

2-3-1 River Water Intake and Filtration Unit

This unit located within the plant at shatt AL –Arab river. It consist of two clarifiers with alum dosing system and Sand Filtration with chlorine dosing system. There is not much mechanical damage and most of the works were carried by Iraqi subcontractors. Some Rotary machineries are missing, chlorine-dosing system are damaged.

2-3 -2 Demineralized Water Unit

This plant is also heavily damaged during the war. The repair works and equipment manufacturing had been carried out by Iraqi subcontractors
Piping and fittings, equipments, all rotary machineries, rubber lining materials, etc. are either damaged or missing.

2- 3- 3 Reverse Osmosis Unit (New one)

The existing system is not functional due to the increase of salinity of water in the Shat. AL-Arab to produce demeneralized water unit.
Therefore completely a new system (Reverse Osmosis Unit) with a treated water capacity of 600 m^3/hr is planned to be built.

2-3-4 Polishing Unit

The damage is not much. Repairing of equipment and fabrication new equipment are nearly completed. The progress is high.
Pumps and their drivers are missing also some material.

2-3-5 Boilers

There are 4 No.s of Mitsubishi made package boilers .The damage is moderate.

Refractory lining, insulation, some equipment, piping and fitting are damaged. Also pumps are missing.

2-3-6 Cooling Tower

The old cooling tower has been demolished. A new cooling tower with eight cells is under construction. The new design has been adopted by SIDCCO using counter-flow instead of cross-flow for the old one. Presently the concrete structure is completed. Technical evaluation shall be made in order to insure reliable design and performance and accordingly give the recommended fans, gear box, motor filling materials, water distribution pipes, also circulation pumps with their drivers to be supplied.

2-3-7 Waste water Treatment System

In the original design there was not a waste water treatment system. Now

it is planned to install such system . The new system shall designed to

comply with the local rules of pollution.

2-4 Offsite Facilities

Appendix No. (3)

Preliminary Scope of Work

ANNEX NO. 1

Modifications

The complex (Ammonia and Urea Unites) was constructed in the 1974 based on the technology of Toppsoe for ammonia and Snamprogetti for urea at that time. Since more than (25) years is passed and development is take place with these technologies, a certain modifications are concerned.

1- Ammonia Plant: -

1- Modification of Secondary Reformer Burner:

Nozzles of the burner shall be modified by inserting tips at these nozzles (using the new technology developed by toppsoe).

2- Ammonia Converter:

The design of the existing ammonia converter is Chemco Type. Modification of this converter from Chemco to S-200 is foreseen.

3- Process condensate treatment:

All condensate in this unit shall be treated to produce water suitable to be used as boiler feed water.

2- Urea Plant:

Modification for this Unit shall be as the following:

1-Ten efficient trays are to be added in the urea converter

2-MP inert washing tower has been foreseen to reduce ammonia losses in the tail gas.

3-The existing crystallizing / prilling processes to be replaced by the vacuum concentration system.

4-The process condensate shall be deeply hydrolyzed to recover all the process condensate as boiler feed water.

5-The high pressure tail gas from the carbonate separator and the tail gas from the medium pressure decomposer is recovered and mix the carbonate solution from the P-503AB To heat the urea solution in the vacuum preconcentrator and increase the urea concentration from 73% to 83%. Thus, the steam consumption is reduced.

ANNEX NO. 2

Stationary Equipment

1- **The bidder shall supply the equipment on the list attached here within.**

2- **A complete equipment to be supplied shall be manufactured, tested, inspected and shipped to the port of Basrah.**

3- **The design, manufacture, test and inspection of such equipment shall be according to the latest standard and codes as listed in the Basis of design and in accordance of specifications and drawings and as per the requirements in the original detail design drawings.**

4- **The materials to be supplied for the manufacturing those equipment in Iraq shall be high quality and as per the requirements in the original detail design drawings, which shall include plates that have specific requirements, to the material and dimensions, heat exchanging tubes and general tubes.**

5- **The bidder shall also give an option for supply complete bundles for the heat exchangers and coolers and this will be considered.**

LIST OF EQUIPMENT TO BE SUPPLIED AS A COMPLETE PEICE

CODE	DESC
V- 326AB	SEAL OIL TRAPS FOR K 301
V-328AB	SYN. GAS H.P CASING SEAL OIL TRAP.
V-329	SYN. GAS COMPRESSOR GOVOIL ACCUMULATER
V-330A/B	SYN. GAS H.P & MP SEAL OIL PUMP SUCT ACCUMULATER
V-331A/B	SYN. GAS H.P & MP SEAL OIL PUMP DISCH ACCUMUL.
V-332A/B	SYN. GAS H.P & MP SEAL OIL HYDRAULIC DESURGER
V-342	AIR COMPRESSOR GOV OIL ACCUMULATER
V-503	MED. PRESSURE UREA SOLUATION HOLDER
V-504	LOW. PRESSURE SEPERATOR
V-534	CO2 COMPRESSOR SEAL OIL TRAP
V-535	CO2 COMPRESSOR GOV OIL ACCUMULATER
E-115	P-101 A.T OIL COOLER
E-116	P-101 A.T AIR EJECTOR CONDENSER
E-117	P-101 A.T LEAKAGE CONDSER
E-201	CATACARB REBOILER
E-206AB	P-201 OIL COOLER
E-304	3RD STAGE SYN. GAS COOLER
E-305	1ST STAGE AIR COOLER
E-306	2ND STAGE AIR COOLER
E-307	3RD STAGE AIR COOLER
E-316	SYN. GAS COMPER MAIN EJECTOR COND
E-317	SYN. GAS COMPER. LEAKAGE CONDENSER
E-320	AIR COMP. LEAKAGE CONDNSER
E-404AB	WATER COOLED CONDENSER
E-461	PRODUCT NH3 HEATER
E-462	NH3 VAPORIZER
E-502	MEDIUM PRESSER DECOMPOSER
E-504	1'ST CARBAMATE CONDENSER
E-505	2'ST CARBAMATE CONDENSER
E-508	AMMONIA CONDENSER
E-531A	3RD STAGE CO2 COOLER
E-517	WSEHING WATER COOLER
E-531	CO2 COMP LEAKAGE CONDENSER
E-712ABC	P-711A, B, CT OIL COOLER
E-802ABC	K-801 A.T OIL COOLER
T-202	CO2 REGENERATOR
F-307A	SYN. GAS COMPRESSOR H.P.SEAL FILTER
F-308	GOV. OIL FILTER
F-316	AIR COMP. GOV. OIL FILTER
F-325AB	NG & REF. COMP. LUBE OIL FILTER

F-326AB	NG & REF. COMP. SEAL OIL FILTER
F-327	NG & REF. COMP. GOV. OIL FILTER
F-530AB	CO2 COMPRESSOR LUBE OIL FILTER
F-531AB	CO2 COMP. SEAL OIL FILTER
F-532	CO2 COMP. GOV. OIL FILTER
V-354A/F	TRANSFER BARRIER
V-355AB	SEAL OIL TRAPS
V-356	NG& REF. COMP. GOV.OIL ACCUMALATER
E-532AB	LUBE AND SEAL OIL COOLERS
J-501	CARBAMATE RECYCLE EJECTOR
J-502	CARBAMATE MIXER
E-106	METHANATION HEAT EXCHANGER
E-118	P-101 OIL COOLER
E-205AB	OVERHEAD CONDENSER
E-301	SYN. GAS PRECOOLER
E-302	1^{ST} STAGE SYN. GAS COOER
E-303	2^{ND} STAGE SYN. GAS COOLER
E-308	N.G. BY-PASS COOLER
E-315	SYN. GAS AFTER COOLER
E-318	SYN. GAS COMP'R COOLER
E-324B	N.G. & REFR. COMP'R COOLER
E-402	BFW PREHEATER
E-405	PRIMARY AMMONIA COLD CONDENSER
E-406	SECONDARY AMMONIA COLD CONDENSER
E-408	PURGE GAS CONDENSER
E-412	AMMONIA CONDENSER
E-420	REFR. COMP'R LEAKAGE CONDENSER
E-507	LOW PRESSURE CONDENSER
E-509A/F	STRIPPING TOWER PREHEATER
E-512	2^{ND} STAGE CO2 COOLER
V-119	N.G. SUCTION SEPERATOR
V-451	AMMONIA STORAGE TANK
V-507	CARBAMATE SOLUTION TANK
V-509	SUCTION K.O. DRUM
V-520	CARBONATE PUMP SECTION
V-552	MOTHER LIQUOR TANK
T-201	CO2 ABSORBER
T-202	CO2 REGENERATOR
R-401	SYNTHESIS CONVERTOR
R-501	UREA REACTOR
E-108	REFORMED GAS WASTE HEAT BOILER
E-501	STRIPPER

E-118 OIL COOLER

TYPE : **TSC-3A**
MAKER : **TAISEI**
HEAT EXCHANGED : **6000 Kcal/h**
COOLING AREA : **3 m^2**
OIL : **# 90 TURBINE OIL**
COOLING WATER : **COOLING TOWER WATER**

	SHELL SIDE	TUBE SIDE
FLUID	L.O.	C.T.W
PRESSURE DROP	LESS THAN 0.8 kg/cm^2	LESS THAN 0.3 kg/cm^2
OUTLET TEMP.	40 C	35.8 C
INLET TEMP.	50 C	34.6 C
FLOW RATE		
SHELL	FCD45 , SGP	
BODY	SS41 , SGP	
SHELL FLANGE	FCD45	
COVER A,B	FC20	
TUBE PLATE A,B	SS41	
RING	SS41	
SUPPORT	SS	
TUBE	SUS304 8 * 0.6 * 1017	
DISTANCE PIPE	STKH12A	
BAFFLE PLATE	SPC	
FLANGE	SS41	
PACKING	RUBBER	
PACKING	V#1500	
"O" RING	RUBBER	
ZINC PLUG	ZN , PT ½	
PLUG	FCMB , PT ¾	
BOLT	SS41 , M12 WITH NUT	
BOLT	SCM3 , M10	
AIR VENT PLUG	FCMB , PT ½	
DRAIN PLUG	FCMB , PT ¾	

MITSUBISHI HEAVY INDUSTRIES, LTD

TUBULAR HEAT EXCHANGER DATA SHEET

Rev.	
Date	
Check	

Plant	IRAQ EXP. NH3 UNIT	Item No.	E-201
Customer	MOI IRAQ	Service	CATACARB REBOILER
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type	BKU STL	Surface per Unit	1630 m²
Shell I.D.	2400/1770 Tube Length 8000	Surface per Shell	1630 m²
Regulation	Code ASME TEMA R		

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		CATACARB SOLUTION	REFORMED GAS
Total		M.W. 211800 kg/h	M.W. 139618 kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. 211800 kg/h	M.W. kg/h
Steam		18 M.W. kg/h	18 M.W. 55189 kg/h
Non-Condensable		M.W. kg/h	M.W. 84429 kg/h
Liquid	Density	1190 kg/m³ at 126.1 °c	kg/m³ at °c
	Viscosity	0.61 cp. at 126.1 °c	cp. at °c
	Specific Heat	0.739 kcal/kg °c at 126.1 °c	kcal/kg °c at °c
	Boiling Point	°c	°c
	Ther. Conductivity	0.535 kcal/mh °c at 126.1 °c	kcal/mh °c at °c
Vapor	Density	kg/m³ at °c	9.79 kg/m³ at 155 °c
	Viscosity	cp. at °c	0.0189 cp. at 155 °c
	Specific Heat	kcal/kg °c at °c	0.485 kcal/kg °c 155 °c
	Dew Point	°c	°c
	Ther. Conductivity	kcal/mh °c at °c	0.0825 kcal/mh °c at 155 °c
Fluid Vap. or Cond.		M.W. 43400 kg/h	M.W. kg/h
Steam Condensed		M.W. kg/h	M.W. 39080 kg/h
Latent Heat		kcal/kg at °c	kcal/kg at °c
Temp. In. & Out.		In: 120.8 °c Out: 126.1 °c	In: 176 °c Out: 133.3 °c
Operating Press.		1.05 kg/cm² G	In: 21.5 kg/cm² G
No. of Pass & Velocity		1 & m/s	2 & m/s
Pressure Drop		Spec.: 0.07 kg/cm² Calc.: — kg/cm²	Spec.: 0.28 kg/cm² Calc.: 0.186 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		23.08 X 10⁶ kcal/h	23.08 X 10⁶ kcal/h
Fouling Factor		Spec.: 0.0004 m²h°c/kcal	Spec.: 0.0002 m²h°c/kcal
Film Coefficient		kcal/m²h°c	kcal/m²h°c
Overall Trans. Coeff.		Clean: kcal/m²h°c Fouled	kcal/m²h°c Designed 596 kcal/m²h°c
LMTD		°c	LMTD (Corrected) 23.75 °c

Construction

Pressure	Des'n kg/cm² G	Test kg/cm² G	Des'n kg/cm² G	Test kg/cm² G			
Design Temperature	°c		°c				
Tube	No. per Shell:	Size: O.D. X	t X	Thick. (min. ave.)	Pitch		
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:)			
Channel:		Gasket:	Channel Cover:				
Shell Cover:		Gasket:	Floating Head:		Gasket:		
Tube Sheet: Stationary:		Thick.:	Floating:		Thick.:		
Cross Baffle:	Thick.:	Type:	No:	Cut:	Space:		
Long Baffle:	Thick.:	Type:	No:				
Tube Support:	Thick.:	Type:			Space:		
Corrosion Allowance	mm				mm		
Stress Relief	No , Yes		Radiograph: No , Yes		%		
Weight per Unit	Empty: kg , Tube Bundle:		kg , Full of Water:		kg		

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet		
Outlet		
Drain		
Vent		

Remarks

E-206AB OIL COOLER SPEC.

NAME OF PURCHASER / MCEC
LOCATION / M.O.I. IRAQ
PURCHASER'S ITEM NO. / E-206AB
SERVICE / P-201AB OIL COOLER

UNIT/ 2

1- PARTICULARS

2- TYPE / OC-84

SURFACE AREA		M^2	8	
			SHELL SIDE	TUBE SIDE
FLUID MATERIAL			OIL	C.T.W
QUANTITY & OPERATING PRESS.		M^3/H*KG/CMG	3.5*1.0	5*NOR.5.5
INLET TEMP.		C	55	34.6
OUTLET TEMP.		C	45	37.6
NO. OF PASS			1	4
HYDRO'C TEST PASSES		KG/CM^2G	5	10.5
TUBE NO.	OUT DIA.		THICK.	PITCH
116	15.9MM		1.6MM	21MM
WEIGHT DRY.	APPROX.		FULL WATER	APPROX.
	400KG			500KG
FOULING FACTOR	0.0006 M^2HC/KCAL			

3-NOZZLES AND CONNECTION

* C.W. INLET & OUTLET / JIS 10K – 2" FF
* OIL INLET & OUTLET / ANSI150LB- 2" RF

4-ACCESSORIES FOR / UNIT

AC1 VALVE WITH CAP(1/2", SW ,800LB) 1 , AC5 PLUG (PF 3/4) 1
AC2 VALVE WITH CAP(1/2", SW ,800LB) 1 , AC6 PLUG (PF 3/4) 1
AC3 VALVE WITH CAP(1/2", SW ,800LB) 1 , AC7 PLUG (PF 1/2) 1
AC4 PLUG (PF 3/4) 2 , AC8 VALVE WITH CAP(1/2", SW ,800LB) 1

5-SPARE PART FOR 2 UNIT

sheet packing part no. 29 400%
(for construction & contract)

6-SPECIAL TOOLS FOR UNIT /

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXP. NH3 UNIT		Item No.	E-301
Customer	M.O.I. IRAQ		Service	SYN GAS PRECOOLER
Order			No. Req'd	1
Location	Indoor (Outdoor)		Shells per Unit	1
Type	BEU		Surface per Unit	310 m²
Shell I.D.	1000	Tube Length 5000 STL	Surface per Shell	310 m²
Regulation	Code ASME TEMA R			

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		SYN. GAS	COOLING WATER
Total		8.90 M.W. 39907 kg/h	M.W. 718500 kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. kg/h	M.W. 718500 kg/h
Steam		18 M.W. 1945 kg/h	18 M.W. kg/h
Non-Condensable		8.67 M.W. 37962 kg/h	M.W. kg/h
Liquid	Density	kg/m³ at °c	993.4 kg/m³ at 37 °c
	Viscosity	cp. at °c	0.695 cp. at 37 °c
	Specific Heat	kcal/kg·°c at °c	0.998 kcal/kg·°c at 37 °c
	Boiling Point	°c	°c
	Ther. Conductivity	kcal/mh·°c at °c	0.536 kcal/mh·°c at 37 °c
Vapor	Density	5.81 kg/m³ at 86 °c	kg/m³ at °c
	Viscosity	0.0170 cp. at 86 °c	cp. at °c
	Specific Heat	0.7765 kcal/kg·°c at 86 °c	kcal/kg·°c °c
	Dew Point	77 °c	°c
	Ther. Conductivity	0.1130 kcal/mh·°c at 86 °c	kcal/mh·°c at °c
Fluid Vap. or Cond.		M.W. kg/h	M.W. kg/h
Steam Condensed		18 M.W. 1598 kg/h	M.W. kg/h
Latent Heat		kcal/kg at °c	kcal/kg at °c
Temp. In & Out		In: 135.7 °c Out: 43 °c	In: 34.6 °c Out: 40 °c
Operating Press.		In: 19.5 kg/cm²G	In: 5.5 kg/cm²G
No. of Pass & Velocity		1 & - m/s	2 & - m/s
Pressure Drop		Spec.: 0.22 kg/cm² Calc.: 0.172 kg/cm²	Spec.: 2.7 kg/cm² Calc.: 0.645 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		3.88 X 10⁶ kcal/h	3.88 X 10⁶ kcal/h
Fouling Factor		Spec.: 0.0002 m²h·°c/kcal	Spec.: 0.0006 m²h·°c/kcal
Film Coefficient		kcal/m²h·°c	- kcal/m²h·°c
Overall Trans. Coeff.		Clean: kcal/m²h·°c Fouled	kcal/m²h·°c Designed 386 kcal/m²h·°c
LMTD		°c	LMTD (Corrected) 32.43 °c

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G
Design Temperature	°c		°c	
Tube	No. per Shell:	Size: O.D. X	L X	Thick. (min. ave.)	Pitch
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:)
Channel:		Gasket:	Channel Cover:	
Shell Cover:		Gasket:	Floating Head:	Gasket:
Tube Sheet: Stationary:		Thick.:	Floating:	Thick.:
Cross Baffle:	Thick.:	Type:	No: Cut:	Space:
Long Baffle:	Thick.:	Type:	No:	
Tube Support:	Thick.:	Type:		Space:
Corrosion Allowance	mm			mm
Stress Relief	No Yes		Radiograph: No Yes	%
Weight per Unit	Empty: kg	Tube Bundle:	kg Full of Water	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			

TUBULAR HEAT EXCHANGER DATA SHEET

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Plant	IRAQ EXP. NH_3 UNIT	Item No.	E-302
Customer	M.O.I. IRAQ	Service	1ST STAGE SYN. GAS COOLER
Order		No. Req'd	1
Location	Indoor / Outdoor	Shells per Unit	1
Type	BEU STL	Surface per Unit	210 m²
Shell I.D.	860 Tube Length 5500	Surface per Shell	210 m²
Regulation	Code ASME TEMA R		

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		COOLING WATER	SYN GAS
Total		M.W. 627800 kg/h	8.72 M.W. 38309 kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. 627800 kg/h	M.W. kg/h
Steam		18 M.W. kg/h	18 M.W. 347 kg/h
Non-Condensable		M.W. kg/h	8.67 M.W. 37962 kg/h
Liquid	Density	993.4 kg/m³ at 37 °c	kg/m³ at °c
Liquid	Viscosity	0.695 cp. at 37 °c	cp. at °c
Liquid	Specific Heat	0.998 kcal/kg °c at 37 °c	kcal/kg °c at °c
Liquid	Boiling Point	°c	°c
Liquid	Ther. Conductivity	0.536 kcal/mh °c at 37 °c	kcal/mh °c at °c
Vapor	Density	kg/m³ at °c	10.87 kg/m³ at 94.5 °c
Vapor	Viscosity	cp. at °c	0.0175 cp. at 94.5 °c
Vapor	Specific Heat	kcal/kg °c at °c	0.7925 kcal/kg °c 94.5 °c
Vapor	Dew Point	°c	57 °c
Vapor	Ther. Conductivity	kcal/mh °c at °c	0.1181 kcal/mh °c at 94.5 °c
Fluid Vap. or Cond.		M.W. kg/h	M.W. kg/h
Steam Condensed		M.W. kg/h	18 M.W. 173 kg/h
Latent Heat		kcal/kg at °c	kcal/kg at °c
Temp. In. & Out.		In: 34.6 °c Out: 40 °c	In: 148.9 °c Out: 43 °c
Operating Press.		In: 5.5 kg/cm² G	In: 39.7 kg/cm² G
No. of Pass & Velocity		1 & m/s	2 & m/s
Pressure Drop		Spec.: 0.7 kg/cm² Calc.: 0.504 kg/cm²	Spec.: 0.50 kg/cm² Calc.: 0.470 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		3.39 X 10⁶ kcal/h	3.39 X 10⁶ kcal/h
Fouling Factor		Spec.: 0.0006 m²h °c/kcal	Spec.: 0.0002 m²h °c/kcal
Film Coefficient		kcal/m²h °c	kcal/m²h °c
Overall Trans. Coeff.		Clean: kcal/m²h °c Fouled	kcal/m²h °c Designed 455 kcal/m²h °c
LMTD		°c	LMTD (Corrected) 35.5 °c

Construction

Pressure	Des'n kg/cm² G	Test kg/cm² G	Des'n kg/cm² G	Test kg/cm² G
Design Temperature	°c		°c	
Tube	No. per Shell:	Size: O.D. ×	t × Thick., min. ave.:	Pitch △ □
Material & Other	Tube:	Shell:	(Shell I.D.: Thick.:)	
Channel:		Gasket:	Channel Cover:	
Shell Cover:		Gasket:	Floating Head:	Gasket:
Tube Sheet: Stationary:		Thick.:	Floating:	Thick.:
Cross Baffle:	Thick.:	Type:	No. Cut:	Space:
Long Baffle:	Thick.:	Type:	No:	
Tube Support:	Thick.:	Type:		Space:
Corrosion Allowance	mm			mm
Stress Relief	No Yes		Radiograph: No Yes	%
Weight per Unit	Empty kg	Tube Bundle kg	Full of Water:	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet		
Outlet		
Drain		
Vent		

Remarks

Painting		
Insulation	No Hot, Cold Thick. mm	

		Checked by	Designed by / Date

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MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

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Plant	IRAQ EXP. NH3 UNIT	Item No.	E-303
Customer	M.O.I IRAQ	Service	2ND STAGE SYN. GAS COOLER
Order		No. Req'd	1
Location	Indoor / Outdoor	Shells per Unit	1
Type	BEU STL	Surface per Unit	200 m²
Shell I.D.	810 Tube Length 6000	Surface per Shell	200 m²
Regulation	Code ASME TEMA R		

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		COOLING WATER	SYN. GAS
Total		18 M.W. 619300 kg/h	8.70 M.W. 38136 kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. 619300 kg/h	M.W. kg/h
Steam		18 M.W. kg/h	18 M.W. 174 kg/h
Non-Condensable		M.W. kg/h	8.67 M.W. 37962 kg/h
Liquid	Density	993.4 kg/m³ at 37 °c	kg/m³ at °c
	Viscosity	0.695 cp. at 37 °c	cp. at °c
	Specific Heat	0.998 kcal/kg·°c at 37 °c	kcal/kg·°c at °c
	Boiling Point	°c	°c
	Ther. Conductivity	0.536 kcal/mh·°c at 37 °c	kcal/mh·°c at °c
Vapor	Density	kg/m³ at °c	20.39 kg/m³ at 94 °c
	Viscosity	cp. at °c	0.0177 cp. at 94 °c
	Specific Heat	kcal/kg·°c at °c	0.804 kcal/kg·°c 94 °c
	Dew Point	°c	°c
	Ther. Conductivity	kcal/mh·°c at °c	0.12 kcal/mh·°c at 94 °c
Fluid Vap. or Cond.		M.W. kg/h	M.W. kg/h
Steam Condensed		M.W. kg/h	18 M.W. 84 kg/h
Latent Heat		kcal/kg at °c	kcal/kg at °c
Temp. In. & Out.		In: 34.6 °c Out: 40 °c	In: 148.3 °c Out: 43 °c
Operating Press.		In: 5.5 kg/cm²G	In: 75.5 kg/cm²G
No. of Pass & Velocity		1 & m/s	2 & m/s
Pressure Drop		Spec.: 0.7 kg/cm² Calc.: 0.576 kg/cm²	Spec.: 0.45 kg/cm² Calc.: 0.380 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		3.34 x 10⁶ kcal/h	3.34 x 10⁶ kcal/h
Fouling Factor		Spec.: 0.0006 m²h·°c/kcal	Spec.: 0.0002 m²h·°c/kcal
Film Coefficient		kcal/m²h·°c	kcal/m²h·°c
Overall Trans. Coeff.		Clean: kcal/m²h·°c Fouled	kcal/m²h·°c Designed 472 kcal/m²h·°c
LMTD		°c	LMTD (Corrected) 35.4 °c

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G			
Design Temperature	°c		°c				
Tube	No. per Shell:	Size: O.D. ×	t×	Thick. (min. ave.)	Pitch	△ □	
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:	)		
Channel:		Gasket:	Channel Cover:				
Shell Cover:		Gasket:	Floating Head:	Gasket:			
Tube Sheet: Stationary:		Thick.:	Floating:	Thick.:			
Cross Baffle:	Thick.:	Type:	No:	Cut:	Space:		
Long Baffle:	Thick.:	Type.	No:				
Tube Support:	Thick.:	Type:		Space:			
Corrosion Allowance	mm		mm				
Stress Relief	No , Yes		Radiograph: No , Yes	%			
Weight per Unit	Empty: kg , Tube Bundle:		kg , Full of Water:	kg			

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

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Plant IRAQ EXP. NH_3 UNIT	Item No. E-304
Customer M.O.I. IRAQ	
Order	Service 3RD STAGE SYN. GAS COOLER
Location Indoor Outdoor (circled)	No. Req'd 1
Type BJU	Shells per Unit 1
Shell I.D. 830 Tube Length 6500 STL	Surface per Unit 230 m²
Regulation Code ASME TEMA R	Surface per Shell 230 m²

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	COOLING WATER	SYN. GAS
Total	18 M.W. 898500 kg/h	8.69 M.W. 38052 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. 898500 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. 90 kg/h
Non-Condensable	M.W. kg/h	8.67 M.W. 37962 kg/h
Liquid – Density	993.4 kg/m³ at 37 °c	kg/m³ at °c
Liquid – Viscosity	0.695 cp. at 37 °c	cp. at °c
Liquid – Specific Heat	0.998 kcal/kg °c at 37 °c	kcal/kg °c at °c
Liquid – Boiling Point	°c	°c
Liquid – Ther. Conductivity	0.536 kcal/mh °c at 37 °c	kcal/mh °c at °c
Vapor – Density	kg/m³ at °c	41.88 kg/m³ at 114 °c
Vapor – Viscosity	cp. at °c	0.0187 cp. at 114 °c
Vapor – Specific Heat	kcal/kg °c at °c	0.8219 kcal/kg °c 114 °c
Vapor – Dew Point	°c	°c
Vapor – Ther. Conductivity	kcal/mh °c at °c	0.1334 kcal/mh °c at 114 °c
Fluid Vap. or Cond.	M.W. kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	18 M.W. 51 kg/h
Latent Heat	kcal/kg at °c	kcal/kg at °c
Temp. In. & Out.	In: 34.6 °c Out: 40 °c	In: 193.9 °c Out: 43 °c
Operating Press.	In: 5.5 kg/cm² G	In: 175 kg/cm² G
No. of Pass & Velocity	DIVIDED & m/s	2 & m/s
Pressure Drop	Spec.: 0.7 kg/cm² Calc.: 0.628 kg/cm²	Spec.: 0.53 kg/cm² Calc.: 0.136 kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	4.85×10^6 kcal/h	4.85×10^6 kcal/h
Fouling Factor	Spec.: 0.0006 m² h °c/kcal	Spec.: 0.0002 m² h °c/kcal
Film Coefficient	kcal/m² h °c	kcal/m² h °c
Overall Trans. Coeff.	Clean: kcal/m² h °c Fouled	kcal/m² h °c Designed 464 kcal/m² h °c
LMTD	°c	LMTD (Corrected) 45.4 °c

Construction

Pressure	Des'n kg/cm² G	Test kg/cm² G	Des'n kg/cm² G	Test kg/cm² G
Design Temperature	°c		°c	
Tube	No. per Shell:	Size: O.D. X ℓ X	Thick. (min. ave.)	Pitch △
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:)
Channel:		Gasket:	Channel Cover:	
Shell Cover:		Gasket:	Floating Head:	Gasket:
Tube Sheet: Stationary:		Thick.:	Floating:	Thick.:
Cross Baffle:	Thick.:	Type:	No: Cut:	Space:
Long Baffle:	Thick.:	Type:	No:	
Tube Support:	Thick.:	Type:		Space:
Corrosion Allowance	mm		mm	
Stress Relief	No , Yes		Radiograph: No , Yes	%
Weight per Unit	Empty: kg , Tube Bundle:		kg , Full of Water:	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

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Plant	IRAQ EXP NH3 UNIT		Item No.	E-305	
Customer	M.O.I. IRAQ		Service	1ST STAGE AIR COOLER	
Order			No. Req'd	1	
Location	Indoor (Outdoor)		Shells per Unit	1	
Type	BJS		Surface per Unit	550	m²
Shell I.D.	1290	Tube Length 6000	Surface per Shell	550	m²
Regulation	Code ASME TEMA - R				

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		AIR	COOLING WATER
Total		28.45 M.W. 43606 kg/h	M.W. 283300 kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. kg/h	M.W. 283300 kg/h
Steam		18 M.W. 1306 kg/h	18 M.W. kg/h
Non-Condensable		28.97 M.W. 42300 kg/h	M.W. kg/h
Liquid	Density	kg/m³ at °C	993.4 kg/m³ at 37 °C
	Viscosity	cp. at °C	0.695 cp. at 37 °C
	Specific Heat	kcal/kg·°C at °C	0.998 kcal/kg·°C at 37 °C
	Boiling Point	°C	°C
	Ther. Conductivity	kcal/mh·°C at °C	0.536 kcal/mh·°C at 37 °C
Vapor	Density	2.02 kg/m³ at 105 °C	kg/m³ at °C
	Viscosity	0.0211 cp. at 105 °C	cp. at °C
	Specific Heat	0.2427 kcal/kg·°C at 105 °C	kcal/kg·°C °C
	Dew Point	°C	°C
	Ther. Conductivity	0.0268 kcal/mh·°C at 105 °C	kcal/mh·°C at °C
Fluid Vap. or Cond.		M.W. kg/h	M.W. kg/h
Steam Condensed		18 M.W. 187 kg/h	M.W. kg/h
Latent Heat		kcal/kg at °C	kcal/kg at °C
Temp. In & Out		In: 174.4 °C Out: 43 °C	In: 34.6 °C Out: 40 °C
Operating Press.		In: 1.5 kg/cm²G	In: 5.5 kg/cm²G
No. of Pass & Velocity		DIVIDED & m/s	4 & m/s
Pressure Drop		Spec.: 0.16 kg/cm² Calc.: 0.159 kg/cm²	Spec.: 0.7 kg/cm² Calc.: 0.223 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		1.53 x 10⁶ kcal/h	1.53 x 10⁶ kcal/h
Fouling Factor		Spec.: 0.0002 m²h·°C/kcal	Spec.: 0.0006 m²h·°C/kcal
Film Coefficient		kcal/m²h·°C	kcal/m²h·°C
Overall Trans. Coeff.		Clean: kcal/m²h·°C Fouled	kcal/m²h·°C Designed 70.1 kcal/m²h·°C
LMTD		°C	LMTD (Corrected) 39.67 °C

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G			
Design Temperature	°C		°C				
Tube	No. per Shell:	Size: O.D. ×	× Thick. (min. ave.):	Pitch			
Material & Other	Tube:	Shell:	(Shell I.D.: Thick.:)				
Channel:		Gasket:	Channel Cover:				
Shell Cover:		Gasket:	Floating Head:	Gasket:			
Tube Sheet: Stationary:		Thick.:	Floating:	Thick.:			
Cross Baffle:	Thick.:	Type:	No:	Cut:	Space:		
Long Baffle:	Thick.:	Type:	No:				
Tube Support:	Thick.:	Type:			Space:		
Corrosion Allowance	mm				mm		
Stress Relief	No , Yes		Radiograph: No , Yes		%		
Weight per Unit	Empty: kg , Tube Bundle:		kg , Full of Water:		kg		

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			

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TUBULAR HEAT EXCHANGER DATA SHEET

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Plant	IRAQ EXP. NH_3 UNIT	Item No.	E-306
Customer	M.O.I. IRAQ	Service	2ND STAGE AIR COOLER
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type	BJS	Surface per Unit	500 m²
Shell I.D.	1140 Tube Length 6000	Surface per Shell	500 m²
Regulation	Code ASME TEMA R		

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	AIR	COOLING WATER
Total	28.52 M.W. 43419 kg/h	M.W. 322200 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. kg/h	M.W. 322200 kg/h
Steam	18 M.W. 1119 kg/h	18 M.W. kg/h
Non-Condensable	28.97 M.W. 42300 kg/h	M.W. kg/h
Liquid: Density	kg/m³ at °C	993.4 kg/m³ at 37 °C
Liquid: Viscosity	cp. at °C	0.695 cp. at 37 °C
Liquid: Specific Heat	kcal/kg °C at °C	0.998 kcal/kg °C at 37 °C
Liquid: Boiling Point	°C	°C
Liquid: Ther. Conductivity	kcal/mh °C at °C	0.536 kcal/mh °C at 37 °C
Vapor: Density	4.557 kg/m³ at 110 °C	kg/m³ at °C
Vapor: Viscosity	0.0213 cp. at 110 °C	cp. at °C
Vapor: Specific Heat	0.2431 kcal/kg °C at 110 °C	kcal/kg °C °C
Vapor: Dew Point	°C	°C
Vapor: Ther. Conductivity	0.0268 kcal/mh °C at 110 °C	kcal/mh °C at °C
Fluid Vap. or Cond.	M.W. kg/h	M.W. kg/h
Steam Condensed	18 M.W. 656 kg/h	M.W. kg/h
Latent Heat	kcal/kg at °C	kcal/kg at °C
Temp. In. & Out.	In: 169.4 °C Out: 43 °C	In: 34.6 °C Out: 40 °C
Operating Press.	In: 4.6 kg/cm² G	In: 5.5 kg/cm² G
No. of Pass & Velocity	DIVIDED & m/s	4 & m/s
Pressure Drop	Spec.: 0.15 kg/cm² Calc.: 0.12 kg/cm²	Spec.: 0.7 kg/cm² Calc.: 0.675 kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	1.74×10^6 kcal/h	1.74×10^6 kcal/h
Fouling Factor	Spec.: 0.0002 m²h°C/kcal	Spec.: 0.0006 m²h°C/kcal
Film Coefficient	kcal/m²h°C	kcal/m²h°C
Overall Trans. Coeff.	Clean: kcal/m²h°C Fouled:	kcal/m²h°C Designed: 120 kcal/m²h°C
LMTD	°C	LMTD (Corrected) 28.9 °C

Construction

Pressure	Des'n kg/cm² G	Test kg/cm² G		Des'n kg/cm² G	Test kg/cm² G		
Design Temperature	°C			°C			
Tube	No. per Shell:	Size: O.D. ×		t ×	Thick. (min. ave.)	Pitch	△ □
Material & Other	Tube:	Shell:		(Shell I.D.:	Thick.:)		
Channel:		Gasket:		Channel Cover:			
Shell Cover:		Gasket:		Floating Head:		Gasket:	
Tube Sheet: Stationary:		Thick.:		Floating:		Thick.:	
Cross Baffle:	Thick.:	Type:		No:	Cut:	Space:	
Long Baffle:	Thick.:	Type:		No:			
Tube Support:	Thick.:	Type:				Space:	
Corrosion Allowance	mm					mm	
Stress Relief	No , Yes			Radiograph: No , Yes		%	
Weight per Unit	Empty: kg , Tube Bundle:			kg , Full of Water:		kg	

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet		
Outlet		
Drain		
Vent		

Remarks

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

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Plant	IRAQ EXP. NH3 UNIT	Item No.	E-307
Customer	M.O.I. IRAQ		
Order		Service	3RD STAGE AIR COOLER
Location	Indoor (Outdoor)	No. Req'd	1
Type	BES	Shells per Unit	1
Shell I.D.	810	Tube Length	6000
Surface per Unit	250 m²		
Regulation	Code ASME TEMA R	Surface per Shell	250 m²

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		AIR	COOLING WATER
Total		28.78 M.W. 42763 kg/h	M.W. 277800 kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. kg/h	M.W. 277800 kg/h
Steam		18 M.W. 463 kg/h	18 M.W. kg/h
Non-Condensable		28.97 M.W. 42300 kg/h	M.W. kg/h
Liquid	Density	kg/m³ at °c	993.4 kg/m³ at 37 °c
	Viscosity	cp. at °c	0.695 cp. at 37 °c
	Specific Heat	kcal/kg·c at °c	0.998 kcal/kg·c at 37 °c
	Boiling Point	°c	°c
	Ther. Conductivity	kcal/mh·c at °c	0.536 kcal/mh·c at 37 °c
Vapor	Density	11.46 kg/m³ at 110 °c	kg/m³ at °c
	Viscosity	0.0216 cp. at 110 °c	cp. at °c
	Specific Heat	0.2414 kcal/kg·c at 110 °c	kcal/kg·c °c
	Dew Point	°c	°c
	Ther. Conductivity	0.0272 kcal/mh·c at 110 °c	kcal/mh·c at °c
Fluid Vap. or Cond.		M.W. kg/h	M.W. kg/h
Steam Condensed		18 M.W. 280 kg/h	M.W. kg/h
latent Heat		kcal/kg at °c	kcal/kg at °c
Temp. In & Out.		In: 170 °c Out: 43 °c	In: 34.6 °c Out: 40 °c
Operating Press.		1.0 12.3 kg/cm²G	1.0 5.5 kg/cm²G
No. of Pass & Velocity		1 & m/s	2 & m/s
Pressure Drop		Spec.: 0.25 kg/cm² Calc.: 0.241 kg/cm²	Spec.: 0.7 kg/cm² Calc.: 0.229 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		1.50 × 10⁶ kcal/h	1.50 × 10⁶ kcal/h
Fouling Factor		Spec.: 0.0002 m²h·c/kcal	Spec.: 0.0006 m²h·c/kcal
Film Coefficient		kcal/m²h·c	kcal/m²h·c
Overall Trans. Coeff.		Clean: kcal/m²h·c Fouled	kcal/m²h·c Designed 181 kcal/m²h·c
LMTD		°c	LMTD (Corrected) 33.2 °c

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G
Design Temperature	°c		°c	
Tube	No. per Shell:	Size: O.D. ×	t ×	Thick. (min. ave.)	Pitch △
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:)
Channel:		Gasket:	Channel Cover:	
Shell Cover:		Gasket:	Floating Head:	Gasket:
Tube Sheet: Stationary:		Thick.:	Floating:	Thick.:
Cross Baffle:	Thick.:	Type:	No: Cut:	Space:
Long Baffle:	Thick.:	Type:	No:	
Tube Support:	Thick.:	Type:		Space:
Corrosion Allowance	mm		mm	
Stress Relief	No Yes		Radiograph: No Yes	%
Weight per Unit	Empty: kg	Tube Bundle:	kg Full of Water:	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXP. NH3 UNIT		Item No.	E-308
Customer	M.O.I IRAQ		Service	N G BY-PASS COOLER
Order			No. Req'd	1
Location	Indoor (Outdoor)		Shells per Unit	1
Type	BEU		Surface per Unit	80.0 m²
Shell I.D.	620	Tube length 4000 STL	Surface per Shell	80.0 m²
Regulation	Code ASME TEMA R			

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		COOLING WATER	NATURAL GAS
Total		M.W. 153600 kg/h	M.W. 21.50 M.W. 14000 kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. 153600 kg/h	M.W. kg/h
Steam		18 M.W. kg/h	18 M.W. kg/h
Non-Condensable		M.W. kg/h	21.50 M.W. 14000 kg/h
Liquid	Density	993.4 kg/m³ at 37 °c	kg/m³ at °c
	Viscosity	0.695 cp. at 37 °c	cp. at °c
	Specific Heat	0.998 kcal/kg·°c at 37 °c	kcal/kg·°c at °c
	Boiling Point	°c	°c
	Ther. Conductivity	0.536 kcal/mh·°c at 37 °c	kcal/mh·°c at °c
Vapor	Density	kg/m³ at °c	11.22 kg/m³ at 95 °c
	Viscosity	cp. at °c	0.0127 cp. at 95 °c
	Specific Heat	kcal/kg·°c at °c	0.5436 kcal/kg·°c 95 °c
	Dew Point	°c	°c
	Ther. Conductivity	kcal/mh·°c at °c	0.0317 kcal/mh·°c at 95 °c
Fluid Vap. or Cond.		M.W. kg/h	M.W. kg/h
Steam Condensed		M.W. kg/h	M.W. kg/h
Latent Heat		kcal/kg at °c	kcal/kg at °c
Temp. In. & Out.		In: 34.6 °c Out: 40 °c	In: 152.4 °c Out: 43 °c
Operating Press.		In: 5.5 kg/cm²G	In: 15 kg/cm²G
No. of Pass & Velocity		1 & m/s	2 & m/s
Pressure Drop		Spec.: 0.7 kg/cm² Calc.: 0.443 kg/cm²	Spec.: 0.5 kg/cm² Calc.: 0.235 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		0.83 x 10⁶ kcal/h	0.83 x 10⁶ kcal/h
Fouling Factor		Spec.: 0.0006 m²h·°c/kcal	Spec.: 0.0002 m²h·°c/kcal
Film Coefficient		kcal/m²h·°c	kcal/m²h·°c
Overall Trans. Coeff.		Clean: kcal/m²h·°c Fouled	kcal/m²h·°c Designed 286 kcal/m²h·°c
LMTD		°c	LMTD Corrected 36.3 °c

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G		Des'n kg/cm²G	Test kg/cm²G		
Design Temperature	°c			°c			
Tube	No. per Shell:	Size: O.D. x	t x	Thick. (min. ave.):	Pitch	△ □	
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:)			
Channel:		Gasket:		Channel Cover:			
Shell Cover:		Gasket:		Floating Head:		Gasket:	
Tube Sheet: Stationary:		Thick.:		Floating:		Thick.:	
Cross Baffle:	Thick.:	Type:	No:	Cut:	Space:		
Long Baffle:	Thick.:	Type:	No:				
Tube Support:	Thick.:	Type:			Space:		
Corrosion Allowance	mm				mm		
Stress Relief	No , Yes			Radiograph. No , Yes	%		
Weight per Unit	Empty: kg , Tube Bundle:			kg , Full of Water:	kg		

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev.	
Date	
Check	

Plant	IRAQ EXP. NH3 UNIT	Item No.	E-402
Customer	M.O.I. IRAQ		
Order		Service	BFW PREHEATER
Location	Indoor / (Outdoor)	No. Req'd	1
Type	U-TUBE	Shells per Unit	1
Shell I.D.	1100 Tube length 4000 STL	Surface per Unit	290 m²
Regulation	Code ASME TEMA R	Surface per Shell	290 m²

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	B.F.W	CONVERTED GAS
Total	M.W. 112200 kg/h	11.24 M.W. 174952 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. 112200 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	11.24 M.W. 174952 kg/h
Liquid — Density	885 kg/m³ at 190 °c	kg/m³ at °c
Liquid — Viscosity	0.15 cp. at 190 °c	cp. at °c
Liquid — Specific Heat	1.065 kcal/kg °c at 190 °c	kcal/kg °c at °c
Liquid — Boiling Point	°c	°c
Liquid — Ther. Conductivity	0.576 kcal/mh °c at 190 °c	kcal/mh °c at °c
Vapor — Density	kg/m³ at °c	48.51 kg/m³ at 270 °c
Vapor — Viscosity	cp. at °c	0.0219 cp. at 270 °c
Vapor — Specific Heat	kcal/kg °c at °c	0.73 kcal/kg °c 270 °c
Vapor — Dew Point	°c	°c
Vapor — Ther. Conductivity	kcal/mh °c at °c	0.134 kcal/mh °c at 270 °c
Fluid Vap. or Cond.	M.W. kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °c	kcal/kg at °c
Temp. In. & Out.	In: 125.5 °c Out: 260 °c	In: 336 °c Out: 205.7 °c
Operating Press.	In: 82 kg/cm² G	In: 217.6 kg/cm² G
No. of Pass & Velocity	2 & m/s	2 & m/s
Pressure Drop	Spec.: 0.8 kg/cm² Calc.: 0.191 kg/cm²	Spec.: 1.40 kg/cm² Calc.: 1.229 kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	16.61 X 10⁶ kcal/h	16.61 X 10⁶ kcal/h
Fouling Factor	Spec.: 0.0002 m² h °c/kcal	Spec.: 0.0002 m² h °c/kcal
Film Coefficient	kcal/m² h °c	kcal/m² h °c
Overall Trans. Coeff.	Clean: kcal/m² h °c Fouled	kcal/m² h °c Designed 730 kcal/m² h °c
LMTD	°c	LMTD (Corrected 78.5 °c

Construction

Pressure	Des'n kg/cm² G Test kg/cm² G	Des'n kg/cm² G Test kg/cm² G
Design Temperature	°c	°c
Tube	No. per Shell:	Size: O.D.X ℓX Thick. (min. ave.) Pitch
Material & Other	Tube:	Shell: (Shell I.D.: Thick.:)
Channel:	Gasket:	Channel Cover:
Shell Cover:	Gasket:	Floating Head: Gasket:
Tube Sheet: Stationary:	Thick.:	Floating: Thick.:
Cross Baffle:	Thick.: Type:	No: Cut: Space:
Long Baffle:	Thick.: Type:	No:
Tube Support:	Thick.: Type:	Space:
Corrosion Allowance	mm	mm
Stress Relief	No , Yes	Radiograph: No , Yes %
Weight per Unit	Empty: kg , Tube Bundle:	kg , Full of Water: kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			
Painting			
Insulation	No Hot Cold Thick. mm		

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. 1
Date
Check

Plant	IRAQ EXP. NH3 UNIT	Item No.	E-404 AB
Customer	M.O.I IRAQ	Service	WATER COOLED CONDENSER
Order		No. Req'd	2
Location	Indoor (Outdoor)	Shells per Unit	1
Type	U-TUBE	Surface per Unit	600 m²
Shell I.D.	1250 Tube Length 8000 STL	Surface per Shell	600 m²
Regulation	Code ASME TEMA R		

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	COOLING WATER	CONVERTED SYN. GAS
Total	M.W. 1300000 ① kg/h	11.24 M.W. 174952 kg/h
Vapor	M.W. kg/h	17.03 M.W. 45554 kg/h
Liquid	M.W. 1300000 ① kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	10.04 M.W. 129398 kg/h
Liquid: Density	994 kg/m³ at 36 °c	kg/m³ at °c
Liquid: Viscosity	0.709 cp. at 36 °c	cp. at °c
Liquid: Specific Heat	0.998 kcal/kg °c at 36 °c	kcal/kg °c at °c
Liquid: Boiling Point	°c	°c
Liquid: Ther. Conductivity	0.535 kcal/mh °c at 36 °c	kcal/mh °c at °c
Vapor: Density	kg/m³ at °c	79.30 kg/m³ at 68 °c
Vapor: Viscosity	cp. at °c	0.0157 cp. at 68 °c
Vapor: Specific Heat	kcal/kg °c at °c	0.75 kcal/kg °c 68 °c
Vapor: Dew Point	°c	°c
Vapor: Ther. Conductivity	kcal/mh °c at °c	0.0982 kcal/mh °c at 68 °c
Fluid Vap. or Cond.	M.W. kg/h	17.03 M.W. 11748 kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °c	kcal/kg at °c
Temp. In & Out	In: 34.6 °c Out: 42.8 ① °c	In: 101.7 °c Out: 41 °c
Operating Press.	In: 5.5 kg/cm²G	In: 214.6 kg/cm²G
No. of Pass & Velocity	2 & m/s	2 & m/s
Pressure Drop	Spec.: 1.1 kg/cm² Calc.: 0.68 kg/cm²	Spec.: 0.84 kg/cm² Calc.: 0.691 kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	10.61×10^6 kcal/h	10.61×10^6 kcal/h
Fouling Factor	Spec.: 0.0006 m²h°c/kcal	Spec.: 0.0002 m²h°c/kcal
Film Coefficient	kcal/m²h°c	kcal/m²h°c
Overall Trans. Coeff.	Clean: kcal/m²h°c Fouled	kcal/m²h°c Designed: 1099 kcal/m²h°c
LMTD	°c	LMTD (Corrected) 16.09 °c

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G	
Design Temperature	°c		°c		
Tube	No. per Shell:	Size: O.D. X	t X	Thick. (min. ave.)	Pitch △ □
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:)	
Channel:		Gasket:	Channel Cover:		
Shell Cover:		Gasket:	Floating Head:		Gasket:
Tube Sheet: Stationary:		Thick.:	Floating:		Thick.:
Cross Baffle:	Thick.:	Type:	No:	Cut:	Space:
Long Baffle:	Thick.:	Type:	No:		
Tube Support:	Thick.:	Type:			Space:
Corrosion Allowance	mm				mm
Stress Relief	No	Yes	Radiograph: No		Yes %
Weight per Unit	Empty: kg, Tube Bundle:		kg Full of Water		kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			
Painting			
Insulation	No Hot, Cold Thick. mm		

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MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. ◇
Date
Check

Plant	IRAQ EXP. NH_3 UNIT	Item No.	E-404 AB
Customer	M.O.I IRAQ	Service	WATER COOLED CONDENSER
Order			
Location	Indoor (Outdoor)	No. Req'd	2
Type	U-TUBE	Shells per Unit	1
Shell I.D.	1250 Tube Length 8000 STL	Surface per Unit	600 m²
Regulation	Code ASME TEMA R	Surface per Shell	600 m²

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	COOLING WATER	CONVERTED SYN. GAS
Total	M.W. 1300000 ◇ kg/h	11.24 M.W. 124952 kg/h
Vapor	M.W. kg/h	17.93 M.W. 45554 kg/h
Liquid	M.W. 1300000 ◇ kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	10.04 M.W. 129398 kg/h
Liquid: Density	994 kg/m³ at 36 °c	kg/m³ at °c
Liquid: Viscosity	0.709 cp. at 36 °c	cp. at °c
Liquid: Specific Heat	0.998 kcal/kg·°c at 36 °c	kcal/kg·°c at °c
Liquid: Boiling Point	°c	°c
Liquid: Ther. Conductivity	0.535 kcal/mh·°c at 36 °c	kcal/mh·°c at °c
Vapor: Density	kg/m³ at °c	79.30 kg/m³ at 68 °c
Vapor: Viscosity	cp. at °c	0.0157 cp. at 68 °c
Vapor: Specific Heat	kcal/kg·°c at °c	0.75 kcal/kg·°c 68 °c
Vapor: Dew Point	°c	°c
Vapor: Ther. Conductivity	kcal/mh·°c at °c	0.0982 kcal/mh·°c at 68 °c
Fluid Vap. or Cond.	M.W. kg/h	17.03 M.W. 11748 kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °c	kcal/kg at °c
Temp. In & Out	In: 34.6 °c Out: 42.8 ◇ °c	In: 101.7 °c Out: 41 °c
Operating Press.	In: 5.5 kg/cm²G	In: 214.6 kg/cm²G
No. of Pass & Velocity	2 & m/s	2 & m/s
Pressure Drop	Spec.: 1.1 kg/cm² Calc.: 0.68 kg/cm²	Spec.: 0.84 kg/cm² Calc.: 0.681 kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	10.61×10^6 kcal/h	10.61×10^6 kcal/h
Fouling Factor	Spec.: 0.0006 m²h·°c/kcal	Spec.: 0.0002 m²h·°c/kcal
Film Coefficient	kcal/m²h·°c	kcal/m²h·°c
Overall Trans. Coeff.	Clean: kcal/m²h·°c Fouled	kcal/m²h·°c Designed: 1099 kcal/m²h·°c
LMTD	°c	LMTD (Corrected) 16.09 °c

Construction

Pressure	Des'n kg/cm²G Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G
Design Temperature	°c	°c	
Tube	No. per Shell:	Size: O.D. × t ×	Thick (min. ave.): Pitch △
Material & Other	Tube:	Shell: (Shell I.D.: Thick.:)	
Channel:		Gasket:	Channel Cover:
Shell Cover:		Gasket:	Floating Head: Gasket:
Tube Sheet: Stationary:		Thick.:	Floating: Thick.:
Cross Baffle:	Thick.:	Type:	No: Cut: Space:
Long Baffle:	Thick.:	Type:	No:
Tube Support:	Thick.:	Type:	Space:
Corrosion Allowance	mm		mm
Stress Relief	No Yes		Radiograph: No Yes %
Weight per Unit	Empty: kg Tube Bundle:	kg Full of Water	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			
Painting			
Insulation			

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MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. | Date | Check

Plant	IRAQ EXP. NH3 UNIT	Item No.	E-405
Customer	M.O.I. IRAQ	Service	PRIMARY NH3 COOLER CONDENSER
Order		No Req'd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type	U-KETTLE	Surface per Unit	460 m²
Shell I.D.	1900/1250 Tube Length 5000 STL	Surface per Shell	460 m²
Regulation	Code ASME TEMA R		

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	REFRIGERANT NH3	RECYCLE GAS
Total	17.03 M.W. 67027 kg/h	10.97 M.W. 158034 kg/h
Vapor	17.03 M.W. 4915 kg/h	17.03 M.W. 19826 kg/h
Liquid	17.03 M.W. 62112 kg/h	17.03 M.W. 12941 kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	10.03 M.W. 125267 kg/h
Liquid: Density	627 kg/m³ at 8.33 °c	kg/m³ at °c
Liquid: Viscosity	0.15 cp. at 8.33 °c	cp. at °c
Liquid: Specific Heat	1.12 kcal/kg·c at 8.33 °c	kcal/kg·c at °c
Liquid: Boiling Point	°c	°c
Liquid: Ther. Conductivity	0.428 kcal/mh·c at 8.33 °c	kcal/mh·c at °c
Vapor: Density	kg/m³ at °c	89.74 kg/m³ at 20 °c
Vapor: Viscosity	cp. at °c	0.0145 cp. at 20 °c
Vapor: Specific Heat	kcal/kg·c at °c	0.76 kcal/kg·c 20 °c
Vapor: Dew Point	°c	°c
Vapor: Ther. Conductivity	kcal/mh·c at °c	0.0981 kcal/mh·c at 20 °c
Fluid Vap. or Cond.	17.03 M.W. 15642 kg/h	17.03 M.W. 6500 kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °c	kcal/kg at °c
Temp. In & Out	In: 8.33 °c Out: 8.33 °c	In: 26.5 °c Out: 14 °c
Operating Press.	4.89 kg/cm²G	In: 236.9 kg/cm²G
No. of Pass & Velocity	1 & m/s	2 & m/s
Pressure Drop	Spec.: 0.014 kg/cm² Calc.: kg/cm²	Spec.: 0.84 kg/cm² Calc.: 0.547 kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	3.16 X 10⁶ kcal/h	3.16 X 10⁶ kcal/h
Fouling Factor	Spec.: 0.0002 m²h·c/kcal	Spec.: 0.0002 m²h·c/kcal
Film Coefficient	kcal/m²h·c	
Overall Trans. Coeff.	Clean: kcal/m²h·c Fouled	kcal/m²h·c Designed 635 kcal/m²h·c
LMTD	°c	LMTD (Corrected) 10.81 °c

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G		Des'n kg/cm²G	Test kg/cm²G		
Design Temperature	°c			°c			
Tube	No. per Shell:	Size: O.D. X	t X	Thick. (min. ave.):	Pitch	△	
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:	)		
Channel:		Gasket:	Channel Cover:				
Shell Cover:		Gasket:	Floating Head:		Gasket:		
Tube Sheet: Stationary:		Thick.:	Floating:		Thick.:		
Cross Baffle:	Thick.:	Type:	No:	Cut:	Space:		
Long Baffle:	Thick.:	Type:	No:				
Tube Support:	Thick.:	Type:			Space:		
Corrosion Allowance	mm				mm		
Stress Relief	No Yes		Radiograph: No Yes		%		
Weight per Unit	Empty: kg Tube Bundle:		kg Full of Water		kg		

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet		
Outlet		
Drain		
Vent		

Remarks

Painting

Insulation: No Hot, Cold Thick. mm

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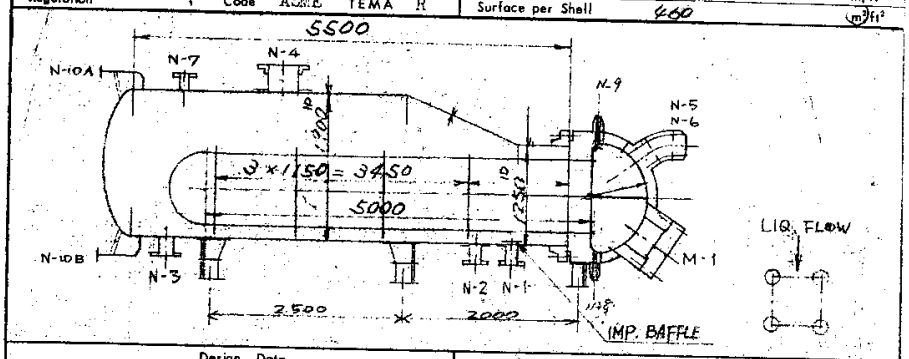
MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET

Rev.	
Date	
Check	

Plant	800 MT/D NH3 UNIT
Customer	M.O.I. IRAQ
Order	563021
Location	Indoor · Outdoor
Type	U-KETTLE STL
Shell I.D.	1900/1250 Tube Length 5000
Regulation	Code ASME TEMA R

Item No.	E-405
Service	PRIMARY NH3 COOLED CONDENSER
No. Req'd	1 (ONE)
Shells per Unit	1
Surface per Unit	460 m^2 ft^2
Surface per Shell	460 (m^2) ft^2



Design Data

		Shell Side	Tube Side
Fluid		REFRIG. NH3	REC'C. GAS
Oper. Press.	kg/cm² G, PSIG	4.9	237.2
Design Press.	kg/cm² G, PSIG	20	263
Oper. Temp. In & Out	°C, °F	8.99/12.33	26.5/14
Design Temp.	°C, °F	46	46
Hydro. Test Press.	kg/cm² G, PSIG	30	395
Pneu. Test Press.	kg/cm² G, PSIG	20	263
Radiograph		20%	100%
Post Weld Heat Treatment		NO	YES
Joint Efficiency	%	85	100
Corrosion Allowance	mm, in.	3.2	3.2
Painting		YES	YES
Insulation Hot, (Cold)	mm, in.	40	30
Number of Pass		1	2

Tube 15.9 O.D. × 2.3 (Min. Aver. Wall) × 5.000 L

No. per Shell U1014 Pitch 22 △ ▷ □ ◇

Weight : Empty kg, lb

Full of Water kg, lb

Bill of Material

Part	Mat'l	No. Req'd	Remarks
SHELL	SM41B		
SHELL FLANGE	SF50		
CHANNEL COVER	SB46		
TUBE SHEET	SF50		
TUBE	STB35-S		
NOZZLE NECK	STPG38		
NOZZLE FLANGE	SF45		
STUB END	SF50		
BAFFLE & TIE ROD	S541		
SPACER	SGP		
BOLT (FOR M.H.)	SCM3		
NUT	S45C		
GASKET (SHELL)	Y#520		
SADDLE	SM41B/SS41		
GASKET (M.H.)	SOFT IRON		
MAN HOLE & COVER	SF50		

Nozzle & Connection

Mark	Size	No. Req'd	Rating	Service	Proj. L to Face	Remarks
N-1	4B	1	ANSI 300 50 RF	LIQ. NH3 IN		
N-2	5B	1	ANSI 300 50 RF	LIQ NH3 IN		
N-3	4B	1	ANSI 300 50 RF	LIQ. NH3 OUT		
N-4	10B	1	ANSI 300 50 RF	VAP. NH3 OUT		
N-5	10B	1	STUB END	GAS INLET		ID 216.4
N-6	10B	1	STUB END	GAS OUTLET		ID 216.4
N-7	4B	1	ANSI 300 50 RF	S. V.		
N-8	3/4B	1	STUB END	DRAIN		ID 16.2
N-9	3/4B	1	STUB END	VENT		ID 16.2
N-10 A, B	2B	2	ANSI 300 50 RF	LG LIC (ONN		
M-1	450	1		MAN HOLE		

Note (1) STRENGTH WELD TUBES TO TUBE SHEET.

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXP. NH_3 UNIT	Item No.	E-406
Customer	M.O.I. IRAQ	Service	SECONDARY NH_3 COOLED CONDENSER
Order		No. Req'd	1
Location	Indoor / (Outdoor)	Shells per Unit	1
Type	U-KETTLE	Surface per Unit	500 m²
Shell I.D.	1900/1250 Tube Length 5000 STL	Surface per Shell	500 m²
Regulation	Code ASME TEMA R		

Performance of One Unit

		Shell Side		Tube Side	
Fluid Circulated		REFRIGERANT NH_3		RECYCLE GAS	
Total		17.03 M.W. 51385 kg/h		10.44 M.W. 195897 kg/h	
Vapor		17.03 M.W. 2281 kg/h		17.03 M.W. 17537 kg/h	
Liquid		17.03 M.W. 49104 kg/h		17.03 M.W. 15230 kg/h	
Steam		18 M.W. kg/h		18 M.W. kg/h	
Non-Condensable		M.W. kg/h		9.68 M.W. 163095 kg/h	
Liquid	Density	644 kg/m³ at −4 °c		kg/m³ at °c	
	Viscosity	0.15 cp. at −4 °c		cp. at °c	
	Specific Heat	1.1 kcal/kg·°c at −4 °c		kcal/kg·°c at °c	
	Boiling Point	°c		°c	
	Ther. Conductivity	0.45 kcal/mh·°c at −4 °c		kcal/mh·°c at °c	
Vapor	Density	kg/m³ at °c		87.36 kg/m³ at 8 °c	
	Viscosity	cp. at °c		0.0145 cp. at 8 °c	
	Specific Heat	kcal/kg·°c at °c		0.76 kcal/kg·°c 8 °c	
	Dew Point	°c		°c	
	Ther. Conductivity	kcal/mh·°c at °c		0.0952 kcal/mh·°c at 8 °c	
Fluid Vap. or Cond.		17.03 M.W. 12684 kg/h		17.03 M.W. 5471 kg/h	
Steam Condensed		M.W. kg/h		M.W. kg/h	
Latent Heat		kcal/kg at °c		kcal/kg at °c	
Temp. In & Out		In: −3.89 °c Out: −3.39 °c		In: 13.3 °c Out 2.2 °c	
Operating Press.		2.75 kg/cm²G		In: 235.6 kg/cm²G	
No. of Pass & Velocity		1 & m/s		2 & m/s	
Pressure Drop		Spec.: 0.0141 kg/cm² Calc.: — kg/cm²		Spec.: 0.84 kg/cm² Calc.: 0.634 kg/cm²	
Sensible Heat		kcal/h		kcal/h	
Latent Heat		kcal/h		kcal/h	
Total Heat Duty		3.17×10^6 kcal/h		3.17×10^6 kcal/h	
Fouling Factor		Spec.: 0.0002 m²h·°c/kcal		Spec.: 0.0002 m²h·°c/kcal	
Film Coefficient		kcal/m²h·°c		kcal/m²h·°c	
Overall Trans. Coeff.		Clean: kcal/m²h·°c Fouled		kcal/m²h·°c Designed 570 kcal/m²h·°c	
LMTD		°c		LMTD Corrected: 11.18 °c	

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G	
Design Temperature	°c		°c		
Tube	No. per Shell:	Size: O.D. ×	t ×	Thick.(min. ave.):	Pitch △
Material & Other	Tube:	Shell:	(Shell I.D..	Thick.:)	
Channel		Gasket:	Channel Cover:		
Shell Cover:		Gasket:	Floating Head:	Gasket:	
Tube Sheet: Stationary:		Thick.:	Floating:	Thick.:	
Cross Baffle:	Thick.:	Type:	No:	Cut:	Space:
Long Baffle:	Thick.:	Type:	No:		
Tube Support:	Thick.:	Type:			Space:
Corrosion Allowance	mm		mm		
Stress Relief	No Yes		Radiograph: No Yes		%
Weight per Unit	Empty: kg Tube Bundle:		kg Full of Water:		kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			
Painting			

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET

Rev.	
Date	
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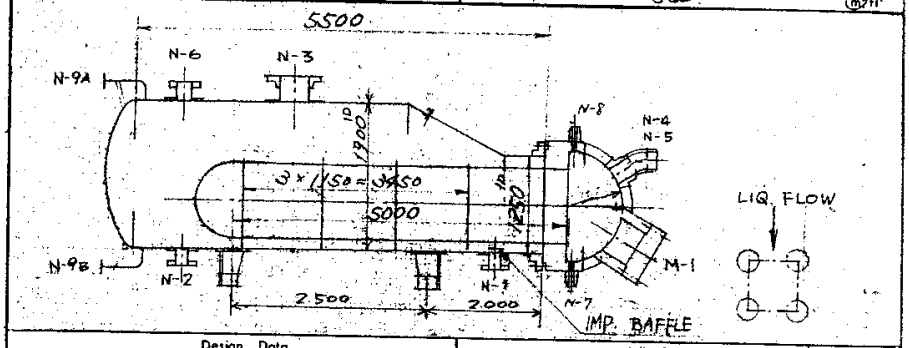
Plant	800 MT/D NH3 UNIT	Item No.	E-406
Customer	M.O.I. IRAQ	Service	SECONDARY NH3 COOL) CONDENSER
Order	583021	No. Req'd	1 (ONE)
Location	Indoor / Outdoor	Shells per Unit	1
Type	U-KETTLE	Surface per Unit	500 m² ft²
Shell I.D.	1900/1250 Tube Length 5000 STL	Surface per Shell	500 (m²) ft²
Regulation	Code ASME TEMA R		



Design Data

		Shell Side	Tube Side
Fluid		REFRIG. NH3	RECYC. GAS
Oper. Press.	kg/cm²G PSIG	2.75	235
Design Press.	kg/cm²G PSIG	20.0	263
Oper. Temp. In & Out	℃ °F	-2.33/3.89	13.3/21.2
Design Temp.	℃ °F	46	28
Hydro. Test Press.	kg/cm²G PSIG	30	395
Pneu. Test Press.	kg/cm²G PSIG	20	263
Radiograph		20%	100%
Post Weld Heat Treatment		YES	YES
Joint Efficiency	%	85	100
Corrosion Allowance	mm in.	3.2	3.2
Painting		YES	YES
Insulation Hot, Cold	mm in.	75	50
Number of Pass		1	2

Tube 15.9 O.D. × 2.3 (Min. Aver. Wall) t × 5000 L

No. per Shell 1101 Pitch 22 △ ▷ □ ◇

Weight : Empty kg, Lb

Full of Water kg, Lb

Nozzle & Connection

Mark	Size	No. Req'd	Rating	Service	Proj. to Face	Remarks
N-1	4B	1	ANSI 300 SO.RF	LIQ. NH3 IN.		
N-2	4B	1	ANSI 300 SO.RF	LIQ. NH3 OUT		
N-3	10B	1	ANSI 300 SO.RF	VAP. NH3 OUT		
N-4	10B	1	STUB END	GAS INLET		IP 216.4
N-5	10B	1	STUB END	GAS OUTLET		IP 216.4
N-6	4B	1	ANSI 300 SO.RF	S. V		
N-7	3/4B	1	STUB END	DRAIN		
N-8	3/4B	1	STUB END	VENT		
N-9A,B	2B	2	ANSI 300 SO.RF	LG. LIQ. CONN.		
M-1	450A	1	SPECIAL	M.H.		

Bill of Material

Part	Mat'l	No. Req'd	Remarks
SHELL	SM41B		
SHELL FLANGE	SF50		
CHANNEL COVER	SB46		
TUBE SHEET	SF50		
TUBE	STB35-S		
NOZZLE NECK	STPG38		
NOZZLE FLANGE	SF45		
STUB END	SF50		
BAFFLE & TIE ROD	SS41		
SPACER	SGP		
BOLT	SCM3		
NUT	S45C		
GASKET (SHELL)	V*520		
SADDLE	SM41B/SS41		
GASKET (MAN HOLE)	SOFT IRON		
MAN HOLE & COVER	SF50		

Note (1) STRENGTH WELD TUBES TO TUBE SHEET.

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant: IRAQ EXP NH3 STORAGE UNIT
Customer: M.O.I IRAQ
Order:
Location: Indoor / (Outdoor)
Type: HORIZONTAL U-TUBE BEU
Shell I.D.: 480 Tube Length: 3000 STL
Regulation: Code: TEMA: R

Item No.: E-460
Service: PRODUCT AMMONIA HEATER
No. Req'd: 1
Shells per Unit: 1
Surface per Unit: 35.0 m²
Surface per Shell: 35.0 m²

Performance of One Unit

	Shell Side		Tube Side	
Fluid Circulated	VAPORIZED AMMONIA		LIQUID AMMONIA	
Total	17.03 M.W.	4,794.5 kg/h	17.03 M.W.	24,000 kg/h
Vapor	17.03 M.W.	4,794.5 kg/h		kg/h
Liquid	M.W.	kg/h	17.03 M.W.	24,000 kg/h
Steam	18 M.W.	kg/h	18 M.W.	kg/h
Non-Condensable	M.W.	kg/h	M.W.	kg/h
Liquid: Density	581	kg/m³ at 40 °C	652	kg/m³ at −9 °C
Liquid: Viscosity	0.19	cp. at 40 °C	0.24	cp. at −9 °C
Liquid: Specific Heat	1.194	kcal/kg·°C at 40 °C	1.095	kcal/kg·°C at −9 °C
Liquid: Boiling Point		°C		°C
Liquid: Ther. Conductivity	0.425	kcal/m·h·°C at 40 °C	0.467	kcal/m·h·°C at −9 °C
Vapor: Density		kg/m³ at °C		kg/m³ at °C
Vapor: Viscosity		cp. at °C		cp. at °C
Vapor: Specific Heat		kcal/kg·°C at °C		kcal/kg·°C at °C
Vapor: Dew Point	40	°C		°C
Vapor: Ther. Conductivity		kcal/m·h·°C at °C		kcal/m·h·°C at °C
Fluid Evap. Cond.	17.03 M.W.	4794.5 kg/h	M.W.	kg/h
Steam Condensed	M.W.	kg/h	M.W.	kg/h
Latent Heat	262.85	kcal/kg at 40 °C		kcal/kg at °C
Temp. In & Out	In 40 °C	Out 40 °C	In −33 °C	Out 15 °C
Operating Press.	14.85	kg/cm²G		kg/cm²G
No. of Pass & Velocity	1	& m/s	2	& m/s
Pressure Drop	Spec. kg/cm² Calc. —	kg/cm²	Spec. 0.7 kg/cm² Calc. 0.027	kg/cm²
Sensible Heat		kcal/h	1,260,000	kcal/h
Latent Heat	1,260,000	kcal/h		kcal/h
Total Heat Duty	1,260,000	kcal/h	1,260,000	kcal/h
Fouling Factor	Spec. 0.0002	m²·h·°C/kcal	Spec. 0.0002	m²·h·°C/kcal
Film Coefficient		kcal/m²·h·°C		kcal/m²·h·°C
Overall Trans. Coeff.	Clean: kcal/m²·h·°C	Fouled	kcal/m²·h·°C Designed 803	kcal/m²·h·°C
LMTD	°C		LMTD Corrected 44.8	°C

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G
Design Temperature	°C		°C	
Tube	No. per Shell:	Size: O.D. ×	Thick. mm ave.	Pitch
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:
Channel		Gasket:	Channel Cover:	
Shell Cover		Gasket:	Floating Head:	Gasket:
Tube Sheet: Stationary		Thick.:	Floating:	Thick.:
Cross Baffle:	Thick.:	Type:	No: Cut	Space:
Long Baffle:	Thick.:	Type:	No:	
Tube Support:	Thick.:	Type:		Space:
Corrosion Allowance	mm			mm
Stress Relief	No	Yes	Radiograph: No	Yes %
Weight per Unit	Empty: kg	Tube Bundle	kg	Full of Water kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)	Remarks
Inlet			
Outlet			
Drain			
Vent			

Painting

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXP. NH_3 STORAGE UNIT	Item No.	E-461
Customer	M.O.I. IRAQ	Service	AMMONIA VAPORIZER
Order		No. Req'd	1
Location	Indoor / (Outdoor)	Shells per Unit	1
Type	U-TUBE KETTLE BKU	Surface per Unit	23.0 m²
Shell I.D.	700/400 Tube Length 3000 STL	Surface per Shell	23.0 m²
Regulation	Code TEMA R		

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	LIQUID AMMONIA	LOW PRESS. STEAM
Total	17.03 M.W. 4794.5 kg/h	18 M.W. 2196.3 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	17.03 M.W. 4,794.5 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. 2196.3 kg/h
Non-Condensable	M.W. kg/h	M.W. kg/h
Liquid: Density	581 kg/m³ at 40 °C	926.5 kg/m³ at 138.2 °C
Liquid: Viscosity	0.19 cp at 40 °C	0.20 cp at 138.2 °C
Liquid: Specific Heat	1.194 kcal/kg°C at 40 °C	1.036 kcal/kg°C at 138.2 °C
Liquid: Boiling Point	40 °C	°C
Liquid: Ther. Conductivity	0.425 kcal/mh°C at 40 °C	0.585 kcal/mh°C at 138.2 °C
Vapor: Density	kg/m³ at °C	1.60 kg/m³ at 199.1 °C
Vapor: Viscosity	cp at °C	0.0161 cp at 199.1 °C
Vapor: Specific Heat	kcal/kg°C at °C	0.502 kcal/kg°C 199.1 °C
Vapor: Dew Point	°C	138.2 °C
Vapor: Ther. Conductivity	kcal/mh°C at °C	0.029 kcal/mh°C at 199.1 °C
Steam Gas	17.03 M.W. 4794.5 kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	18 M.W. 2196.3 kg/h
Heat Vap.	262.85 kcal/kg at 40 °C	kcal/kg at °C
Temp. In & Out	In: 40 °C Out: 40 °C	In: 260 °C Out: 138.2 °C
Operating Press.	14.85 kg/cm²G	2.5 kg/cm²G
Allowable Press. Drop & Velocity	1 & m/s	2 & m/s
Allowable Drop	Spec.: kg/cm² Calc.: — kg/cm²	Spec.: kg/cm² Calc.: — kg/cm²
Sensible Heat	kcal/h	132500 kcal/h
Latent Heat	1,260,000 kcal/h	1127,500 kcal/h
Total Heat Duty	1,260,000 kcal/h	1,260,000 kcal/h
Fouling Factor	Spec.: 0.0002 m²h°C/kcal	Spec.: 0.0002 m²h°C/kcal
Film Coefficient	kcal/m²h°C	kcal/m²h°C
Overall Trans. Coeff.	Clean kcal/m²h°C Fouled	kcal/m²h°C Designed 558 kcal/m²h°C
LMTD	°C	LMTD Corrected: 98.2 °C

Construction

Pressure	Des'n kg/cm²G	Test kg/cm²G	Des'n kg/cm²G	Test kg/cm²G
Design Temperature	°C		°C	
Tube	No. per Shell:	Size: O.D. ×	t ×	Thick. (min. ave.):	Pitch	△
Material & Other	Tube:	Shell:	(Shell I.D.:	Thick.:)
Channel		Gasket:	Channel Cover:	
Shell Cover:		Gasket:	Floating Head:	Gasket:
Tube Sheet, Stationary:		Thick.:	Floating:	Thick.:
Cross Baffle:	Thick.:	Type:	No: Cut	Space:
Long Baffle:	Thick.:	Type:	No:	
Tube Support:	Thick.:	Type:		Space:
Corrosion Allowance	mm		mm	
Stress Relief	No Yes		Radiograph: No Yes	%
Weight per Unit	Empty: kg	Tube Bundle kg	Full of Water:	kg

Nozzle	Size & Rating Shell Side	Size & Rating Tube Side
Inlet		
Outlet		
Drain		
Vent		

Painting

Insulation: No Hot Cold Thick. mm

Remarks

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. | Date | Check

Plant	IRAQ EXPANSION UREA UNIT	Item No.	E-501
Customer	M.O.I. IRAQ	Service	STRIPPER
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type		Surface per Unit	747 m²
Shell I.D.	1470 Tube Length 6820	Surface per Shell	747 m²
Regulation	A.D. MERKBLÄTTER Code ~~TEMA~~		

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		26 ATA STEAM	UREA SOLUTION
Total		M.W. kg/h	M.W. kg/h
Vapor		M.W. kg/h	M.W. kg/h
Liquid		M.W. kg/h	M.W. kg/h
Steam		18 M.W. kg/h	18 M.W. kg/h
Non-Condensable		M.W. kg/h	M.W. kg/h
Liquid	Density	kg/m³ at °c	kg/m³ at °c
	Viscosity	cp. at °c	cp. at °c
	Specific Heat	kcal/kg °c at °c	kcal/kg °c at °c
	Boiling Point	°c	°c
	Ther. Conductivity	kcal/mh °c at °c	kcal/mh °c at °c
Vapor	Density	kg/m³ at °c	kg/m³ at °c
	Viscosity	cp. at °c	cp. at °c
	Specific Heat	kcal/kg °c at °c	kcal/kg °c °c
	Dew Point	°c	°c
	Ther. Conductivity	kcal/mh °c at °c	kcal/mh °c at °c
Fluid Vap. or Cond.		M.W. kg/h	M.W. kg/h
Steam Condensed		M.W. kg/h	M.W. kg/h
Latent Heat		kcal/kg at °c	kcal/kg at °c
Temp. In & Out		In: 225 °c Out: 225 °c	In: 185 °c Out: 210 °c
Operating Press.		25 kg/cm² G	150 kg/cm² G
No. of Pass & Velocity		1 & m/s	1 & m/s
Pressure Drop		Spec.: kg/cm² Calc.: kg/cm²	Spec.: kg/cm² Calc.: kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		kcal/h	kcal/h
Fouling Factor		Spec.: m²h °c/kcal	Spec.: m²h °c/kcal
Film Coefficient		kcal/m²h °c	kcal/m²h °c
Overall Trans. Coeff.		Clean: kcal/m²h °c Fouled	kcal/m²h °c Designed kcal/m²h °c
LMTD		°c	LMTD (Corrected) °c

Construction

Pressure	Des'n 28 kg/cm² G	Test kg/cm² G	Des'n 165 kg/cm² G Test kg/cm² G
Design Temperature	°c		225 °c
Tube	No. per Shell: 1561	Size: 25.4 O.D. × 6820 L × 2.7 Thick. (min. ave.)	Pitch 33.5 ○ △
Material & Other	Tube: 99.5% Ti	Shell: C.S.	(Shell I.D.: Thick.:)
Channel:	C.S. + 99.5% Ti LINING	Gasket:	Channel Cover: C.S. + 99.5% Ti LINING
Shell Cover:		Gasket:	Floating Head: Gasket:
Tube Sheet: Stationary:	C.S + 99.5% Ti LINING	Thick.:	Floating: Thick.:
Cross Baffle:	Thick.:	Type:	No: Cut: Space:
Long Baffle:	Thick.:	Type:	No:
Tube Support:	Thick.:	Type:	Space:
Corrosion Allowance	mm		mm
Stress Relief	No Yes		Radiograph: No Yes %
Weight per Unit	Empty: kg	Tube Bundle:	kg Full of Water: kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet		
Outlet		
Drain		
Vent		

Remarks

Painting		
Insulation	No Hot, Cold Thick. mm	

Checked by: Designed by: Date:

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MITSUBISHI HEAVY INDUSTRIES, LTD.

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TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXPANSION	Item No.	E-502
Customer	M.O.I. IRAQ	Service	MEDIUM PRESS. DECOMPOSER
Order		No. Req'd	1
Location	Indoor / Outdoor	Shells per Unit	1
Type	FIXED TUBE SHEET	Surface per Unit	279 m²
Shell I.D.	1200	Tube Length	5000
Regulation	ASME VIII	Code	TEMA R
		Surface per Shell	279 m²

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	STEAM CONDENSATE	UREA SOL'N
Total	M.W. 52000 kg/h	M.W. 115.779 kg/h
Vapor	M.W. kg/h	M.W. 550 kg/h
Liquid	M.W. 52.000 kg/h	M.W. 115,229 kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	M.W. kg/h
Liquid: Density	875 kg/m³ at 127.5 °C	kg/m³ at °C
Liquid: Viscosity	0.147 cp. at 127.5 °C	cp. at °C
Liquid: Specific Heat	1.064 kcal/kg·°C at 127.5 °C	kcal/kg·°C at °C
Liquid: Boiling Point	°C	°C
Liquid: Ther. Conductivity	0.574 kcal/m·h·°C at 127.5 °C	kcal/m·h·°C at °C
Vapor: Density	kg/m³ at °C	kg/m³ at °C
Vapor: Viscosity	cp. at °C	cp. at °C
Vapor: Specific Heat	kcal/kg·°C at °C	kcal/kg·°C at °C
Vapor: Dew Point	°C	°C
Vapor: Ther. Conductivity	kcal/m·h·°C at °C	kcal/m·h·°C at °C
Fluid Vap. or Cond.	M.W. kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °C	kcal/kg at °C
Temp. In & Out	In 225 °C Out 154 °C	In 129 °C Out 155 °C
Operating Press.	25 kg/cm² G	17 kg/cm² G
No. of Pass & Velocity	1 m/s	1 m/s
Pressure Drop	Spec. kg/cm² Calc. kg/cm²	Spec. kg/cm² Calc. kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	kcal/h	kcal/h
Fouling Factor	Spec. 0.0002 m²·h·°C/kcal	Spec. m²·h·°C/kcal
Film Coefficient	kcal/m²·h·°C	kcal/m²·h·°C
Overall Trans. Coeff.	Clean kcal/m²·h·°C Fouled	kcal/m²·h·°C Designed kcal/m²·h·°C
LMTD	°C	LMTD Corrected °C

Construction

Pressure	Design 28 kg/cm²G Test kg/cm²G	Design 22 kg/cm²G Test kg/cm²G
Design Temperature	255 °C	185 °C
Tube	No. per Shell 486 Size: 38.1 O.D. × 5000 × 1.6 Thick. t min. ave. Pitch 48 Ø	
Material & Other	Tube: SUS 316 C≤0.08 Shell: C.S. (Shell I.D. Thick.	
Channel	Gasket: Channel Cover:	
Shell Cover	Gasket: Floating Head: Gasket:	
Tube Sheet: Stationary	C.S + SUS 316 C≤0.08 Thick. Floating: Thick.	
Cross Baffle	C.S. Thick. Type: SEGMENTAL No. 20 Cut: 25% Space: 200	
Long Baffle	Thick. Type: No. Space:	
Tube Support	Thick. Type: (Min. 2) mm	
Corrosion Allowance	3.2 mm	Radiograph: No Yes %
Stress Relief	No Yes	
Weight per Unit	Empty kg Tube Bundle: kg	Full of Water: kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet	SEE SKELETON DIVG.	SEE SKELETON DIVG.
Outlet		
Drain		
Vent		

Remarks

Painting

Insulation No. Hot / Cold Thick. mm

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MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET

Rev.
Date
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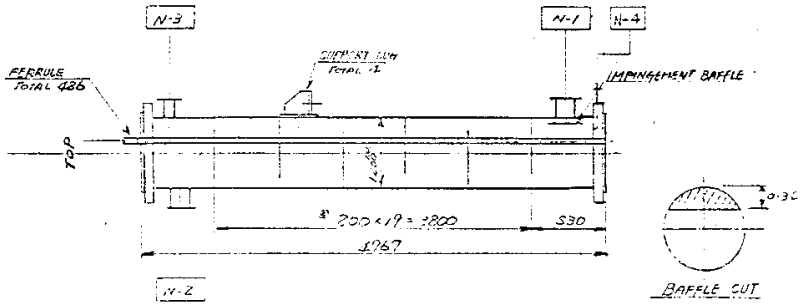
Plant	IRAQ EXPANSION	Item No.	E-502
Customer	M.O.I. IRAQ		
Order		Service	MEDIUM PRESS. DECOMPOSER
Location	Indoor (Outdoor)	No. Req'd	1
Type	FIXED TUBE SHEET	Shells per Unit	1
Shell I.D.	1200 Tube Length 5000	Surface per Unit	279 m²
Regulation	ASME VIII Code TEMA R	Surface per Shell	279 m²



Design Data	Shell Side	Tube Side
Fluid		
Oper. Press. kg/cm²G, PSIG	25	17
Design Press. kg/cm²G, PSIG	29	22
Oper. Temp. In & Out °C	229/254	129/155
Design Temp. °C	255	195
Hydro. Test Press. kg/cm²G, PSIG		
Pneu. Test Press. kg/cm²G, PSIG		
Radiograph		
Post Weld Heat Treatment		
Joint Efficiency %		
Corrosion Allowance mm	3.2	(Min.2)
Painting		
Insulation (Hot), Cold mm	HOT	HOT
Number of Pass	1	1
Tube 38.1 O.D. × 1.6 Min. Aver. Wall t/X		5000 L
No. per Shell 486. Pitch 48		(Δ)
Weight : Empty kg, lb		
Full of Water kg, lb		

Bill of Material			
Part	Mat'l	No. Req'd	Remarks
SHELL	SM413		
PIPE SHEET	SUS316		Min. 54
TUBE	SUS 316TB		
BAFFLE	SS41		
TIE ROD & SPACER	SM41 / GP		
NOZZLE & FLANGE	SUS316 SUS		
IMPINGEMENT	SS41		
FERRULE	SUS316		

Nozzle & Connection						
Mark	Size	No. Req'd	Rating	Service	Flange Facing	Remarks
N-1	6B	1	ANSI #300 RF	COND. INLET		
N-2	6B	1	"	COND. OUTLET		
N-3		1	"	PCV CONN.		
N-4		1		DRAIN		

Note
1. CARBON CONTENT OF ALL SUS316 MATERIAL TO BE LESS THAN 0.06%.

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. D
Date 5/6/76
Check

Plant IRAQ EXPANSION
Customer M.O.I. IRAQ
Order
Location Indoor (Outdoor)
Type U-TUBE KETTLE , BKU
Shell I.D. 2300/1575 Tube Length 12300 mm
Regulation ASME VIII Code TEMA R

Item No. E-504
Service 1ST CARBAMATE CONDENSER
No. Read 1
Shells per Unit 1
Surface per Unit 1950 m²
Surface per Shell 1950 m²

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	CONDENSATE	CARBAMATE SOLN
Total	18 M.W. 62020 kg/h	M.W. 112.884 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. 62020 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	M.W. kg/h
Liquid: Density	909 kg/m³ at 158 °C	kg/m³ at °C
Liquid: Viscosity	cp. at 158 °C	cp. at °C
Liquid: Specific Heat	kcal/kg/°C at 158 °C	kcal/kg/°C at °C
Liquid: Boiling Point	158 °C	°C
Liquid: Ther. Conductivity	kcal/mh/°C at 158 °C	kcal/mh/°C at °C
Vapor: Density	kg/m³ at °C	kg/m³ at °C
Vapor: Viscosity	cp. at °C	cp. at °C
Vapor: Specific Heat	kcal/kg/°C at °C	kcal/kg/°C at °C
Vapor: Dew Point	°C	°C
Vapor: Ther. Conductivity	kcal/mh/°C at °C	kcal/mh/°C at °C
Flow (Net)	18 M.W. 59990 kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Heat	kcal/kg at °C	kcal/kg at °C
Temp. In & Out	In 153 °C Out 158 °C	In 128 °C Out 140 °C
Operating Press.	5 kg/cm²G	2 kg/cm²G
No. of Pass & Velocity	1 & — m/s	Spec. kg/cm²G Calc. kg/cm²G
Pressure Drop	Spec. — kg/cm² Calc. — kg/cm²	kg/h
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	kcal/h	Spec. m²h°C/kcal
Fouling Factor	Spec. 0.0002 m²h°C/kcal	kcal/m²h°C
Film Coefficient	kcal/m²h°C	kcal/m²h°C Designed
Overall Trans. Coeff.	Clean: kcal/m²h°C Fouled	°C
LMTD	°C	LMTD Corrected

Construction

Pressure	Design 7 kg/cm²G Test kg/cm²G	Design 16.5 kg/cm²G Test kg/cm²G
Design Temperature	140 °C	210 °C
Tube	No. per Shell U-1367 Size: 19 O.D. × 12300 L × 2.1 Thick. min. ave. Pitch 25 ○ ▭	
Material & Other	Tube *SUS 316L MOD. Shell C.S.	Shell I.D. Thick.
Channel	*C.S. + SUS 316L MOD. Gasket:	Channel Cover *C.S + SUS 316L MOD.
Shell Cover	C.S. Gasket:	Floating Head: Gasket:
Tube Sheet	Stationary *C.S. + SUS 316L MOD. Thick.:	Floating: Thick.
Cross Baffle	Thick.: Type:	No: Cut: Space:
Long Baffle	Thick.: Type:	No: Space:
Tube Support	C.S. Thick.: Type:	
Corrosion Allowance	3.2 mm	316L Min (Min 2) mm
Stress Relief	No Yes	Radiograph: No Yes %
Weight per Unit	Empty: kg Tube Bundle:	kg Full of Water: kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet	SEE SKELETON DWG	SEE SKELETON DWG
Outlet		
Drain		
Vent		

Painting
Insulation No Cold Thick. mm

Remarks
* SUS 316L MOD: SEE ATTACHED SPECIFICATI

MITSUBISHI HEAVY INDUSTRIES, LTD.

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TUBULAR HEAT EXCHANGER DATA SHEET

Rev. D
Date 5/6/74
Check

Plant	IRAQ EXPANSION	Item No.	E-504
Customer	M.O.I. IRAQ	Service	1ST CARBAMATE CONDENSER
Order		No. Reqd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type	U-TUBE KETTLE BKU	Surface per Unit	1950 m²
Shell I.D.	2300/1575 Tube Length 12300 S/L	Surface per Shell	1950 m
Regulation	ASME VIII Code TEMA R		

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	CONDENSATE	CARBAMATE SOLN
Total	12 M.W. 62020 kg/h	M.W. 112884 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. 62020 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	M.W. kg/h
Liquid: Density	909 kg/m³ at 158 °C	kg/m³ at °C
Liquid: Viscosity	cp. at 158 °C	cp. at °C
Liquid: Specific Heat	kcal/kg °C at 158 °C	kcal/kg °C at °C
Liquid: Boiling Point	158 °C	°C
Liquid: Ther. Conductivity	kcal/m hr °C at 158 °C	kcal/m hr °C at °C
Vapor: Density	kg/m³ at °C	kg/m³ at °C
Vapor: Viscosity	cp. at °C	cp. at °C
Vapor: Specific Heat	kcal/kg °C at °C	kcal/kg °C
Vapor: Dew Point	°C	°C
Vapor: Ther. Conductivity	kcal/m hr °C at °C	kcal/m hr °C at °C
Flow (Max)	18 M.W. 50000 kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °C	kcal/kg at
Temp. In & Out	In 158 °C Out 158 °C	In 178 °C Out 168 °C
Operating Press.	5 kg/cm²G	3.151 kg/cm²G
No. of Pass & Velocity	1 & — m/s	2 m/s
Pressure Drop	Spec. — kg/cm² Calc. — kg/cm²	Spec. kg/cm² Calc. kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	kcal/h	kcal/h
Fouling Factor	Spec. 0.0002 m²h°C/kcal	Spec. m²h°C/kcal
Film Coefficient	kcal/m²h°C	kcal/m²h°C
Overall Trans. Coeff.	Clean: kcal/m²h°C Fouled	kcal/m²h°C Designed kcal/m²h°C
LMTD	°C	LMTD Corrected °C

Construction

Pressure	Design 7 kg/cm²G Test kg/cm²G	Design 16.5 kg/cm²G Test kg/cm²G
Design Temperature	190 °C	210 °C
Tube	No. per Shell: U-1369 Size: 19 O.D. × 12300 L × 2.1 Thick. (min. ave.) Pitch 25 ○ =	
Material & Other	Tube: *SUS 316L MOD. Shell: C.S. Shell I.D. Thick.	
Channel	*C.S. + SUS 316L MOD. Gasket:	Channel Cover: *C.S + SUS 316L MOD.
Shell Cover	C.S. Gasket:	Floating Head: Gasket:
Tube Sheet	Stationary: *C.S. + SUS 316L MOD. Thick.:	Floating: Thick.
Cross Baffle	Thick.: Type: No: Cut: Space:	
Long Baffle	Thick.: Type: No:	
Tube Support	C.S. Thick.: Type: Space:	
Corrosion Allowance	3.2 mm	316L Mtg (Nm 2) mm
Stress Relief	No Yes	Radiograph: No Yes %
Weight per Unit	Empty: kg Tube Bundle: kg	Full of Water: kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet	SEE SKELETON DWG	SEE SKELETON DWG
Outlet		
Drain		
Vent		

Remarks

* SUS 316L MOD: SEE ATTACHED SPECIFICATION

Painting
Insulation No (Hot) Cold Thick mm

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. 0
Date 5/1978
Check

Plant IRAQ EXPANSION
Customer M.O.I. IRAQ
Order
Location Indoor (Outdoor)
Type U-TUBE KETTLE , 5 KU
Shell I.D. 2300/1575 Tube length 12300 mm
Regulation ASME VIII Code TEMA R

Item No. E-504
Service 1ST CARBAMATE CONDENSER
No. Read 1
Shells per Unit 1
Surface per Unit 19.50 m²
Surface per Shell 19.50 m²

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	CONDENSATE	CARBAMATE SOLN
Total	18 M.W. 62020 kg/h	M.W. 112,884 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. 62020 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	M.W. kg/h
Liquid: Density	909 kg/m³ at 158 °C	kg/m at °C
Liquid: Viscosity	cp. at 158 °C	cp. at °C
Liquid: Specific Heat	kcal/kg°C at 158 °C	kcal/kg°C at °C
Liquid: Boiling Point	158 °C	°C
Liquid: Ther. Conductivity	kcal/mh°C at 158 °C	kcal/mh°C at °C
Vapor: Density	kg/m at °C	kg/m at °C
Vapor: Viscosity	cp. at °C	cp. at °C
Vapor: Specific Heat	kcal/kg°C at °C	kcal/kg°C at °C
Vapor: Dew Point	°C	°C
Vapor: Ther. Conductivity	kcal/mh°C at °C	kcal/mh°C at °C
Fluid Condensed	18 M.W. 59,000 kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °C	kcal/kg at °C
Temperature In / Out	In 158 °C Out 158 °C	In 178 °C Out 152 °C
Operating Press.	5 kg/cm²G	5.15 kg/cm²G
No. of Pass & Velocity	1 & — m/s	2 & — m/s
Pressure Drop	Spec. — kg/cm² Calc. — kg/cm²	Spec. kg/cm² Calc. kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	kcal/h	kcal/h
Fouling Factor	Spec. 0.0002 m²h°C/kcal	Spec. m²h°C/kcal
Film Coefficient	kcal/m²h°C	kcal/m²h°C
Overall Trans. Coeff.	Clean: kcal/m²h°C Fouled	kcal/m²h°C Designed kcal/m²h°C
LMTD	°C	LMTD Corrected °C

Construction

	Shell Side	Tube Side
Pressure	Design 7 kg/cm²G Test kg/cm²G	Design 165 kg/cm²G Test kg/cm²G
Design Temperature	190 °C	210 °C
Tube	No. per Shell U-1367 Size: 19 O.D. × 12300 mm × 2.1 Thick. min. ave. Pitch 25 ○ =	
Material & Other	Tube *SUS 316L MOD. Shell: C.S. Shell I.D. Thick.	
Channel: *C.S. + SUS 316L MOD.	Gasket:	Channel Cover: *C.S + SUS 316L MOD.
Shell Cover: C.S.	Gasket:	Floating Head: Gasket:
Tube Sheet: Stationary *C.S. + SUS 316L MOD.	Thick.:	Floating: Thick.
Cross Baffle:	Thick.: Type:	No: Cut: Space:
Long Baffle:	Thick.: Type:	No: Space:
Tube Support: C.S.	Thick.: Type:	
Corrosion Allowance	3.2 mm	316L Mod (Min 2) mm
Stress Relief	No Yes	Radiograph: No Yes %
Weight per Unit	Empty: kg Tube Bundle:	kg Full of Water: kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet	SEE SKELETON DWG.	SEE SKELETON DWG.
Outlet		
Drain		
Vent		

Painting
Insulation No Cond. Thick. mm

Remarks
* SUS 316L MOD: SEE ATTACHED SPECIFICATION

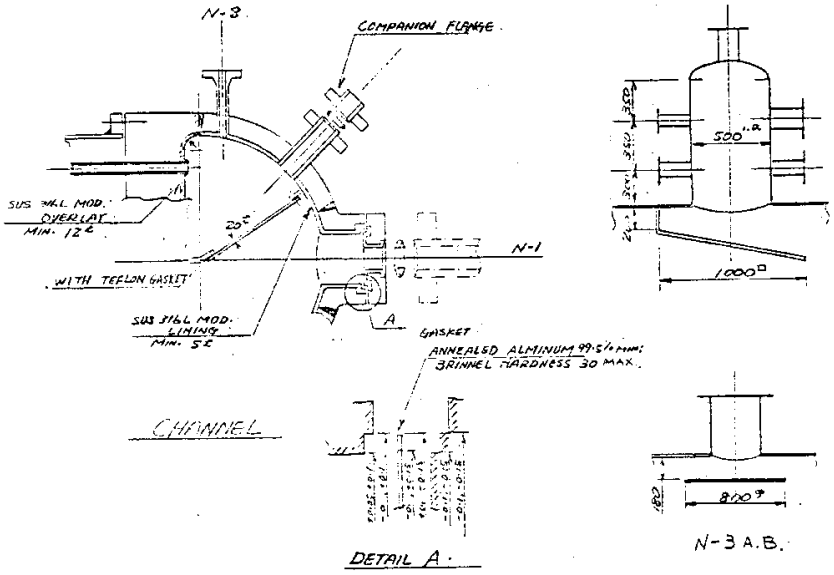
19-5

MITSUBISHI HEAVY INDUSTRIES, LTD

DATA SHEET

Rev
Date
Check

Plant	IRAQ EXPANSION
Customer	M.O.I IRAQ
Order	
Location	Indoor (Outdoor)
Item No.	E-504
Service	1st CARBAMATE CONDENSER
No. Req'd	1



REMARKS

1. STRONGTH WELD TUBE TO TUBE SHEET.
2. OVERLAY FOR TUBE SHEET SHALL NOT BE LESS THAN 12 mm AND TUBE SHEET HOLES SHALL BE MACHINED WITH ONE ADDITION GROOVE IN THE OVERLAY MATERIAL.
3. PROVIDE SOLUTION ANNEALD OF TUBE AFTER BENDING.
4. IN MECHANICAL CALCULATION STAINLESS THK FOR CLAD. LINING & OVERLAY SHALL BE CONSIDERED AS CORROSION ALLOWANCE ONLY.
5. ALL TUBES SHALL BE ULTRASONIC TESTED.
   TELL-TALE HOLES SHALL BE CARRY OUT WITH STAINLESS STEEL 316L MOD. PIPE PROJECTING 20 mm OVER THE INSULATION.

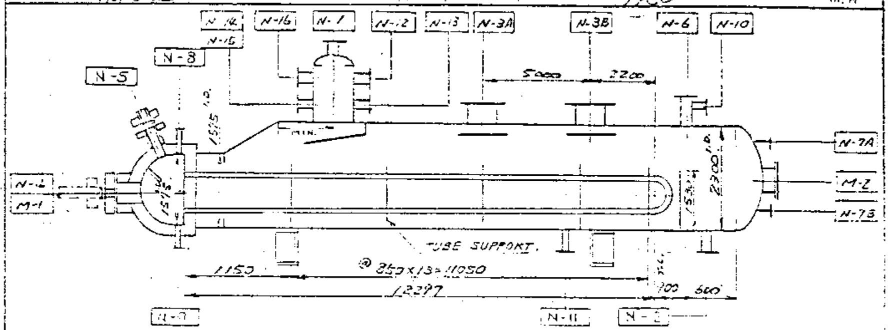
Mark		Size	Rating	Service	Mark	Q'ty	Size	Rating	Service

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXPANSION	Item No.	E-504
Customer	M.O.I. IRAQ		
Order		Service	1st CARBAMATE CONDENSER
Location	Indoor, Outdoor	No. Req'd	1
Type	U-TUBE KETTLE; SKU	Shells per Unit	1
Shell I.D.	2300/1575 Tube length 12300 S.L.	Surface per Unit	1950 m², ft²
Regulation	ASME VIII Code TEMA R	Surface per Shell	1950 m², ft²



Design Data		Shell Side	Tube Side
Fluid		CONDENSATE	CARBAMATE
Oper. Press.	kg/cm² G, PSIG	5.1	151
Design Press.	kg/cm² G, PSIG	7	165
Oper. Temp. In & Out	°C, °F	152	178/162
Design Temp.	°C, °F	190	210
Hydro Test Press.	kg/cm² G, PSIG		
Pneu. Test Press.	kg/cm² G, PSIG		
Radiograph			
Post Weld Heat Treatment			
Joint Efficiency	%		
Corrosion Allowance	mm, in.	3.2	(MIN.2)
Painting			
Insulation Hot, Cold	mm, in.		
Number of Pass		1	2
Tube 19 O.D. × 2.1 (Min. Aver. Wall) × 12300 S.L.			
No. per Shell U-1369 Pitch 25			
Weight Empty	kg, lb		
Full of Water	kg, lb		

Bill of Material: Part	Mat'l	No. Req'd	Remarks
SHELL	SB42B		
SHELL COVER	"		
CHANNEL	A516 + 25Cr22Ni2Mo (MIN. 5mm)		
TUBE	25Cr22Ni2Mo		
TUBE SHEET	[illegible] 25Cr22Ni2Mo (MIN 12 mm)		
BAFFLE	SS41		
SHELL SIDE NOZZLE, FLANGE	STPG38, SF45		
TUBE SIDE NOZZLE, FLANGE	SUS316L Mod. [illegible] SUS316L Mod.		

Nozzle & Connection

Mark	Size	No. Req'd	Rating	Service	[illegible]	Remarks
N-1	8"	1	ANSI #150 RF	COND. INLET		
N-2	4"	1	"	COND. OUTLET		
N-3A,B	16"	2	"	STEAM OUTLET		
N-4	8"	1	LENS #1500	CARBA. INLET		
N-5	8"	1	LENS "	CARBA. OUTLET		
N-6		1	ANSI #150 RF	PSV CONN.		
N-7A,B	2"	2	"	LC, LG CONN.		
N-8	3/4"	1	ANSI #1500 RJ	VENT		
N-9	3/4"	1	"	DRAIN		
N-10	1/2"	1	ANSI #150 RF	PI, PC CONN.		
N-11	3"	1	"	DRAIN		
M-1	20"	1		MANHOLE		
M-2	20"	1		MANHOLE		

Note

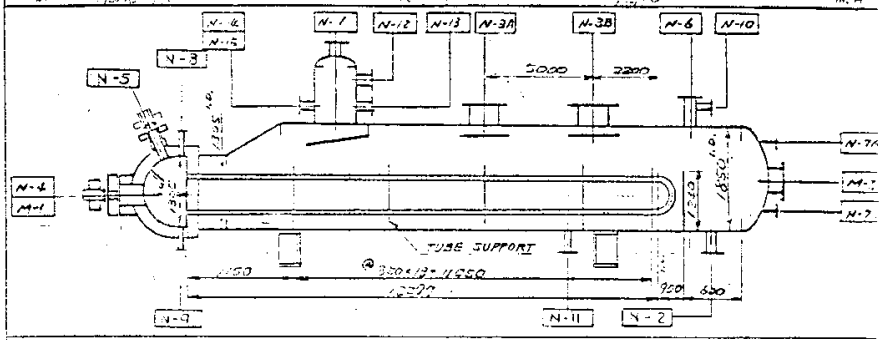
Mark	Size	No. Req'd	Rating	Service
N-12	8"	1	ANSI #150 SO RF	COND. INLET
N-13	1"	1	"	"
N-14	2"	1	"	"
N-15	2"	1	"	"

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXPANSION	Item No.	E-505
Customer	M.O.I IRAQ	Service	2nd CARBANATE CONDENSER
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type	U-TUBE KETTLE	Surface per Unit	1240 m²
Shell I.D.	1350/1205 Tube Length 12300 m/m	Surface per Shell	1240 m²
Regulation	ASME VIII Code	TEMA R	



Design Data

	Shell Side	Tube Side
Fluid	CONDENSATE	2nd CARBANATE
Oper. Press. kg/cm²G, PSIG	3.5	4.5
Design Press. kg/cm²G, PSIG	5.5	7.0
Oper. Temp. In & Out °C, °F	138	133 / 105
Design Temp. °C, °F	170	200
Hydro. Test Press. kg/cm²G, PSIG		
Pneu. Test Press. kg/cm²G, PSIG		
Tantagraph		
Post Weld Heat Treatment		
Joint Efficiency %		
Corrosion Allowance mm, in.	3.2	(mm.)
Painting		
Insulation Hot, Cold mm, in.		
Number of Pass	1	2
Tube 19 O.D. × 2.1 Min. Aver. Wall t × 12350 ℓ		
No. per Shell U-367 Pitch 25		
Weight : Empty kg, lb		
Full of Water kg, lb		

Bill of Material

Part	Mat'l	No. Req'd	Remarks
SHELL	S.S.		
SHELL COVER	S.S.		
CHANNEL	C.S.+SUS316L MOD.		
TUBE	SUS316L MOD.		
TUBE SHEET	C.S.+SUS316L MOD.		
BAFFLE	S.S.		
SHELL SIDE NOZZLE FLANGE	S.S.		
TUBE SIDE NOZZLE FLANGE	SUS316L MOD. C.S.+SUS316L MOD.		

Nozzle & Connection

Mark	Size	No. Req'd	Rating	Service	Remarks
N-1	8B	1	ANSI #150 RF	COND. INLET	
N-2	4B	1	"	COND. OUTLET	
N-3	16B	2	"	STEAM INLET	
N-4	8B	1	LENS "	CARBA. INLET	
N-5	8B	1	LENS "	CARBA. OUTLET	
N-6		1	ANSI #150 RF	PSV CONN.	
N-7	2B	2	"	LC, LG CONN.	
N-8	3/4B	1	ANSI #3000 RJ	VENT	
N-9	1/2B	1	"	DRAIN	
N-10	1/2B	1	ANSI #150 RF	PI, PG CONN.	
N-11	3B	1	"	DRAIN	
M-1	18B	1		MANHOLE	
M-2	18B	1		MANHOLE	

Note

Mark	Size	No. Req'd	Rating	Service
N-12	1B	1	ANSI #150 RF	COND. INLET
N-13	1/2B	1	"	"
N-14	2B	1	"	"
N-15	1/2B	1	"	"

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXPANSION	Item No.	E-505
Customer	M.O.I IRAQ	Service	2ND CARBAMATE CONDENSER
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type	U-TUBE KETTLE BKU	Surface per Unit	1240 m²
Shell I.D.	1850 / 1305 Tube Length 12300 S-L	Surface per Shell	1240 m²
Regulation	ASME VIII Code	TEMA R	

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	CONDENSATE	CARBAMATE SOLN
Total	M.W. 40,578 kg/h	M.W. 112,884 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. 40 578 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	M.W. kg/h
Liquid: Density	928 kg/m³ at 138 °C	kg/m³ at °C
Liquid: Viscosity	cp. at 138 °C	cp. at °C
Liquid: Specific Heat	kcal/kg°C at 138 °C	kcal/kg°C at °C
Liquid: Boiling Point	138 °C	°C
Liquid: Ther. Conductivity	kcal/mh°C at 138 °C	kcal/mh°C at °C
Vapor: Density	kg/m³ at °C	kg/m³ at °C
Vapor: Viscosity	cp. at °C	cp. at °C
Vapor: Specific Heat	kcal/kg°C at °C	kcal/kg°C °C
Vapor: Dew Point	°C	°C
Vapor: Ther. Conductivity	kcal/mh°C at °C	kcal/mh°C at °C
Gas (Vap) Condensed	M.W. 20 533 kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at °C	kcal/kg at °C
Temp. In & Out	In 138 °C Out 138 °C	In 168 °C Out 155 °C
Operating Press.	2.5 kg/cm²G	0 151 kg/cm²G
No. of Pass & Velocity	1 & — m/s	2 & — m/s
Pressure Drop	Spec. — kg/cm² Calc. — kg/cm²	Spec. kg/cm² Calc. kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	kcal/h	kcal/h
Fouling Factor	Spec. 0.0002 m²h°C/kcal	Spec. m²h°C/kcal
Film Coefficient	kcal/m²h°C	kcal/m²h°C
Overall Trans. Coeff.	Clean kcal/m²h°C Fouled	kcal/m²h°C Designed kcal/m²h°C
LMTD	°C	LMTD Corrected °C

Construction

Pressure	Desn 5.5 kg/cm²G	Test kg/cm²G	Desn 165 kg/cm²G	Test kg/cm²G	
Design Temperature	170 °C		200 °C		
Tube	No. per Shell U-267	Size 19 O.D × 12300 S-L × 2.1 Thick. (min. ave.)			Pitch 25. □
Material & Other	Tube *SUS 316L MOD.	Shell C.S.	Shell I.D.:	Thick.:	
Channel	*C.S. + SUS 316L MOD.	Gasket:	Channel Cover: *C.S. + SUS 316L MOD.		
Shell Cover	C.S.	Gasket:	Floating Head:	Gasket:	
Tube Sheet	Stationary: *C.S. + SUS 316L MOD.	Thick.:	Floating:	Thick.:	
Cross Baffle:	Thick.:	Type:	No: Cut:	Space:	
Long Baffle	Thick.:	Type:	No:		
Tube Support: C.S.	Thick.:	Type:		Space:	
Corrosion Allowance	3.2 mm		(Min 2) mm		
Stress Relief	No Yes		Radiograph: No Yes	%	
Weight per Unit	Empty kg	Tube Bundle:	kg	Full of Water:	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet	SEE SKELETON DWG.	SEE SKELETON DWG.
Outlet		
Drain		
Vent		
Flanging		
Insertion	No (Int.) Ext. Thick. mm	

Remarks

*SUS316L MOD : SEE ATTACHED SPECIFICATION.

MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev.	
Date	
Check	

No.	Item		
1	Plant	IRAQ EXPANSION UREA UNIT	Item No. E-507
2	Customer	M.2.I. IRAQ	
3	Order		Service: LOW PRESS. CONDENSER
4	Location	Indoor (Outdoor)	No. Req'd: 1
5	Type	FIXED TUBE SHEET (VERTICAL) BEM	Shells per Unit: 1
6	Shell I.D.	1440 Tube Length 6000	Surface per Unit: 520 m²
7	Regulation	Code TEMA: R	Surface per Shell: 520 m²
8	Performance of One Unit		
9		Shell Side	Tube Side
10	Fluid Circulated	CARBONATE SOLUTION	COOLING WATER
11	Total	M.W. kg/h	M.W. 1320 000 kg/h
12	Vapor	M.W. kg/h	M.W. kg/h
13	Liquid	M.W. kg/h	M.W. 1320 000 kg/h
14	Steam	18 M.W. kg/h	18 M.W. kg/h
15	Non-Condensable	M.W. kg/h	M.W. kg/h
16	Liquid – Density	kg/m³ at °c	993 kg/m³ at 37.3 °c
17	Liquid – Viscosity	cp. at °c	0.691 cp. at 37.3 °c
18	Liquid – Specific Heat	kcal/kg °c at °c	0.998 kcal/kg °c at 37.3 °c
19	Liquid – Boiling Point	°c	°c
20	Liquid – Ther. Conductivity	kcal/mh °c at °c	0.536 kcal/mh °c at 37.3 °c
21	Vapor – Density	kg/m³ at °c	kg/m³ at °c
22	Vapor – Viscosity	cp. at °c	cp. at °c
23	Vapor – Specific Heat	kcal/kg °c at °c	kcal/kg °c °c
24	Vapor – Dew Point	°c	°c
25	Vapor – Ther. Conductivity	kcal/mh °c at °c	kcal/mh °c at °c
26	Fluid Vap. or Cond.	M.W. kg/h	M.W. kg/h
27	Steam Condensed	M.W. kg/h	M.W. kg/h
28	Latent Heat	kcal/kg at °c	kcal/kg at °c
29	Temp. In & Out	In: [illegible] °c Out: 47 °c	In: 32.5 °c Out: 40 °c
30	Operating Press.	[illegible] kg/cm² G	4 kg/cm² G
31	No. of Pass & Velocity	1 & m/s	1 & m/s
32	Pressure Drop	Spec.: kg/cm² Calc.: kg/cm²	Spec.: kg/cm² Calc.: kg/cm²
33	Sensible Heat	kcal/h	kcal/h
34	Latent Heat	kcal/h	kcal/h
35	Total Heat Duty	kcal/h	kcal/h
36	Fouling Factor	Spec.: m² h °c/kcal	Spec.: 0.0005 m² h °c/kcal
37	Film Coefficient	kcal/m² h °c	kcal/m² h °c
38	Overall Trans. Coeff.	Clean: kcal/m² h °c Fouled kcal/m² h °c	Designed kcal/m² h °c
39	LMTD	°c	LMTD (Corrected) °c
40	Construction		
41	Pressure	Des'n 5.5 kg/cm² G Test kg/cm² G	Des'n 7 kg/cm² G Test kg/cm²
42	Design Temperature	140 °c	60 °c
43	Tube	No. per Shell: 1546	Size: 19 O.D. × 6000 L × 1.6 Thick. (min. ave.) Pitch 32
44	Material & Other	Tube: SUS 316 C<0.06	Shell: C.S + SUS 316 C<0.06 Shell I.D.: Thick.:
45	Channel: C.S.	Gasket:	Channel Cover: C.S.
46	Shell Cover:	Gasket:	Floating Head: Gasket:
47	Tube Sheet: Stationary: SUS 316 C<0.06	Thick.:	Floating: Thick.:
48	Cross Baffle: SUS 316 C<0.06	Thick.:	Type: SEGMENTAL No: 18 Cut: 25% Space: 280
49	Long Baffle:	Thick.:	Type: No:
50	Tube Support:	Thick.:	Type: Space:
51	Corrosion Allowance	(MIN. 2) mm	3.2 mm
52	Stress Relief	No Yes	Radiograph: No Yes %
53	Weight per Unit	Empty: kg Tube Bundle: kg	Full of Water: kg
54	Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
55	Inlet	14B ANSI 150 S.O. RF	18B JIS 10K
56	Outlet	6B "	18B "
57	Drain		3/4B "
58	Vent		3/4B "
59			
60	Painting		

Remarks

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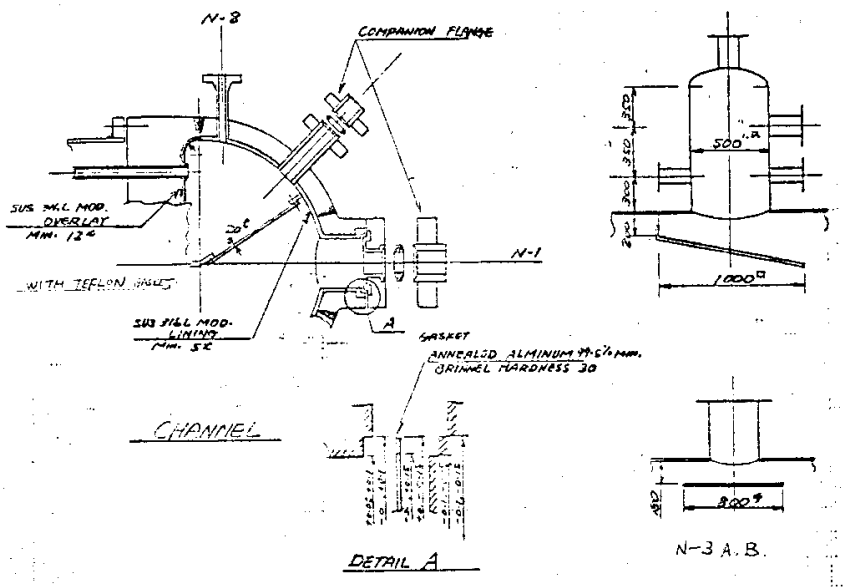
MITSUBISHI HEAVY INDUSTRIES, LTD

DATA SHEET

Rev.	
Date	
Check	

Plant	IRAQ EXPANSION	Item No.	E-505
Customer	M.O.I. IRAQ	Service	2nd. CARBAMATE CONDENSER
Order		No. Req'd	1
Location	Indoor (Outdoor)		



REMARKS

1. STRENGTH WELD TUBE TO TUBE SHEET AFTER LIGHTLY EXPANDED
2. OVERLAY FOR TUBE SHEET SHALL NOT BE LESS THAN 12 mm AND TUBE SHEET HOLES SHALL BE MACHINED WITH ONE ADDITION GROOVE IN THE OVERLAY MATERIAL.
3. PROVIDE SOLUTION ANNEALD OF TUBE AFTER BENDING.
4. THE CONSTRUCTION AND MATERIAL SHALL MEET ALL REQUIREMENTS OUR. SPEC.
5. IN MECHANICAL CALCULATION STAINLESS TH'K FOR CLAD. LINING & OVERLAY SHALL BE CONSIDERED AS CORROSION ALLOWANCE ONLY.
6. ALL TUBES SHALL BE ULTRASONIC TESTED.
7. TELL-TALE HOLES SHALL BE CARRY OUT WITH STAINLESS STEEL 316L MOD. PIPE PROJECTING 20 mm OVER THE INSULATION.

Mark		Size	Rating	Service	Mark	Q'ty	Size	Rating	Service

MITSUBISHI HEAVY INDUSTRIES, LTD.

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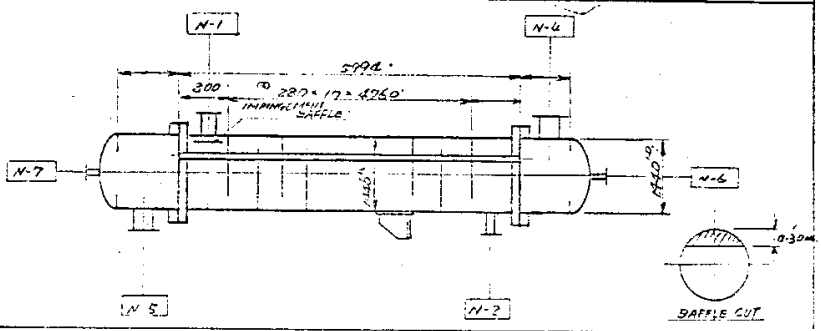
TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET

Rev.	
Date	
Check	

Plant	IRAQ EXPANSION UREA UNIT	Item No.	E-507
Customer	M.O.I. IRAQ		
Order		Service	LOW PRESS. CONDENSER
Location	Indoor (Outdoor)	No. Req'd	1
Type	V-BEM	Shells per Unit	1
Shell I.D.	1440 Tube Length 6000	Surface per Unit	520 m²
Regulation	Code ASME VIII TEMA R	Surface per Shell	520 m²



Design Data

		Shell Side	Tube Side
Fluid		CARBAMATE SOLN	COOLING WATER
Oper. Press.	kg/cm²G	5.5	4
Design Press.	kg/cm²G	7.5	7
Oper. Temp. In & Out	°C	171 40	34 / 40
Design Temp.	°C	180	50
Hydro. Test Press.	kg/cm²G	9.2	9.7
Pneu. Test Press.	kg/cm²G	5.5	7
Radiograph		SPOT	NO
Post Weld Heat Treatment		NO	YES
Joint Efficiency	%		
Corrosion Allowance	mm, in.	(Note 2)	3.2
Painting			
Insulation Hot, Cold	mm, in.		
Number of Pass		1	1

Tube 19 O.D. × 1.6t (Min. Aver. Wall) × 6000 L

No. per Shell 1646 Pitch 32 ○ △

Weight: Empty kg, Lb

Full of Water kg, Lb

Bill of Material

Part	Mat'l	Req'd	Remarks
SHELL	SS41 + SUS316		Note 1, 2
CHANNEL	SS41		
CHANNEL COVER	SS41		
TUBE	JIS TM TB-TP		Note 2
TUBE SHEET	JIS 316		Note 2
BAFFLE	JIS 316		Note 2
SHELL SIDE NOZZLE	SUS 304 TP		Note 2
" FLANGE	SF45 JIS 2214		
TUBE SIDE NOZZLE	STPT 38		
" FLANGE	SF45		

Nozzle & Connection

Mark	Size	No. Req'd	Rating	Service	Min. t to face	Remarks
N-1	14B	1	ANSI 150 RF	GAS INLET		
N-2	6B	1	"	CARBA. OUTLET		
N-4	18B	1	JIS 10K RF	C.W. INLET		
N-5	18B	1	"	C.W. OUTLET		
N-6	3/4B	1	"	DRAIN		
N-7	1/2B	1	"	VENT		

Note.

1. IN MECANICAL CALCULATION STAINLESS THK FOR CLAD, LINING AND OVERLAY SHALL BE CONSIDERED AS CORROSION ALLOWANCE ONLY.
2. CORROSION ALLOWANCE FOR STAINLESS SOLID SHALL BE 2 mm. (EXCEPT TUBES)
3. CARBON CONTENT OF ALL SUS316 MATERIAL TO BE LESS THAN 0.06%.

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MITSUBISHI HEAVY INDUSTRIES, LTD. 1/2

Rev. / Date / Check

TUBULAR HEAT EXCHANGER DATA SHEET

Plant	IRAQ EXPANSION UREA UNIT	Item No.	E-508
Customer	M.O.I. IRAQ	Service	AMMONIA CONDENSER
Order			
Location	Indoor (Outdoor)	No. Req'd	1
Type	FIXED TUBE	Shells per Unit	1
Shell I.D.	1240	Tube Length	12000
Surface per Unit	1390		m²
Regulation	Code TEMA R	Surface per Shell	1390 m²

Performance of One Unit

		Shell Side	Tube Side
Fluid Circulated		AMMONIA & INERT	COOLING WATER
Total		M.W. 19750 kg/h	M.W. 1400 000 kg/h
Vapor		M.W. 19 400 kg/h	M.W. kg/h
Liquid		M.W. kg/h	M.W. 1400 000 kg/h
Steam		18 M.W. kg/h	18 M.W. kg/h
Non-Condensable		M.W. 350 kg/h	M.W. kg/h
Liquid	Density	578 kg/m³ at 38 °C	994 kg/m³ at 36 °C
	Viscosity	0.187 cp at 38 °C	0.72 cp at 36 °C
	Specific Heat	1.189 kcal/kg·°C at 38 °C	0.998 kcal/kg·°C at 36 °C
	Boiling Point	°C	°C
	Ther. Conductivity	0.422 kcal/m·h·°C at 38 °C	0.536 kcal/m·h·°C at 36 °C
Vapor	Density	kg/m³ at °C	kg/m³ at °C
	Viscosity	cp at °C	cp at °C
	Specific Heat	kcal/kg·°C at °C	kcal/kg·°C °C
	Dew Point	°C	°C
	Ther. Conductivity	kcal/m·h·°C at °C	kcal/m·h·°C at °C
Fluid Vap. or Cond.		17 M.W. 16 925 kg/h	M.W. kg/h
Steam Condensed		M.W. kg/h	M.W. kg/h
Latent Heat		kcal/kg at °C	kcal/kg at °C
Temp. in & Out		In: 123 °C Out: 38 °C	In: 34.5 °C Out: 37.35 °C
Operating Press.		16.7 kg/cm²G	4 kg/cm²G
No. of Pass & Velocity		/ & m/s	/ & m/s
Pressure Drop		Spec. 0.2 kg/cm² Calc. 0.156 kg/cm²	Spec. 0.7 kg/cm² Calc. 0.237 kg/cm²
Sensible Heat		kcal/h	kcal/h
Latent Heat		kcal/h	kcal/h
Total Heat Duty		4 550 000 kcal/h	4 550 000 kcal/h
Fouling Factor		Spec. 0.0002 m²h°C/kcal	Spec. 0.0006 m²h°C/kcal
Film Coefficient		2150 kcal/m²h°C	3500 kcal/m²h°C
Overall Trans. Coeff.		Clean 1750 kcal/m²h°C Fouled	kcal/m²h°C Designed 587 kcal/m²h°C
LMTD		°C	LMTD Corrected 5.5 °C

Construction

Pressure	Design 22 kg/cm²G	Test kg/cm²G	Design 7 kg/cm²G	Test kg/cm²G	
Design Temperature	60 °C		60 °C		
Tube	No. per Shell 1090	Size: 19 O.D. × 12000 L × 2 Thick. (min. ave.)		Pitch 25 Δ	
Material & Other	Tube: C.S.	Shell: C.S.	Shell I.D.:	Thick.:	
Channel: C.S.		Gasket:	Channel Cover: C.S.		
Shell Cover:		Gasket:	Floating Head:	Gasket:	
Tube Sheet: Stationary: C.S.		Thick.:	Floating:	Thick.:	
Cross Baffle: C.S.		Thick.:	Type: SEGMENTAL	No: 30 Cut: 25 %	Space: 650 & 265
Long Baffle:		Thick.:	Type:	No:	
Tube Support:		Thick.:	Type:		Space:
Corrosion Allowance	3.2 mm		3.2 mm		
Stress Relief	No Yes		Radiograph: No Yes	%	
Weight per Unit	Empty kg	Tube Bundle:	kg	Full of Water:	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating (Tube Side)
Inlet	10B ANSI #300 S.O.RF	3B 3/13.10t
Outlet	6B "	2B "
Drain		1/4B "
Vent	4B ANSI #300 S.O.RF	1/4B "

Remarks:

Painting

MITSUBISHI HEAVY INDUSTRIES, LTD.

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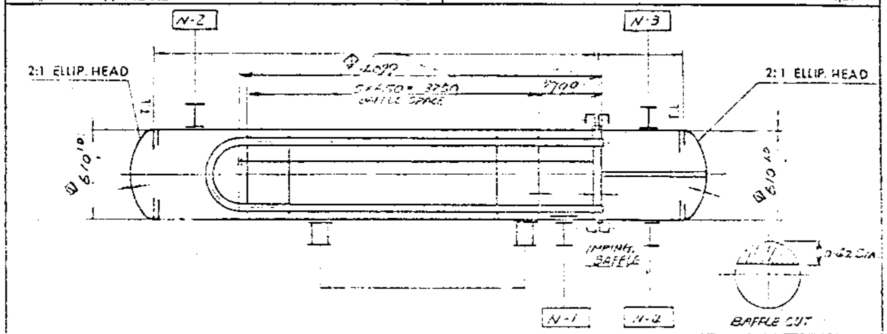
TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET (U TUBE TYPE)

Rev.	1	2
Date	5/19	Aug. 26 '84
Check		

Plant	IRAQ EXPANSION UREA UNIT	Item No.	E-513A
Customer	M.O.I. IRAQ		
Order		Service	3rd STAGE CO_2 COOLER
Location	Indoor (Outdoor)	No. Req'd	1
Type	BEU	Shells per Unit	1
Shell I.D.	610 — Tube Length 4100 S.L.	Surface per Unit	66.0 m²
Regulation	ASME VIII — Code TEMA R	Surface per Shell	66.0 m²



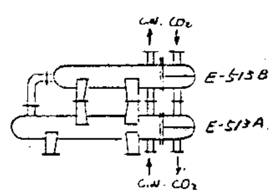
Design Data	Shell Side	Tube Side
Fluid	C.W.	CO_2 GAS
Oper. Press. kg/cm² G	4	73
Design Press. kg/cm² G	7	80.3
Oper. Temp. In & Out °C	34.5/41.7	165/53
Design Temp. °C	50	200
Hydro. Test Press. kg/cm² G		
Pneu. Test Press. kg/cm² G		
Radiograph		
Post Weld Heat Treatment		
Joint Efficiency %		
Corrosion Allowance mm	3.2	0
Painting	YES	YES
Insulation Hot, Cold mm, in.	NO	NO
Number of Pass	1	2
Tube 19 O.D. × 1.6 Min. Aver. Wall × 4100 S.L.		
No. per Shell U-141 Pitch 25		
Weight: Empty kg, lb		
Full of Water kg, lb		

Part	Mat'l	No. Req'd	Remarks
Shell Head	SS41P		
Bonnet	[illegible] + SUS 304 CLAD		
Shell Flange	SF45		
Bonnet Flange	SF50 + SUS 304 OFF		
Tubesheet	SF50 + SUS 304 CLAD		
Tube	SUS 304 TB	U-141	
Transverse Baffle	SS41		Cut 42%
Spacer	SS41		
Tie Rod	SS41		
Nozzle Flange Shell Side	SF45		
Nozzle Flange Bonnet Side	SF45 + SUS 304 OFF		
Nozzle Neck Shell Side	STPG 38		
Nozzle Neck Bonnet Side	SUS 304		
Support Saddle	SS41		
Bolt & Nut	SCM3 · S45C		
Anchor Bolt			
Sliding Plate			
Gasket			

Nozzle & Connection

Mark	Size	No. Req'd	Rating	Service	Proj. & in Face	Remarks
N-1	10B	1	JIS 10K SORF	C.W. INLET		
N-2	10B	1	"	C.W. OUTLET		
N-3	6B	1	ANSI 600# WNRF	CO_2 INLET		
N-4	6B	1	"	CO_2 OUTLET		

Note



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MITSUBISHI HEAVY INDUSTRIES, LTD.

TUBULAR HEAT EXCHANGER DATA SHEET

Rev.
Date
Check

Plant	IRAQ EXPANSION UREA UNIT	Item No.	E-513B
Customer	M.O.I. IRAQ	Service	3rd STAGE CO_2 COOLER
Order			
Location	Indoor (Outdoor)	No. Req'd	1
Type	U-TUBE BEU	Shells per Unit	1
Shell I.D.	610	Tube Length	15000 s/s
Surface per Unit	22.0 m²		
Regulation	Code TEMA R	Surface per Shell	22.0 m²

Performance of One Unit

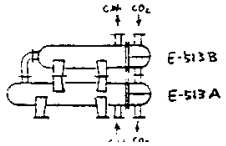
	Shell Side	Tube Side
Fluid Circulated	COOLING WATER	CO_2 GAS
Total	M.W. 380,000 kg/h	M.W. 40.310 kg/h
Vapor	M.W. kg/h	M.W. kg/h
Liquid	M.W. 380,000 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non Condensable	M.W. kg/h	M.W. 40.310 kg/h
Liquid: Density	993 kg/m³ at 38.4 °C	kg/m³ at °C
Liquid: Viscosity	0.69 cp at 38.4 °C	cp at °C
Liquid: Specific Heat	0.998 kcal/kg °C at 38.4 °C	kcal/kg °C at °C
Liquid: Boiling Point	°C	°C
Liquid: Ther. Conductivity	0.537 kcal/mh °C at 38.4 °C	kcal/mh °C at °C
Vapor: Density	kg/m³ at °C	95.9 kg/m³ at 169 °C
Vapor: Viscosity	cp at °C	0.0231 cp at 169 °C
Vapor: Specific Heat	kcal/kg °C at °C	0.272 kcal/kg °C at 169 °C
Vapor: Dew Point	°C	°C
Vapor: Ther. Conductivity	kcal/mh °C at °C	0.0294 kcal/mh °C at 169 °C
Steam Sup. or Cond.	M.W. kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Heat Load	kcal/kg at °C	kcal/kg at °C
Temp. In & Out	In 36.7 °C Out 40 °C	In 227.4 °C Out 108.5 °C
Operating Press.	2 kg/cm² G	73 kg/cm² G
No. of Pass & Velocity	1 m/s	2 m/s
Pressure Drop	Spec. kg/cm² Calc. 0.160 kg/cm²	Spec. kg/cm² Calc. 0.491 kg/cm²
Sensible Heat	kcal/h	kcal/h
Latent Heat	kcal/h	kcal/h
Total Heat Duty	1 321 000 kcal/h	1321 000 kcal/h
Fouling Factor	Spec. 0.0006 m²h °C/kcal	Spec 0.0002 m²h °C/kcal
Film Coefficient	4747 kcal/m²h °C	899 kcal/m²h °C
Overall Trans. Coeff.	Clean 728 kcal/m²h °C Fouled	kcal/m²h °C Designed 508 kcal/m²h °C
LMTD	118 °C	LMTD Corrected °C

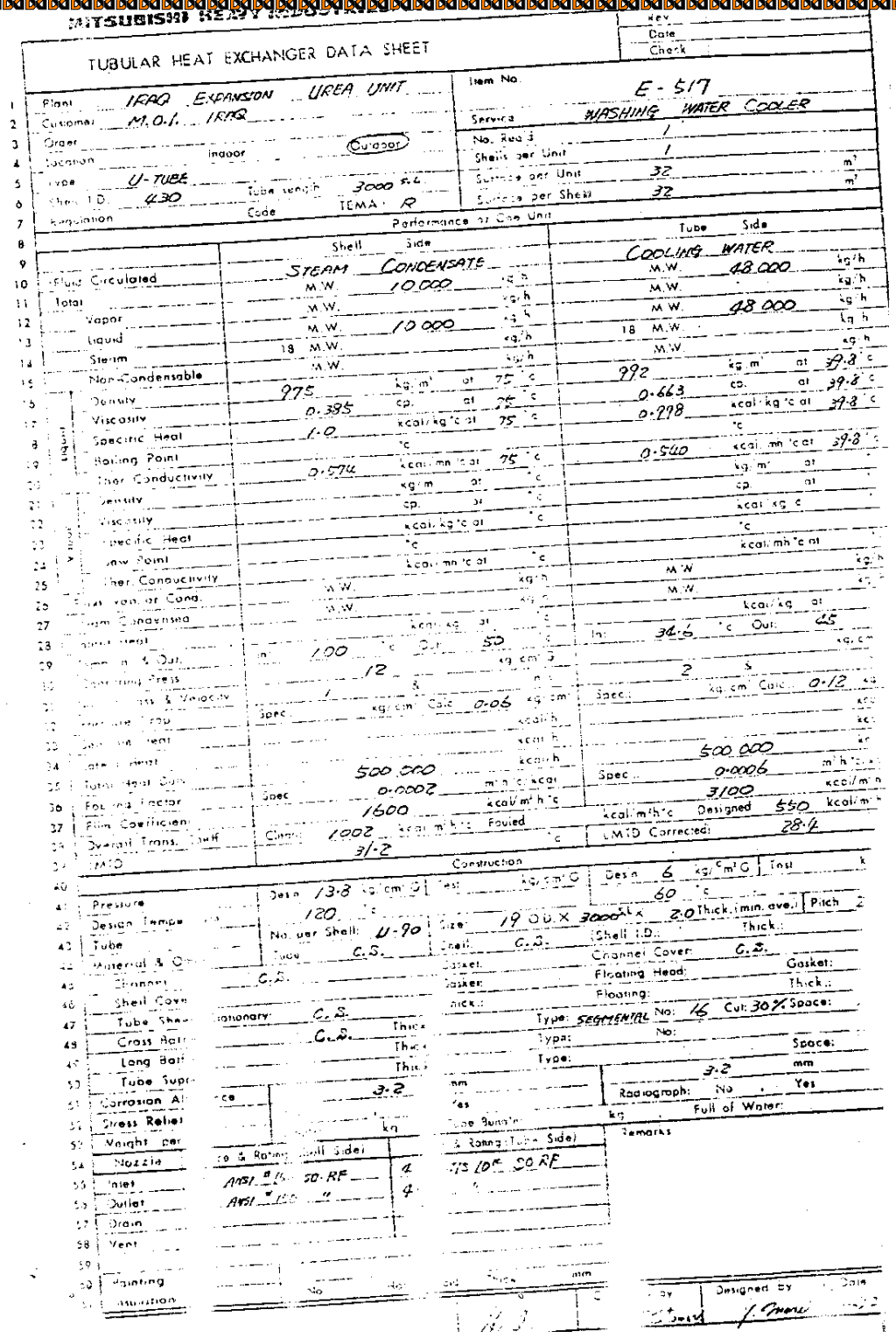
Construction

Pressure	Design 7 kg/cm² G Test kg/cm² G	Design 30.3 kg/cm² G Test kg/cm² G	
Design Temperature	60 °C	240 °C	
Tube	No. per Shell 11-141 Size 19 O.D. × 15000 s/s × 2.0 Thick. min. ave.		Pitch 25 △
Material & Other	Tube C.S. Shell C.S.	Shell I.D. Thick.	
Channel	C.S. Gasket	Channel Cover C.S.	
Shell Cover	C.S. Gasket	Floating Head Gasket	
Tube Sheet: Stationary	C.S. Thick.	Floating Thick.	
Cross Baffle	C.S. Thick. Type: SEGMENTAL	No. 3 Cut 40% Space 670	
Long Baffle	Thick. Type	No.	
Tube Support	Thick. Type		Space
Corrosion Allowance	3.2 mm	3.2 mm	
Stress Relief	No Yes	Radiograph: No Yes	%
Weight per Unit	Empty kg Tube Bundle	kg Full of Water	kg

Nozzle	Size & Rating (Shell Side)	Size & Rating Tube Side
Inlet	10B JIS 10K SORF	6B ANSI #600 W.N.RF
Outlet	10B "	6B "
Drain	3/4B "	
Vent		
Painting		

Remarks





MITSUBISHI HEAVY INDUSTRIES

TUBULAR HEAT EXCHANGER DATA SHEET

Rev. / Date / Check

Plant: IRAQ EXPANSION UREA UNIT — Item No.: E-517

Customer: M.O.I. IRAQ — Service: WASHING WATER COOLER

Order — No. Req'd: 1

Location: Indoor / Outdoor — Shells per Unit: 1

Type: U-TUBE — Surface per Unit: 32 m²

Shell I.D.: 430 — Tube length: 3000 m/m — Surface per Shell: 32 m²

Regulation — Code: TEMA R

Performance of One Unit

	Shell Side	Tube Side
Fluid Circulated	STEAM CONDENSATE	COOLING WATER
Total	M.W. 10.000 kg/h	M.W. 48.000 kg/h
Vapor	M.W. kg/h	M.W. 48.000 kg/h
Liquid	M.W. 10.000 kg/h	M.W. kg/h
Steam	18 M.W. kg/h	18 M.W. kg/h
Non-Condensable	M.W. kg/h	M.W. kg/h
Density	975 kg/m³ at 75 °C	992 kg/m³ at 39.8 °C
Viscosity	0.385 cp. at 75 °C	0.663 cp. at 39.8 °C
Specific Heat	1.0 kcal/kg·°C at 75 °C	0.998 kcal/kg·°C at 39.8 °C
Boiling Point	°C	°C
Ther. Conductivity	0.574 kcal/m·h·°C at 75 °C	0.540 kcal/m·h·°C at 39.8 °C
Density	kg/m³ at °C	kg/m³ at
Viscosity	cp. at °C	cp. at
Specific Heat	kcal/kg·°C at °C	kcal/kg·°C
Dew Point	°C	°C
Ther. Conductivity	kcal/m·h·°C at °C	kcal/m·h·°C at
Latent Heat of Cond.	M.W. kg/h	M.W. kg/h
Steam Condensed	M.W. kg/h	M.W. kg/h
Latent Heat	kcal/kg at	kcal/kg at
Temp. In & Out	In: 100 °C Out: 50 °C	In: 34.6 °C Out: 45 °C
Operating Press.	12 kg/cm²G	2 kg/cm²G
Press. & Velocity	Spec. / kg/cm² Calc. 0.06 kg/cm²	Spec. kg/cm² Calc. 0.12 kg/cm²
Heat Exchanged	kcal/h	kcal/h
Total Heat	kcal/h	500.000 kcal/h
Fouling Factor	Spec. 500.000 kcal/h / 0.0002 m²h°C/kcal	Spec. 0.0006 m²h°C/kcal
Film Coefficient	1600 kcal/m²h°C	3100 kcal/m²h°C
Overall Trans. Coef.	Clean 1002 kcal/m²h°C Fouled	kcal/m²h°C Designed 550 kcal/m²h°C
LMTD	31.2 °C	LMTD Corrected: 28.4

Construction

	Shell Side	Tube Side
Pressure	Desn. 13.8 kg/cm²G Test kg/cm²G	Desn. 6 kg/cm²G Test k
Design Temp.	120 °C	60 °C
Tube	No. per Shell: U-90 Size: 19 O.D. × 3000 lx 2.0 Thick. (min. ave.) Pitch 2	
Material & Grade	Type: C.S. Shell: C.S. Shell I.D. Thick.	
Channel	C.S. Gasket: Channel Cover: C.S. Gasket:	
Shell Cover	Gasket Thick.: Floating Head: Thick.:	
Tube Sheet	Stationary: C.S. Floating:	
Cross Baffle	C.S. Thick. Type: SEGMENTAL No: 16 Cut: 30% Space:	
Long Baffle	Thick. Type: No: Space:	
Tube Support	Type: 3.2 mm	
Corrosion Allowance	3.2 Radiograph: No Yes	
Stress Relief	kg Full of Water:	
Weight per		

Nozzle	No.	Size & Rating (Shell Side)	No.	Size & Rating (Tube Side)
Inlet	1	ANSI 8" 150 SO-RF	1	175 10K SO RF
Outlet	1	ANSI 8" 150 "	1	
Drain				
Vent				

Painting — Insulation — Remarks

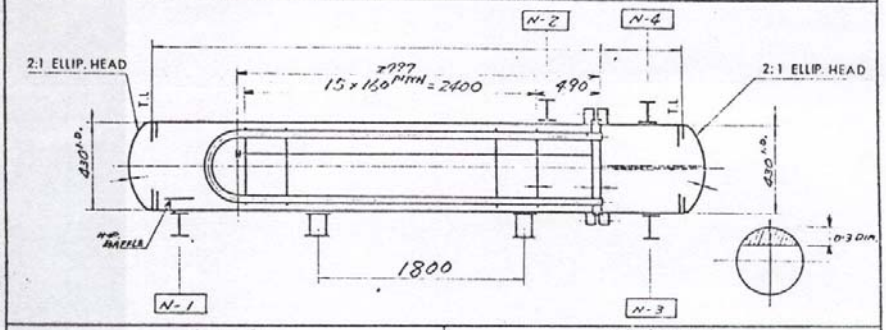
Designed By	Date
J. Tanaka	

MITSUBISHI HEAVY INDUSTRIES, LTD. 2/2

TUBULAR HEAT EXCHANGER MECHANICAL DATA SHEET
(U TUBE TYPE)

Check

Plant	IRAQ EXPANSION UREA UNIT	Item No.	E-517
Customer	M.O.I. IRAQ	Service	WASHING WATER COOLER
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shells per Unit	1
Type	BEU	Surface per Unit	32 m²/ft²
Shell I.D.	430 Tube Length 3000 S.L.	Surface per Shell	32 m²/ft²
Regulation	Code TEMA R		



Design Data

	Shell Side	Tube Side
Fluid	STEAM (CONT)	C.W.
Oper. Press. kg/cm²G, PSIG	12	4
Design Press. kg/cm²G, PSIG	13.8	7
Oper. Temp. In & Out °C, °F	100 / 50	26.6 / 45
Design Temp. °C, °F	120	60
Hydro. Test Press. kg/cm²G, PSIG		
Pneu. Test Press. kg/cm²G, PSIG		
Radiograph	SPOT (20%)	NO
Post Weld Heat Treatment	NO	YES
Joint Efficiency %		
Corrosion Allowance mm, ins	3.2	3.2
Painting	YES	YES
Insulation Hot, Cold mm, ins	NO	NO
Number of Pass	1	2
Tube 19 O.D.× 2.0 (Min. Aver. Wall) × 3000 S.L		
No. per Shell U-90 Pitch 25		
Weight : Empty kg, lb		
Full of Water kg, lb		

Bill of Material

Part	Mat'l	No. Req'd	Remarks
Shell Head	SM41B		
Bonnet	SS41P		
Shell Flange	SF45		
Bonnet Flange	-		
Tubesheet	SF45		
Tube	STB35	Us	
Transverse Baffle	C.S.		Ken Cut %
Spacer	C.S.		
Tie Rod	C.S.		
Nozzle Flange Shell Side	C.S.		
Nozzle Flange Bonnet Side	C.S.		
Nozzle Neck Shell Side	C.S.		
Nozzle Neck Bonnet Side	C.S.		
Support Saddle			
Bolt & Nut			
Anchor Bolt			
Sliding Plate			
Gasket			

Nozzle & Connection

Mark	Size	No. Req'd	Rating	Service	Projection	Remarks
N-1	3B	1	ANSI #150 RF	COND. INLET		
N-2	3B	1	"	COND. OUTLET		
N-3	4B	1	JIS 10K	C.W. INLET		
N-4	4B	1	"	C.W. OUTLET		

Note

EJECTOR CONDENSER DATA SHEET		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	E-316	-	O			C		
	AUX.	-		-	A			D		
	TOTAL	1	-		B			E		

CUSTOMER: MCEC /IRAQ			PLANT NAME : IRAQ EXP.	
ORDER /ITEM : 352434 , 674001			SERVICE : FOR K-301T	CONTINUOUS
OPERATING CONDITION				
SHELL SIDE			TUBE SIDE	
FLUID EJECTOR	STEAM 24.3Kg/hr. AIR		FLUID	CONDENSATE
INLET CONDITION	0.205Kg/cm^2Abs 61.5 c			Max. 60t/h nor. 50t/h
	INTER	AFTER	FLOW	MIN. 27.5 T/HR
INLET TEMP.	C	C	INLET TEMP.	60 C
OUTLET TEMP.	C	C	OUTLET TEMP.	C
WORK PRESS.	0.475 Kg/cm^2g	1.0 Kg/cm^2g	INLET PRESS.	3.5 Kg/cm^2g
DRIVE STEAM	10.0 Kg/hr	10.0 Kg/hr	PRESS LOSS	ALLOW 0.5 Kg/cm^2
HEAT LOAD	Kcal/HR	Kcal/HR		Max. Kg/cm^2
STEAM CONDITION	NOR. 10.0Kg/cm^2g* C		MAX. 13.5 Kg/CM^2G * C	
SPECIFICATION				
TYPE	SINGLE TWO STAGE		CODE	HEI
SHELL SIDE			TUBE SIDE	
DESIGN PRESS.	0.5 Kg/cm^2G & FULL VAC.		DESIGN PRESS.	7 Kg/cm^2G
DESIGN TEMP.	250 C		DESIGN TEMP.	80 C
SURFACE	7.68 M^2		TUBE SIZE	
NO. OF PASSES	1		NO. OF PASSES	2
CORRO. ALLOW	10 MM		CORRO. ALLOW	10 MM FOR CHANNEL
FOULING FACTOR	M^2H C/Kcal		FOULING FACTOR	M^2H C/Kcal
INLET	3" ANSI JIS150 RF		INLET & OUTLET	4" ANSI
DRAIN (INTER)	1 ½" ANSI JIS 150 RF		VENT	¾" PT * 1 PIECE
DRAIN AFTER)	1 ½" ANSI JIS 150 RF		DRAIN	¾" PT * 1 PIECE
VENT	2"			
MATERIAL				
SHELL SIDE			TUBE SIDE	
SHELL	SS41		TUBE	SUS304TB
SHELL COVER	SS41		TUBE SHEET	SUS304
SHELL FLANGE	SS41		CHANNEL	SS41
EXPANSION JOINT			CHANNEL COVER	SS41
GASKET	V#1500 (NO CARBON)		GASKET	V#1500 (NO CARBON)
NOZZLE	STPG38 – 2" –SCH40 , 1 ½" SCH40		NOZZEL	SGP
NOZZLE FLANGE	S25C		NOZZLE FLANGE	SS41
BOLT & NUT	SS41		BOLT & NUT	SS41
BAFFLE PLATE	SS41			
			CHANNEL FLANGE	SS41
EJECTOR				
STEAM CHEST	S25C		DIFFUSER	SS41
NOZZLE	SUS304		STRAINER	SUS304
SUPPLY OF MF/R			SPARE PARTS (SEE)	
COOLER	YES		GASKET	1 SET / 1 UNIT
FOUDATION BOLT & N	YES		TUBE	5 / 1 UNIT
SLIDE PLATE	YES		NOZZLE	1 SET
TEST RING	NO		DIRECTION OF NOZZLE	
TOOLS	YES (SPECIAL ONLY)		OIL IN & OUT	DOWN & UP
SPARE PARTS	YES		AIR STM	SIDE
EJECTOR	YES			
STRAINER	YES			
TEST				
HYDRO TEST PRESS	SHELL 1.5 Kg/cm^2		TUBE 10.5 Kg/cm^2	
LEAK. TEST PRESS.	SHELL 0.5 Kg/cm^2		TUBE : NO Kg/cm^2	
X RAY	SHELL * NO		TUBE NO	
STRES RELIVED	SHELL NO		TUBE NO	
WITNESS	*MHI		MATERIAL CERF.	*YES NO
TEST REPORT	*REQUIRED		BOXING	*DOMESTIC EXPORT
			COATING	*PRIMARY FINISH
COPPER & COPPER ALLOY SHALL NOT BE USED				535-0852-031
CUSTOMER'S SPEC. NO.			DWG. NO. :	
MHI SPEC. NO.			MF'R : SEO KOATSU KOGYO CO.	

COOLER DATA SHEET		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	E-320	-	O			C		
	AUX.			-	A			D		
	TOTAL	1	-		B			E		

CUSTOMER: MCEC /IRAQ	PLANT NAME : IRAQ EXP.
ORDER /ITEM : 6-700219 /0100	SERVICE : 800T/D NH3 UNIT CONTINUOUS

OPERATING CONDITION

SHELL SIDE		TUBE SIDE	
FLUID	STEAM & AIR	FLUID	COOLING TOWER WATER
HEAT LOAD	13.7*10^4 KCAL/HR		
FLOW	STEAM 270 Kg/hr AIR 150 Kg/hr	FLOW	25 T/HR
INLET TEMP.	C	INLET TEMP.	C
OUTLET TEMP.	C	OUTLET TEMP.	40.1 C
INLET PRESS.	-200 mm, Ag	INLET PRESS.	5.5 Kg/cm^2g
		PRESS LOSS	ALLOW Kg/cm^2
			Max. 0.5 Kg/cm^2
			1.58 m/s

SPECIFICATION

TYPE		CODE	Mhi std
SHELL SIDE		TUBE SIDE	
DESIGN PRESS.	1.0 Kg/cm^2G	DESIGN PRESS.	8.5 Kg/cm^2G
DESIGN TEMP.	100 C	DESIGN TEMP.	80 C
SURFACE	7 M^2(APPROX.)	TUBE SIZE	16 t
NO. OF PASSES	1	NO. OF PASSES	4
CORRO. ALLOW	10 MM	CORRO. ALLOW	10 MM FOR CHANNEL
FOULING FACTOR	M^2H C/Kcal	FOULING FACTOR	0.0006 M^2H C/Kcal
INLET CONN	4" ANSI300# RF	IN & OUT CONN	3" JIS10K FF
VENT		VENT	½" PT * 1 PIECE
DRAIN	½" PT * 1 PIECE	DRAIN	½" PT * 1 PIECE
OVERALL HEAT TRANSFER RATE		500 Kcal/m^2 hc	

MATERIAL

SHELL SIDE		TUBE SIDE	
SHELL	STPT38	TUBE	BSTF
		TUBE SHEET	NBSP
SHELL FLANGE	SS41	CHANNEL	STPT38
EXPANSION JOINT	STPG	CHANNEL COVER	SB42
GASKET	V#1500 (NO CARBON)	GASKET	V#1500 (NO CARBON)
NOZZLE		NOZZEL	STPG38
NOZZLE FLANGE	S25C	NOZZLE FLANGE	SS41
BOLT & NUT	SS41	BOLT & NUT	SS41
BAFFLE PLATE	SS41		
NOZZLE(STEAMIN.)	STPT38 4" SCH40	CHANNEL FLANGE	SS41

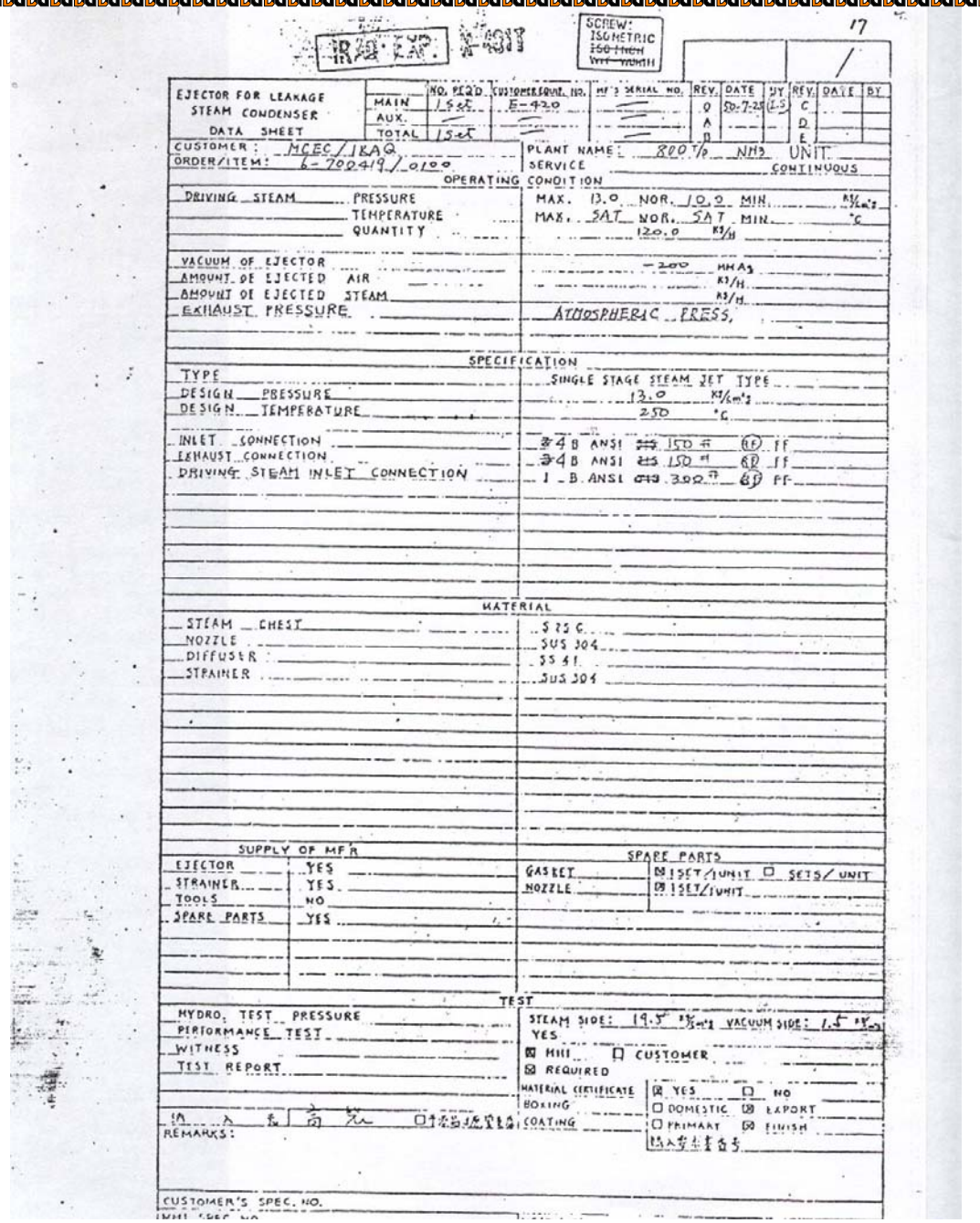
SUPPLY OF MF/R		SPARE PARTS	
CONDENSER	YES	GASKET	1SET 1 UNIT
FOUDATION BOLT	YES	TUBE	5% 1 UNIT
SLIDE PLATE	YES	SAERFIAL PLATE	
TEST RING	NO	DIRECTION OF NOZZLE	
TOOLS	YES (SPECIAL ONLY)		
SPARE PARTS	YES		

TEST

HYDRO TEST PRESS	SHELL 1.5 Kg/cm^2g	TUBE 12.75 Kg/cm^2g	
LEAK. TEST PRESS.	SHELL NO Kg/cm^2g	TUBE NO Kg/cm^2g	
X RAY	SHELL * NO	TUBE *NO	
STRES RELIVED	SHELL * NO	TUBE *NO	
WITNESS	*MHI	MATERIAL CERF.	YES
TEST REPORT	*REQUIRED	BOXING	DOMESTIC *EXPORT
		COATING	PRIMARY *FINISH
COPPER & COPPER ALLOY SHALL NOT BE USED			535-0852-031
CUSTOMER'S SPEC. NO.		DWG. NO. : 730-40314	
MHI SPEC. NO.		MF'R : SEO KOATSU KOGYO CO.	

COOLER DATA SHEET		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	E-324A	-	O			C		
	AUX.	1	E-324B	-	G			D		
	TOTAL	2	-		B			E		

CUSTOMER: MCEC /IRAQ		PLANT NAME : IRAQ EXP.	
ORDER /ITEM : 352434 , 674001		SERVICE : K-303 & K-401	CONTINUOUS
OPERATING CONDITION			
SHELL SIDE		TUBE SIDE	
FLUID	JIS K2213 NO.1 OIL	FLUID	COOLING TOWER WATER
HEAT LOAD	245000 KCAL/HR		
FLOW	751 L/M	FLOW	61.3 T/HR
INLET TEMP.	58.4 C	INLET TEMP.	34.6 C
OUTLET TEMP.	45 C	OUTLET TEMP.	38.6 C
INLET PRESS.	8 Kg/cm^2g	INLET PRESS.	4.5 Kg/cm^2g
PRESS LOSS	ALLOW Kg/cm^2g	PRESS LOSS	ALLOW Kg/cm^2g
	Max. 1.0 Kg/cm^2g		Max. 1.0 Kg/cm^2g
SPECIFICATION			
TYPE	FIXED TUBE SHEET TYPE	CODE	TEMA CLASS "R"
SHELL SIDE		TUBE SIDE	
DESIGN PRESS.	10 Kg/cm^2G	DESIGN PRESS.	7 Kg/cm^2G
DESIGN TEMP.	80 C	DESIGN TEMP.	50 C
SURFACE	76 M^2(APROX.)	TUBE SIZE	3542 L *19 OD * 1.6t
NO. OF PASSES	1	NO. OF PASSES	6
CORRO. ALLOW	3.2 MM	CORRO. ALLOW	3.2 MM FOR CHANNEL
FOULING FACTOR	M^2H C/Kcal	FOULING FACTOR	0.0006 M^2H C/Kcal
VENT	¾" SW *1 PIECE	VENT	¾" PT * 2 PIECE
DRAIN	¾" SW *1 PIECE	DRAIN	¾" PT * 2 PIECE
		MATERIAL	
SHELL SIDE		TUBE SIDE	
SHELL	SM41	TUBE	SUS304TB
SHELL COVER	SM41	TUBE SHEET	SM41
SHELL FLANGE	SM41	CHANNEL	SM41
		CHANNEL COVER	SM41
GASKET	V#1500 (NO CARBON)	GASKET	V#1500 (NO CARBON)
NOZZLE	STPG38 – 2" –SCH40 , 1 ½" SCH80	NOZZEL	STPG38
NOZZLE FLANGE	S25C	NOZZLE FLANGE	SS41
BOLT & NUT	S35C / S25C	BOLT & NUT	S35C / S25C
BAFFLE PLATE	SS41		
		CHANNEL FLANGE	SM41
SUPPLY OF MF/R		SPARE PARTS (SEE 735-991643)	
COOLER	YES		
FOUDATION BOLT &	YES		
SLIDE PLATE	YES		
TEST RING	NO	DIRECTION OF NOZZLE	
TOOLS	YES (SPECIAL ONLY)	OIL IN & OUT	RIGHT HAND VIEW FROM
SPARE PARTS	YES		CHANNEL END
		WATER IN & OUT	LEFT HAND = =
TEST			
HYDRO TEST PRESS	SHELL 15 Kg/cm^2 g	TUBE 11 Kg/cm^2g	
LEAK. TEST PRESS.	SHELL 10 Kg/cm^2 g	TUBE 7 Kg/cm^2g	
X RAY	SHELL NO	TUBE NO	
STRES RELIVED	SHELL NO	TUBE NO	
WITNESS	MHI	MATERIAL CERF.	NO
TEST REPORT	REQUIRED	BOXING	DOMESTIC EXPORT
		COATING	PRIMARY FINISH
COPPER & COPPER ALLOY SHALL NOT BE USED			535-0852-031
CUSTOMER'S SPEC. NO.		DWG. NO. : 730-40314	
MHI SPEC. NO.		MF'R : SEO KOATSU KOGYO CO.	



RA-EXP. F-401

SCREW: ISO METRIC ~~ISO INCH~~ ~~WHITWORTH~~

17

EJECTOR FOR LEAKAGE STEAM CONDENSER DATA SHEET

	NO. REQ'D	CUSTOMER EQUIP. NO.	MFR'S SERIAL NO.	REV.	DATE	BY	REV.	DATE	BY
MAIN	1 set	E-420		0	50-7-25	LS	C		
AUX.	—	—	—	A	—	—	D		
TOTAL	1 set	—	—	B	—	—	E		

CUSTOMER: MCEC / IKAO
ORDER/ITEM: 6-70049 / 0100
PLANT NAME: 800 T/D NH3 UNIT
SERVICE: CONTINUOUS

OPERATING CONDITION

DRIVING STEAM PRESSURE	MAX. 13.0 NOR. 10.0 MIN. — kg/cm²G
DRIVING STEAM TEMPERATURE	MAX. SAT NOR. SAT MIN. — °C
DRIVING STEAM QUANTITY	— 120.0 kg/H
VACUUM OF EJECTOR	— 200 mmAq
AMOUNT OF EJECTED AIR	— kg/H
AMOUNT OF EJECTED STEAM	— kg/H
EXHAUST PRESSURE	ATMOSPHERIC PRESS.

SPECIFICATION

TYPE	SINGLE STAGE STEAM JET TYPE
DESIGN PRESSURE	13.0 kg/cm²G
DESIGN TEMPERATURE	250 °C
INLET CONNECTION	~~3~~4 B ANSI ~~150~~ 300 # (RF) FF
EXHAUST CONNECTION	~~3~~4 B ANSI ~~125~~ 150 # (RF) FF
DRIVING STEAM INLET CONNECTION	1 B ANSI ~~150~~ 300 # (RF) FF

MATERIAL

STEAM CHEST	S 25 C
NOZZLE	SUS 304
DIFFUSER	SS 41
STRAINER	SUS 304

SUPPLY OF MF'R

EJECTOR	YES
STRAINER	YES
TOOLS	NO
SPARE PARTS	YES

SPARE PARTS

GASKET	☒ 1 SET/1 UNIT ☐ SETS/UNIT
NOZZLE	☒ 1 SET/1 UNIT

TEST

HYDRO. TEST PRESSURE	STEAM SIDE: 19.5 kg/cm²G VACUUM SIDE: 1.5 kg/cm²G
PERFORMANCE TEST	YES
WITNESS	☒ MHI ☐ CUSTOMER
TEST REPORT	☒ REQUIRED
MATERIAL CERTIFICATE	☒ YES ☐ NO
BOXING	☐ DOMESTIC ☒ EXPORT
COATING	☐ PRIMARY ☒ FINISH

REMARKS:

CUSTOMER'S SPEC. NO.

Part 3. E-531 Leakage Condenser

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SCREW: ISO METRIC

LEAKAGE STEAM CONDENSER DATA SHEET		NO. REQ'D	CUSTOMER ITEM NO.	M.H.I. SERIAL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1 set	E-531	—	0	79-7-25	[illegible]	C		
	AUX.	—	—	—	A			D		
	TOTAL	1 set	—	—	B			E		

CUSTOMER: MCEC / IRAQ — PLANT NAME: 1300 TD UREA UNIT

ORDER ITEM: 6-700579/3100 — SERVICE: CONTINUOUS

OPERATING CONDITION

SHELL SIDE		TUBE SIDE	
FLUID	STEAM AND AIR	FLUID	TOWER WATER
HEAT LOAD	23.6X10⁶ Kcal/Hr		
FLOW	STEAM 390 Kg/Hr AIR 150 Kg/Hr	FLOW	35 T Hr
INLET TEMP	°C	INLET TEMP	24.6 °C
OUTLET TEMP	°C	OUTLET TEMP	41.4 °C
INLET PRESS	−200 mm Aq [illegible]	INLET PRESS	5.5 Kg cm²G
		PRESS LOSS	ALLOW Kg cm²
			MAX. 0.5 Kg cm²
		[illegible]	1.6 M

SPECIFICATION

TYPE		CODE	TEMA CLASS ~~C~~ R MHI STD.
SHELL SIDE		TUBE SIDE	
DESIGN PRESS	1.0 Kg cm²G	DESIGN PRESS	8.5 Kg/cm²G
DESIGN TEMP	100 °C	DESIGN TEMP	90 °C
SURFACE	10 M²	TUBE SIZE	1100 ☐ I.D. X Size t
NO. OF PASSES	1	NO OF PASSES	☐ 2 ☒ 4 ☐ 6
CORROSION ALLOW	X 1.6 ☐ 3.2 mm	CORROSION ALLOW	X 1.6 ☐ 3.2 mm FOR CHANNEL
FOULING FACTOR	m²h C Kcal	FOULING FACTOR	0.0002 m²h C Kcal
INLET & OUTLET CONN	4 B ANSI ~~300#~~ RF FF	INLET & OUTLET CONN	4 B ANSI JIS 10K RF (FF)
VENT	~~1/4 B PT SW X 1 PIECE~~	VENT	~~1/4~~ 1/8 B PT X 1 PIECE
DRAIN	~~1/4~~ 1/8 B PT SW X 1 PIECE	DRAIN	~~1/4~~ 1/8 B PT X 1 PIECE
DRAIN	1½ B ANSI 150# RF		
OVERALL HEAT TRANSFER RATE		600	Kcal/m² h °C

MATERIAL

SHELL SIDE		TUBE SIDE	
SHELL	☐ SS ☐ SM ☐ STPG ☒ SB42	TUBE	X BSTF ☐ SUS ☐ TP ☐ STB
~~SHELL COVER~~	~~SS SM~~	TUBE SHEET	X NBSP ☐ SM
SHELL FLANGE	☐ S1C X SS ☐ SM	CHANNEL	X SS ☐ SM WITH CORROSION
EXPANSION JOINT	☐ SS ☐ SM ☐ STPG ☐ SB42	CHANNEL COVER	X SS ☐ SM WITH LINING
GASKET	X V ☐ NO CARBON	GASKET	X V ☐ NO CARBON
NOZZLE	~~STPG SCH~~ ☐ 40 SCH80	NOZZLE	☐ SGP X STPG
NOZZLE FLANGE	X S1C	NOZZLE FLANGE	X SS ☐ S1C
BOLT & NUT	X SS ☐ SCM ☐ S1C ☐ S1C S1C	BOLT & NUT	X SS ☐ S1C S1C
BAFFLE PLATE	X SS		
NOZZLE (STEAM INLET)	STPT38 40 SCH40	CHANNEL FLANGE	X SS ☐ SM ☐ S1C
		SACRIFICIAL PLATES	☐ ZINC PLATE

SUPPLY OF M'F'R

CONDENSER	YES
FOUNDATION BOLT & NUT	YES
SLIDE PLATE	YES
TEST RING	YES (NO)
TOOLS	YES (SPECIAL ONLY)
SPARE PARTS	YES

SPARE PARTS

GASKET	X 1 SET / UNIT ☐ SETS / UNIT
TUBE	X 5 % / UNIT
SACRIFICIAL PLATE	☐ SET / UNIT

DIRECTION OF NOZZLE

AIR STEAM WATER

TEST

HYDRO TEST PRESS	SHELL 1.5 Kg cm²g	TUBE 12.75 Kg cm²g		
LEAK TEST PRESS	SHELL (NO) Kg cm²g	TUBE (NO) Kg cm²g		
X RAY	X NO ☐ YES %	TUBE (NO)		
STRESS RELIEVED	SHELL (NO)	TUBE (NO)		
WITNESS	X MHI ☐ CUSTOMER	MATERIAL CERTIFICATE	X YES ☐ NO	
TEST REPORT	X REQUIRED	BOXING	☐ DOMESTIC ☐ EXPORT	
		COATING	PRIMARY X FINISH	

REMARKS:

☐ COPPER & COPPER ALLOY SHALL NOT BE USED FOR

CUSTOMER'S SPEC NO

MHI SPEC. NO — M'F'R M'F'S Working NO

E-712A~C OIL COOLER

ITEM	NAME OF PART	MATERIAL	QTY.	REMARK
1	SHELL	STPG38	1	8B SCH30
2	BONNET	FC20	2	
3	TUBE SHEET	SS41P	2	
4	FLANGE	SS41P	2	
5	COOLING TUBE	SUS304	152	10 *0.8t
6	BAFFLE	SS41	35	1.6t
7	TIEROD	SS41B	4	7
8	COLLAR	SS41B-D		10 *1t
9	COLLAR LOCK NUT	SS41B	8	M7
10	OIL INLET & OUTLET SOCKET	SGP	2	2"
11	OIL INLET & OUTLET FLANGE	SS41P	2	JIS10*FLANGE
12	OIL DRAIN SOCKET	SS41B	1	PT 3/8
13	OIL DRAIN PLUG	FCMB	1	PT 3/8
14	WATER DRAIN PLUG	FCMB	1	PT 3/8
15	THERMOMETER SOCKET	SS41B	2	PT 3/8
16	THERMOMETER PLUG	FCMB	3	PT 3/8
17	PLUG	FCMB	3	PT 3/8
18	ZINC CORROSION ELIMINATOR	ZNB	36	13 *40 L
19	STAND	SS41	9t	
20	"O" RING	NBR	2	Jisw1516-71
21	GASKET (A)	ASB	1	1.5t
22	GASKET (B)	ASB	1	1.5t
23	BOLT WITH S.M	S20C-D	8	M16*65L
24	BOLT WITH SW	S20C-D	4	M16*90L
25	BOLT WITH SW	S20C-D	8	M16*75L
26	BOLT WITH SW	S20C-D	4	M16*100L
27	LINER	SS41P	1	

TEST PRESS.

OIL SIDE 10Kg/cm^2 G
WATER SIDE 15Kg/cm^2G

E-802ABC OIL COOLER SPEC.

NAME OF PURCHASER / MCEC
LOCATION / M.O.I. IRAQ
PURCHASER'S ITEM NO. / E-802 ABC
SERVICE / K-801ABCT OIL COOLER

UNIT/3

1- PARTICULARS

2- TYPE / OC-52

SURFACE AREA	M^2	5	
		SHELL SIDE	TUBE SIDE
FLUID MATERIAL		OIL	C.T.W
QUANTITY & OPERATING PRESS.	M^3/H*KG/CMG	3.3*2	20*MAX.7 NOR.5
INLET TEMP.	C	51.5	34.6
OUTLET TEMP.	C	45	35.1
NO. OF PASS		1	2
HYDRO'C TEST PASSES	KG/CM^2G	5	10.5
TUBE NO. 80	OUT DIA. 5/8"	THICK. 1.6MM	PITCH 21MM
WEIGHT DRY.	APPROX. 270KG	FULL WATER	APPROX. 340KG
FOULING FACTOR	0.0006 M^2HC/KCAL		

3-NOZZLES AND CONNECTION

* C.W. INLET & OUTLET / JIS 10K –3" FF
* OIL INLET & OUTLET / ANSI150LB – 1 1/2" RF

4-ACCESSORIES FOR / UNIT

AC1 VALVE WITH CAP(1/2", SW ,800LB) 1
AC2 VALVE WITH CAP(1/2", SW ,800LB) 1
AC3 VALVE WITH CAP(1/2", SW ,800LB) 1
AC4 THERMOMETER (0–100C, PF3/4, L=100) 2
AC5 PLUG (PF3/4) 1
AC6 PLUG (PF 3/4) 1
AC7 PLUG (PT 1/2) 1
AC8 VALVE WITH CAP(1/2", SW ,800LB) 1

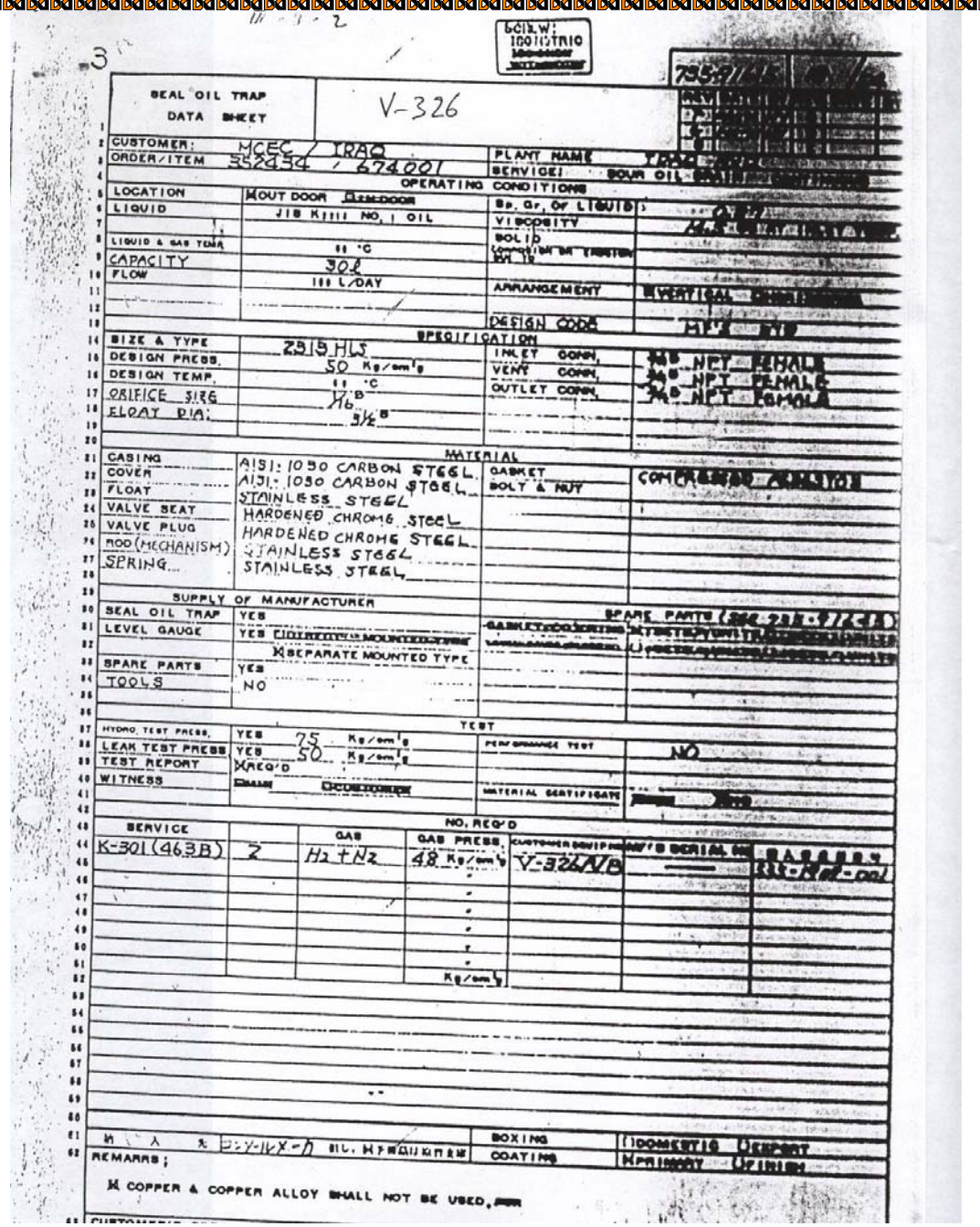
5-SPARE PART FOR UNIT

refer to the spare parts list .

6-SPECIAL TOOLS FOR UNIT /

V-119 NG. COMP. SUCTION SEPARATOR

SEQ.	ITEM	SPECIFICATION
1	LIFTING LUG	SM41B
2	DEMISTER	YORK# 421 OR EQ. (SUS304)
3	INTERNAL BAFFLE	SS41
4	ANCHOR BOLT & NUT	SS41
5	NOZZLE FLANGE	SF45
6	NOZZLE NECK	STPG38
7	MANHOLE GASKET	V#520 OR EQ.
8	MANHOLE BOLT & NUT	SNB7 S45C
9	MANHOLE COVER	SF45
10	MANHOLE FLANGE	SF45
11	MANHOLE NECK	SB42
12	LEG	SS41
13	HEAD	SB42
14	SHELL	SB42
15	INSULATION	NO
16	PAINTING	2COAT (C-2)
17	CORROSION ALLOWANCE	MM
18	JOINT EFFICIENCY	85 %
19	RADIOGRAPH	SPOT
20	POST WELD HEAT TREATMENT	NO
21	PNEUM'C TEST PRESS.	17 Kg/cm^2G
22	HYDRO'C TEST PRESS.	25.5 Kg/cm^2 G
23	OPERATING TEMP.	43 C
24	OPERATING PRESS.	10 Kg/cm^2G
25	DESIGN TEMP.	60 C
26	DESIGN PRESS.	17 Kg/cm^2 G
27	FLUID	NATURAL GAS



SEAL OIL TRAP DATA SHEET

V-326

CUSTOMER: MCEC / IRAQ
ORDER/ITEM 552454 / 674001
PLANT NAME
SERVICE: SOUR OIL

OPERATING CONDITIONS

LOCATION	☒OUT DOOR ☐SEMI-DOOR	Sp. Gr. OF LIQUID	
LIQUID	JIS K1111 NO. 1 OIL	VISCOSITY	
LIQUID & GAS TEMP.	88 °C	SOLID CONTENT OR FREEZING PT.	
CAPACITY	30ℓ		
FLOW	100 L/DAY	ARRANGEMENT	VERTICAL
		DESIGN CODE	

SPECIFICATION

SIZE & TYPE	2515 HLS	INLET CONN.	3/8" NPT FEMALE
DESIGN PRESS.	50 Kg/cm²g	VENT CONN.	3/8" NPT FEMALE
DESIGN TEMP.	88 °C	OUTLET CONN.	3/8" NPT FEMALE
ORIFICE SIZE	1/16"		
FLOAT DIA.	3½"		

MATERIAL

CASING	AISI: 1050 CARBON STEEL	GASKET	COMPRESSED ASBESTOS
COVER	AISI: 1050 CARBON STEEL	BOLT & NUT	
FLOAT	STAINLESS STEEL		
VALVE SEAT	HARDENED CHROME STEEL		
VALVE PLUG	HARDENED CHROME STEEL		
ROD (MECHANISM)	STAINLESS STEEL		
SPRING	STAINLESS STEEL		

SUPPLY OF MANUFACTURER

SEAL OIL TRAP	YES	SPARE PARTS (2 YEARS OPERATION)	
LEVEL GAUGE	YES ☐DIRECTLY MOUNTED TYPE ☒SEPARATE MOUNTED TYPE	GASKET FOR BODY	
SPARE PARTS	YES		
TOOLS	NO		

TEST

HYDRO. TEST PRESS.	YES 75 Kg/cm²g	PERFORMANCE TEST	NO
LEAK TEST PRESS	YES 50 Kg/cm²g		
TEST REPORT	☒REQ'D ☐		
WITNESS	☐MAKER ☐PURCHASER	MATERIAL CERTIFICATE	

NO. REQ'D

SERVICE		GAS	GAS PRESS.	CUSTOMER SHIP. NO.	MAKER'S SERIAL NO.
K-301 (463B)	2	H2+N2	48 Kg/cm²g	V-326/NB	
			"		
			"		
			"		
			"		
			"		
			Kg/cm²g		

M A X [illegible]		BOXING	
		COATING	

REMARKS;

M COPPER & COPPER ALLOY SHALL NOT BE USED.

V 32C Bucket Oil Trap 750-40497 1/1

Dimensions & Data certified correct for:

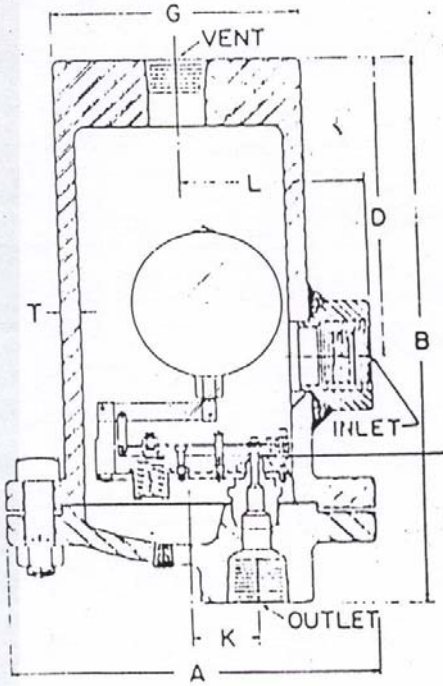
Customer MITSUBISH HEAVY INDUSTRIES, LTD. Order M-639

Job 352434 Q'TY : 2 SETS

ARMSTRONG MACHINE WORKS

By T.V. Patterson

V 711-3
P2 (2/5)
seat 300
seg/11
11/sec 3 etc



Valve No.	2313 HLS	2316 HLS	2313 HLS	2316 HLS	2313 HLS	2316 HLS	2313 HLS	2316 HLS
Pipe Connections, Inches								
Dim. "A", Inches								
"B", Inches								
"D", Inches								
"K", Inches								
"L", Inches								
"T", Inches								
Weight, Lbs.								
Max. Press., Lbs. Water Service	1000	1000	1000	1000	1500	1500	1900	1900
Fluid Dia., Inches								

List of Materials

Part	Material
Cap and Body	Nos. 2313HLS, 2316HLS, 2313HLS, 2316HLS 1020 carbon steel Nos. 2413HLS, 2416HLS, 2416HLS - Alloy Grade F 11 forged steel.
Valve and Seat	Hardened chrome steel - 440F.
Mechanism and Float	Stainless steel
Bolts	Grade B 7 - 125,000 min. tensile
Nuts	Nos. semi finish hot treated
Gasket	Compressed asbestos
Spring	Stainless steel

~~No. 2416 HLS — Body & Cap Fabricated Welded from Plate & Tubing~~

SUNVA TRADING & ENGINEERING CO. LTD.

ARMSTRONG MACHINE WORKS

2313HLS-~~C310HLS~~ SM-311
~~2413HLS-2416HLS~~
Drainers 1/3/69

FOR APPROV

SEAL OIL TRAP DATA SHEET		REV	DATE	BY	REV	DATE	BY
		O			C		
		G	14/1/75	NY	D		
		B			E		

CUSTOMER : MCEC /IRAQ		PLANT NAME : IRAQ EXP.	
ORDER /ITEM 352434 , 674001		SERVICE : SOUR OIL DRAIN	CONTINUOUSE
OPERATING CONDITION			
LOCATION	OUT DOOR	SP. GR. OF LIQUID	0.87
LIQUID	JIS K2213 NO. 1 OIL	VISCOSITY	14.5 CS AT INLET TEMP.
		SOLID	
LIQUID A GAS TEMP.	60 C	CORROSIN ON EMOSION DUE TO	*A
CAPACITY	30L		
FLOW FOR VALVE	500L/DAY MAX.		
SELECTION		DESIGN CODE	JAPAN HIFH PRESS. GAS CONTROL LAW *A
SPECIFICATION			
SIZE & TYPE	CYLINDRICAL VESSEL	INLET CONN.	1" ANSI2500# RTJ * 1
DESIGN PRESS.	240 Kg/cm^2 G	VENT CONN.	4" ANSI2500# RTJ * 1
DESIGN TEMP.	60 C	OUTLET CONN.	1" ANSI2500# RTJ * 1
INSIDE DIA.	246.5 MM	LEVEL GAUGE	3/4" ANSI2500# RTJ * 2
WALL THICKNESS	36MM	LEVEL TRANSMIT	3/4" ANSI2500# RTJ * 2
MATERIAL			
CASING(SHELL)	STPT49S	GASKET	V#440S OR EQ.
COVER(END PLATE)	SM50B	BOLT & NUT	SCM3 & S45C
FLOAT			
VALVE SEAT			
VALVE PLUG			
ROD(MECHANISM)			
FLANGE	SF50 * S25C		
NOZZLE	SF50		
SUPPLY OF MANUFACTURER			
SEAL OIL TRAP	YES		
LEVEL GAUGE	YES *SEPARATE MOUNTED TYPE		
SPARE PARTS	NO		
TOOLS	NO		
TEST			
HYDRO TEST PRESS.	YES 360 Kg/cm^2 G	PERFORMANCE TEST	NO
LEAK TEST PRESS.	YES 240 Kg/cm^2 G		
TEST REPORT	*REQ'D		
WITNESS	*MHI	MATERAILS CERTIFICATE	YES

NO. REQ'D

SERVICE		GAS	GAS PRESS.	CUSTOMER EQUIP. NO	MF'S SERAIL NO	
K-301 (272BR)	2	H2+N2	225 Kg/cm^2 G	V-328A/B	-	
			=			
			=			
			=			
			=			
			=			
			=			
			Kg/cm^2 G			

(SEC. VIII)

*A / STRENGTH CALCULATION SHALL BE PER ASME NON-FIRE PRESS. VESEL FORMULA. FABRICATION PROCEDURE SHALL BE PER MHI STANDARD & "ASME STAMP" IS NOT NECESSARY >

	BOXING	DOMESTIC	EXPORT
	COATING	*PRIMARY	FINISH

ACCUMULATOR DATA SHEET		REV	DATE	BY	REV	DATE	BY
		F	13/12/74	NY	C		
		G	14/1/75	NY	D		
		B			E		

CUSTOMER : MCEC /IRAQ		PLANT NAME : IRAQ EXP.	
ORDER /ITEM 352434 , 674001		SERVICE : GOV. OIL LINE	CONTINUOUS
OPERATING CONDITION			
LOCATION	OUT DOOR	INITIAL CHARGE GAS	N2 GAS
FLUID	JIS K22.5 NO. 1 OIL	INITIAL CHARGE GAS PRESS.	1.8 Kg/cm^2 G
FLUID TEMP.	30~60 C		
MAX. WORKING PRESS	5.5 Kg/cm^2G		
MIN WORKING PRESS.	2.5 Kg/cm^2	DESIGN CODE	MF'R STANDARD
WORKING CAPACITY	9.6 L		
SPECIFICATION			
SIZE & TYPE	MD 210-40	FLUID SIDE CONN.	2" ANSI150# RF
		CHARGE GAS CONN.	MF'S STANDARD
DESIGN TEMP.	70 C		
CAPACITY	39 L		
MATERIAL			
BODY	STH80		
BLADDER	NBR		
SUPPLY OF MANUFACTURER			
ACCUMULATOR	YES		
TOOLS	YES (SPECIAL TOOLS ONLY)		
SPARE PARTS	YES		
GAS CHARGING TOOL	YES		
TEST			
HYDRO TEST PRESS.	YES 15 Kg/cm^2 G	WORKING CAP TEST	YES
TEST REPORT	*REQUIRED	WITNESS	*MHI
MATERIAL CERTIFICATE	YES		
			YES

NO. REQ'D

SERVICE	NO. REQ.	DESIGN PRESS.	CUSTOMER EQUIP. NO	MF'S SERAIL NO	
K-301	1	10 Kg/cm^2 G	**V-329**	-	535-0852-034
K-303 /K-401	1	=	V-356	-	-035
K-302	1	=	V-342	-	-036
		=			-039(TOOLS)

	BOXING	DOMESTIC	EXPORT
	COATING	*PRIMARY	FINISH

ACCUMULATOR DATA SHEET	FOR PLUNGER (HP 50) PUMP SUCTION	REV	DATE	BY	REV	DATE	BY
		O			C		
		G	14/1/75	NY	D		
		B			E		

CUSTOMER : MCEC /IRAQ		PLANT NAME : IRAQ EXP.	
ORDER /ITEM 352434 , 674001		SERVICE : K-301 SYN. GAS	CONTINUOUS
OPERATING CONDITION			
LOCATION	OUT DOOR	INITIAL CHARGE GAS	N2 GAS
FLUID	JIS K22.5 NO. 1 OIL	INITIAL CHARGE GAS PRESS.	5.4 Kg/cm^2 G
FLUID TEMP.	30~60 C		
MAX. WORKING PRESS	8 Kg/cm^2G		
MIN WORKING PRESS.	Kg/cm^2 G	DESIGN CODE	MF'R STANDARD
WORKING CAPACITY	L		
SPECIFICATION			
SIZE & TYPE	MD 210-1	FLUID SIDE CONN.	PS3/4 WITH SW CONN. ADAPTOR
		CHARGE GAS CONN.	MF'S STANDARD
DESIGN TEMP.	70 C		
CAPACITY	1 L		
MATERIAL			
BODY	S38C		
BLADDER	NBR		
SUPPLY OF MANUFACTURER		**SPARE PARTS (SEE 735-91643)**	
ACCUMULATOR	YES		
TOOLS	YES (SPECIAL TOOLS ONLY)		
SPARE PARTS	YES		
GAS CHARGING TOOL	YES		
TEST			
HYDRO TEST PRESS.	YES 15 Kg/cm^2 G	WORKING CAP TEST	YES
TEST REPORT	*REQUIRED	WITNESS	*MHI
MATERIAL CERTIFICATE	YES		
			YES

NO. REQ'D

SERVICE	NO. REQ.	DESIGN PRESS.	CUSTOMER EQUIP. NO	MF'S SERAIL NO	
HP SO PUMP SUCTION	2	10 Kg/cm^2 G	**V-330A/B**	-	535-0852-037

	BOXING	DOMESTIC	EXPORT
	COATING	*PRIMARY	FINISH

HYDRAULIC DESURGER DATA SHEET		REV	DATE	BY	REV	DATE	BY
		O			C		
		G	14/1/75	NY	D		
		H	21/4/75	T.K	E		

CUSTOMER : MCEC /IRAQ		PLANT NAME : IRAQ EXP.	
ORDER /ITEM 352434 , 674001		SERVICE : K-301 SYN. GAS	CONTINUOUS
NO. OF REQUIRED	2 (TWO)	(HP SO PUMP DISCH.)	
CUST'S EQIP. NO.	V-332A/B		
MF'S SERIAL. NO.			
OPERATING CONDITION			
FLUID	JIS K2213 NO. 1 OIL (EQUIVALENT TO SAE10)		
PRESSURE	236 Kg/cm^2G		
TEMPERATURE	MAX. 60 C / MIN 30 C		
FLOW RATE	201 L/Min		
INITIAL CHARGE GAS	N2 GAS		
CHARGE GAS PRESS.	165Kg/cm^2G		
PULSTATION FREQ.	140~200 C/S		
SPECIFICATION			
DESIGN PRESS.	275 Kg/cm^2G		
DESIGN TEMP.	80 C		
TYPE	200 RJ		
INLET CONN.	1 ½" ANSI2500# RTJ		
OUTLET CONN.	1 ½" ANSI2500# RTJ		
NOTE: EQUIPMENT SHALL HAVE THE ENOUGH EFFECT FOR ABSOBING PULSTATION .			
MATERIAL			
BODY	FORGED STEEL		
BOOT	NEOPLANE		
FLANGE	FORGED STEEL		
"O" RING	NEOPLANE		
BOLT & NUT	ALLOY STEEL & FORGED STEEL		
SUPPLY OF MANUFACTURER			
DESURGER ASSEM.	YES		
TOOLS	YES (SPECIAL ONLY)		
SPARE PARTS	YES		
GAS CHARGING TOOL	YES		
SPARE PARTS (SEE 735.91643)			
BOOT			
"O" RING			
GASKET			
TEST			
HYDRO TEST PRESS.	YES 413 Kg/cm^2 G		
PERFORMANCE TEST	YES DAMPING EFFECT TO PULSATION SHALL BE CHECKED		
TEST REPORT	REQ'D		YES

	BOXING	DOMESTIC	EXPORT
	COATING	*PRIMARY	FINISH

OIL FLITER DATA SHEET (SEAL OIL)		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	**F-307A**	-	O			C		
	AUX.	1	F-307B	-	G			D		
	TOTAL	2	-		B			E		

CUSTOMER: MCEC /IRAQ	PLANT NAME : IRAQ EXP. -
ORDER /ITEM : 352434 , 674001	SERVICE : K-301 SYN. GAS CONTINUOUS

OPERATING CONDITION (HP SEAL OIL)

LOCATION	*OUTDOOR	SP.GR. AT INLET TEMP.	0.87
FLUID	JIS K2213 NO.1 OIL	VIS. AT INLET TEMP.	14.5 CS AT 60 C
INLET TEMP	45 C	SOILD	%
INLET PRESS.	236 Kg/cm^2G		
PRESS. LOSS.	NOR. 0.35 Kg/cm^2G AT 114 L/M		
	MAX. 1.75 Kg/cm^2G		
CAPACITY	NOR. 114 L/M		
	DESIGN 201 L/M		

SPECIFICATION

SIZE &TYPE	7D3-F	INLET CONN.	2" ANSI2500 RTJ
DESIGN PRESS.	275 Kg/cm^2G	OUTLET CONN.	2" ANSI2500 RTJ
DESIGN TEMP.	60 C	VENT	½ PT FEMALE WITH PLUG
CORRO. ALLOW	16 MM	DRAIN (INLET SIDE)	3/4PT FEMALE WITH PLUG
FILTRATION	10		

MATERIAL

CASE	S25C	GASKET	V#550S
TOP FLANGE	S25C	ELEMENT	
BOLTS & NUTS	SCM3, S45C		(10) U78-C1
NOZZLE FLANGE	S25C		
NOZZLE PIPE	STPT42-SCHXXS		
BOTTOM PLATE	S25C		

SUPPLY OF MF/R (NOTE)		SPARE PARTS (SEE 735-991643)
FILTER	YES	
FOUDATION BOLT & NUT	NO	
SHIM	NO	
TOOLS	NO	
SPARE PARTS	YES	

TEST

HYDRO TEST PRESS	YES 413 Kg/cm^2G BY OIL	X RAY INSPECTION	YES 100%
LEAK. TEST PRESS.	YES 275 Kg/cm^2G	STRESS RELEVE	YES
TEST REPORT	REQUIRED		
WITNESS	MHI	MATERIAL CERF.	YES
		BOXING	DOMESTIC EXPORT
		COATING	*PRIMARY FINISH

COPPER & COPPER ALLOY SHALL NOT BE USED — 535-0852-005

CUSTOMER'S SPEC. NO.	DWG. NO. : 730-40315
MHI SPEC. NO.	MF'R :

OIL FLITER DATA SHEET (GOV. OIL)		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	F-308	-	O			C		
	AUX.			-	G			D		
	TOTAL	1	-		B			E		
CUSTOMER: MCEC /IRAQ				PLANT NAME : IRAQ EXP.						
ORDER /ITEM : 352434 , 674001				SERVICE : K-301 SYN. GAS				CONTINUOUS		

OPERATING CONDITION			
LOCATION	*OUTDOOR	SP.GR. AT INLET TEMP.	0.87
FLUID	JIS K2213 NO.1 OIL	VIS. AT INLET TEMP.	14.5 CS AT 60 C
INLET TEMP	65 C	SOILD	%
INLET PRESS.	8 Kg/cm^2G		
PRESS. LOSS.	NOR. 0.3 Kg/cm^2		
	MAX. 0.5Kg/cm^2		
CAPACITY	NOR. 60 L/M		
	DESIGN 270 L/M		

SPECIFICATION			
SIZE &TYPE		INLET CONN.	3" ANSI150RF
DESIGN PRESS.	10 Kg/cm^2G	OUTLET CONN.	3" ANSI150 RF
DESIGN TEMP.	70 C	VENT	½ PT FEMALE WITH PLUG
CORRO. ALLOW	16 MM	DRAIN(INLET SIDE)	3/4PT FEMALE WITH PLUG
FILTRATION	100 MESH		

MATERIAL			
CASE	STPG38	GASKET	V#1500
TOP FLANGE	S25C	ELEMENT	SUS304
BOLTS & NUTS	S25C		
NOZZLE FLANGE	S25C		
NOZZLE PIPE	STPG38		
BOTTOM PLATE	S25C		

SUPPLY OF MF/R		SPARE PARTS (SEE 735-91643)
FILTER	YES	
FOUDATION BOLT & NUT	NO	
SHIM	NO	
TOOLS	NO	
SPARE PARTS	YES	
SAFETY VALVE	NO	

TEST			
HYDRO TEST PRESS	YES 15 Kg/cm^2G BY OIL	X RAY INSPECTION	NO
LEAK. TEST PRESS.	NO Kg/cm^2G	STRESS RELEVE	NO
TEST REPORT	REQUIRED		
WITNESS	MHI	MATERIAL CERF.	NO
		BOXING	DOMESTIC EXPORT
		COATING	*PRIMARY FINISH
COPPER & COPPER ALLOY SHALL NOT BE USED			535-0852-007
CUSTOMER'S SPEC. NO.		DWG. NO. : 730-40315	
MHI SPEC. NO.		MF'R :	

OIL FLITER DATA SHEET (GOV. OIL)		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	F-316	-	O			C		
	AUX.			-	G			D		
	TOTAL	1	-		B			E		
CUSTOMER: MCEC /IRAQ				PLANT NAME : IRAQ EXP.						
ORDER /ITEM : 352434 , 674001				SERVICE : K-302 AIR CONTINUOUS						
OPERATING CONDITION										
LOCATION	*OUTDOOR			SP.GR. AT INLET TEMP.	0.87					
FLUID	JIS K2213 NO.1 OIL			VIS. AT INLET TEMP.	14.5 CS AT 60 C					
INLET TEMP	60 C			SOILD	%					
INLET PRESS.	8 Kg/cm^2G									
PRESS. LOSS.	NOR. 0.3 Kg/cm^2									
	MAX. 0.5Kg/cm^2									
CAPACITY	NOR. 220 L/M									
	DESIGN 360 L/M									
SPECIFICATION										
SIZE &TYPE				INLET CONN.	3" ANSI150RF					
DESIGN PRESS.	10 Kg/cm^2G			OUTLET CONN.	3" ANSI150 RF					
DESIGN TEMP.	70 C			VENT	½ PT FEMALE WITH PLUG					
CORRO. ALLOW	16 MM			DRAIN(INLET SIDE)	3/4PT FEMALE WITH PLUG					
FILTRATION	100 MESH									
MATERIAL										
CASE	STPG38			GASKET	V#1500					
TOP FLANGE	S25C			ELEMENT	SUS304					
BOLTS & NUTS	S25C									
NOZZLE FLANGE	S25C									
NOZZLE PIPE	STPG38									
BOTTOM PLATE	S25C									
SUPPLY OF MF/R				**SPARE PARTS (SEE 735-91643)**						
FILTER	YES									
FOUDATION BOLT & NUT	NO									
SHIM	NO									
TOOLS	NO									
SPARE PARTS	YES									
SAFETY VALVE	NO									
TEST										
HYDRO TEST PRESS	YES 15 Kg/cm^2G BY OIL			X RAY INSPECTION	NO					
LEAK. TEST PRESS.	NO Kg/cm^2G			STRESS RELEVE	NO					
TEST REPORT	REQUIRED									
WITNESS	MHI			MATERIAL CERF.	NO					
				BOXING	DOMESTIC EXPORT					
				COATING	*PRIMARY FINISH					
COPPER & COPPER ALLOY SHALL NOT BE USED					535-0852-009					
CUSTOMER'S SPEC. NO.				DWG. NO. :						
MHI SPEC. NO.				MF'R :						

OIL FLITER DATA SHEET (LUBE OIL)		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	F-325A	-	O			C		
	AUX.	1	F-325B	-	G			D		
	TOTAL	2	-		B			E		

CUSTOMER: MCEC /IRAQ		PLANT NAME : IRAQ EXP.	
ORDER /ITEM : 352434 , 674001		SERVICE : K-303 & K-401	CONTINUOUS
OPERATING CONDITION			
LOCATION	*OUTDOOR	SP.GR. AT INLET TEMP.	0.87
FLUID	JIS K2213 NO.1 OIL	VIS. AT INLET TEMP.	14.5 CS AT 60 C
INLET TEMP	45 C	SOILD	%
INLET PRESS.	8 Kg/cm^2G		
PRESS. LOSS.	NOR. 0.35 Kg/cm^2G AT 626L/M		
	MAX. 1.75 Kg/cm^2G		
CAPACITY	NOR. 626 L/M		
	DESIGN 677 L/M		
SPECIFICATION			
SIZE &TYPE	18D3-F	INLET CONN.	3" ANSI150RF
DESIGN PRESS.	10 Kg/cm^2G	OUTLET CONN.	3" ANSI150 RF
DESIGN TEMP.	60 C	VENT	½ PT FEMALE WITH PLUG
CORRO. ALLOW	16 MM	DRAIN(INLET SIDE)	3/4PT FEMALE WITH PLUG
FILTRATION	25	DRAIN (INLET SIDE)	3/4PT FEMALE WITH PLUG
MATERIAL			
CASE	SM41	GASKET	V#1500
TOP FLANGE	S25C	ELEMENT	U78-F9 (25)
BOLTS & NUTS	SCM3 , S45C		
NOZZLE FLANGE	S25C		
NOZZLE PIPE	STPG38		
BOTTOM PLATE	SM41		
SUPPLY OF MF/R (NOTE)		**SPARE PARTS (SEE 735-91643)**	
FILTER	YES		
FOUNDATION BOLT & NUT	NO		
SHIM	NO		
TOOLS	NO		
SPARE PARTS	YES		
SAFETY VALVE	NO		
TEST			
HYDRO TEST PRESS	YES 15 Kg/cm^2G BY OIL	X RAY INSPECTION	NO
LEAK. TEST PRESS.	NO Kg/cm^2G	STRESS RELEVE	NO
TEST REPORT	REQUIRED		
WITNESS	MHI	MATERIAL CERF.	NO
		BOXING	DOMESTIC EXPORT
		COATING	*PRIMARY FINISH
COPPER & COPPER ALLOY SHALL NOT BE USED			535-0852-002
CUSTOMER'S SPEC. NO.		DWG. NO. :	
MHI SPEC. NO.		MF'R :	

OIL FLITER DATA SHEET (SEAL OIL)		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	**F-326A**	-	0			C		
	AUX.	1	**F-326B**	-	G			D		
	TOTAL	2	-		B			E		

CUSTOMER: MCEC /IRAQ	PLANT NAME : IRAQ EXP.
ORDER /ITEM : 352434 , 674001	SERVICE : K-303 & K-401 CONTINUOUS

OPERATING CONDITION

LOCATION	*OUTDOOR	SP.GR. AT INLET TEMP.	0.87
FLUID	JIS K2213 NO.1 OIL	VIS. AT INLET TEMP.	14.5 CS AT 60 C
INLET TEMP	45 C	SOILD	%
INLET PRESS.	32 Kg/cm^2G		
PRESS. LOSS.	NOR. 0.35 Kg/cm^2G AT 51L/M		
	MAX. 1.75 Kg/cm^2G		
CAPACITY	NOR. 51 L/M		
	DESIGN 102 L/M		

SPECIFICATION

SIZE &TYPE	6D2-F	INLET CONN.	1 1/2" ANSI300RF
DESIGN PRESS.	36 Kg/cm^2G	OUTLET CONN.	1 1/2" ANSI300RF
DESIGN TEMP.	60 C	VENT	½ PT FEMALE WITH PLUG
CORRO. ALLOW	16 MM	DRAIN(INLET SIDE)	3/4PT FEMALE WITH PLUG
FILTRATION	10		

MATERIAL

CASE	STPG38	GASKET	V#596
TOP FLANGE	S25C	ELEMENT	(10) U78-C1
BOLTS & NUTS	SCM3 , S45C		
NOZZLE FLANGE	S25C		
NOZZLE PIPE	STPG38		
BOTTOM PLATE	S25C		

SUPPLY OF MF/R		SPARE PARTS (SEE 735-91643)	
FILTER	YES		
FOUDATION BOLT & NUT	NO		
SHIM	NO		
TOOLS	NO		
SPARE PARTS	YES		
SAFETY VALVE	NO		

TEST

HYDRO TEST PRESS	YES 54 Kg/cm^2G BY OIL	X RAY INSPECTION	YES 10%
LEAK. TEST PRESS.	NO 36 Kg/cm^2G	STRESS RELEVE	YES
TEST REPORT	REQUIRED		
WITNESS	MHI	MATERIAL CERF.	YES
		BOXING	DOMESTIC EXPORT
		COATING	*PRIMARY FINISH

COPPER & COPPER ALLOY SHALL NOT BE USED

535-0852-006

CUSTOMER'S SPEC. NO.	DWG. NO. :
MHI SPEC. NO.	MF'R :

OIL FLITER DATA SHEET (GOV. OIL)		NO. REQ.	CUSTOMER EQUP. NO.	SERAIL NO.	REV.	DATE	BY	REV.	DATE	BY
	MAIN	1	F-327	-	O			C		
	AUX.			-	G			D		
	TOTAL	1	-		B			E		

CUSTOMER: MCEC /IRAQ	PLANT NAME ; IRAQ EXP.
ORDER /ITEM : 352434 , 674001	SERVICE : K-303 & K-401 CONTINUOUS

OPERATING CONDITION

LOCATION	*OUTDOOR	SP.GR. AT INLET TEMP.	0.87
FLUID	JIS K2213 NO.1 OIL	VIS. AT INLET TEMP.	14.5 CS AT 60 C
INLET TEMP	60 C	SOILD	%
INLET PRESS.	8 Kg/cm^2G		
PRESS. LOSS.	NOR. 0.3 Kg/cm^2		
	MAX. 0.5 Kg/cm^2		
CAPACITY	NOR. 120 L/M		
	DESIGN 360 L/M		

SPECIFICATION

SIZE &TYPE		INLET CONN.	3" ANSI150RF
DESIGN PRESS.	10 Kg/cm^2G	OUTLET CONN.	3" ANSI150RF
DESIGN TEMP.	70 C	VENT	½ PT FEMALE WITH PLUG
CORRO. ALLOW	16 MM	DRAIN(INLET SIDE)	3/4PT FEMALE WITH PLUG
FILTRATION	100 MESH		

MATERIAL

CASE	STPG38	GASKET	V#1500
TOP FLANGE	S25C	ELEMENT	SUS304
BOLTS & NUTS	S25C		
NOZZLE FLANGE	S25C		
NOZZLE PIPE	STPG38		
BOTTOM PLATE	S25C		

SUPPLY OF MF/R		SPARE PARTS (SEE 735-91643)	
FILTER	YES		
FOUDATION BOLT & NUT	NO		
SHIM	NO		
TOOLS	NO		
SPARE PARTS	YES		
SAFETY VALVE	NO		

TEST

HYDRO TEST PRESS	YES 15 Kg/cm^2G BY OIL	X RAY INSPECTION	NO
LEAK. TEST PRESS.	NO Kg/cm^2G	STRESS RELEVE	NO
TEST REPORT	REQUIRED		
WITNESS	MHI	MATERIAL CERF.	NO
		BOXING	DOMESTIC EXPORT
		COATING	*PRIMARY FINISH

COPPER & COPPER ALLOY SHALL NOT BE USED

535-0852-008

CUSTOMER'S SPEC. NO.	DWG. NO. :
MHI SPEC. NO.	MF'R :

TRANSFER BARRIER DATA SHEET		REV	DATE	BY	REV	DATE	BY
		O			C		
		G	14/1/75	NY	D		
		B			E		

CUSTOMER : MCEC /IRAQ	PLANT NAME : IRAQ EXP.
ORDER /ITEM 352434 , 674001	SERVICE : K-303 & K-401 CONTINUOUS

OPERATING CONDITION

LOCATION	OUT DOOR	CORR. OR EROSION DUE TO	
FLUID	JIS K2213 NO. 1 OIL		
FLUID TEMP.	45 C	ARRENGEMENT	*VERTICAL
FLUID PRESS.	17.6/21 Kg/cm^2G		
WORKING CAPACITY	32 L	DESIGN CODE	

SPECIFICATION

SIZE & TYPE	TB 39-30	TOP CONN.	REFER LINE NO. 45~47
DESIGN PRESS.	45 Kg/cm^2 G	BOTTOM CONN.	REFER LINE NO. 45~47
DESIGN TEMP.	70 C		
CAPACITY	38 L		

MATERIAL

BODY	STH67	"O"RING	NBR
BLADDER	NBR	FLANGE	S25C
VALVE SEAT	S25C		
VALVE PLUG	S35C		

SUPPLY OF MANUFACTURER		SPARE PARTS (SEE 735-91643)
TRANSFER BARRIER	YES	
VENT PLUG	YES	
TOOLS	YES (SPECIAL ONLY)	
SPARE PARTS	YES	

TEST

HYDRO TEST PRESS.	YES STD Kg/cm^2 G (FOR BODY)	PERFORMANCE TEST	CHECK WORKING CAPACITY
HYDRO TEST PRESS.	YES STD Kg/cm^2 G	WITNESS	*MHI
=	YES STD =		
=	YES STD =	MATERIAL CERTIFICATE	YES

STANDARD TYPE

TYPE	DESIGN PRESS.	DESIGN TEMP.	CONNECTION (TOP & BOTTOM)	HYDRO.TEST PRESS.	WORKING CAPACITY
TB 39-30	45 Kg/cm^2 G	70 C	2" ANSI 300# RF	68Kg/cm^2 G	32L

NO. REQ'D

SERVICE	NO. REQ.	TYPE	SOLUTION GAS IN FLUID	CUSTOMER EQUIP. NO	MF'S SERAIL NO	
K-303 NG (1M7)	6	TB 39-30	CH4+C2H6	V-354A~F	-	535-0852-001
K-401 NH3 (2M8.5)	6	TB 39-30	NH3	V-414A~F		-002
K-401 NH3 (2M 10.8)	6	TB 39-30	NH3	V-415A~F		-003

	BOXING	DOMESTIC	EXPORT
	COATING	*PRIMARY	FINISH

SEAL OIL TRAP DATA SHEET		REV	DATE	BY	REV	DATE	BY
		F			C		
		G		NY	D		
		B			E		

CUSTOMER : MCEC /IRAQ		PLANT NAME : IRAQ EXP.	
ORDER /ITEM 352434 , 674001		SERVICE : SOUR OIL DRAIN	CONTINUOUS
OPERATING CONDITION			
LOCATION	OUT DOOR	SP. GR. OF LIQUID	0.87
LIGUID	JIS K2213 NO. 1 OIL	VISCOSITY	14.7 CS AT INLET TEMP.
		SOLID	
LIQUID & GAS TEMP.	60 C	CORR. OR ERR. DUE TO	
FLOW	100 L/DAY	ARRENGEMENT	HORIZENTOL
		DESIGN CODE	MF'R STANDARD
SPECIFICATION			
SIZE & TYPE	TS-46	INLET CONN.	¾" PT FEMALE
DESIGN PRESS.	45 Kg/cm^2 G	VENT CONN.	¾" PT FEMALE
DESIGN TEMP.	60 C	PUTLET CONN.	¾" PT FEMALE
MATERIAL			
CASING	SC49	GASKET	V#567 OR EQ.
COVER	SC49	BOLT & NUT	SCM3 & S45C
FLOAT	SUS304		
VALVE SEAT	SUS420 WITH STELLITE		
VALVE PLUG	SUS304		
ROD	SUS304		
SUPPLY OF MANUFACTURER		**SPARE PARTS (SEE 735-91643)**	
SEAL OIL TRAP	YES		
LEVEL GAUAGE	YES *DIRECT MOUNTED TYPE		
SPARE PARTS	YES		
TOOLS	NO		

TEST			
HYDRO TEST PRESS.	YES 60 Kg/cm^2 G	PERFORMANCE TEST	YES AT 45 Kg/cm^2 G
LEAK TEST PREES.	YES 44 Kg/cm^2 G		
TEST REPORT	*REQ'D		
WITNESS	*MHI	MATERIAL CERTIFICATE	YES

NO. REQ'D

SERVICE	NO. REQ.	GAS	GAS PRESS.	CUSTOMER EQUIP. NO	MF'S SERAIL NO	
K-303 (1M7)	2	CH4+C2H6	21 Kg/cm^2 G	**V-355A/B**	-	535-0854-001
K-401 (2M8.5)	2	NH3	17.6 =	V-416A/B	-	-002
K-401 (2M 10.8)	2	NH3	17.6 =	V-417A/B	-	-003

	BOXING	DOMESTIC	EXPORT
	COATING	*PRIMARY	FINISH

ACCUMULATOR DATA SHEET		REV	DATE	BY	REV	DATE	BY
		F	13/12/74	NY	C		
		G	14/1/75	NY	D		
		B			E		

CUSTOMER : MCEC /IRAQ	PLANT NAME : IRAQ EXP.
ORDER /ITEM 352434 , 674001	SERVICE : GOV. OIL LINE CONTINUOUS

OPERATING CONDITION

LOCATION	OUT DOOR	INITIAL CHARGE GAS	N2 GAS
LIQUID	JIS K223 NO. 1 OIL	INITIAL CHARGE GAS PRESS.	1.8 Kg/cm^2 G
FLUID TEMP.	30~60 C		
MAX. WORKING PRESS	5.5 Kg/cm^2G		
MIN WORKING PRESS.	2.5 Kg/cm^2	DESIGN CODE	MF'R STANDARD
WORKING CAPACITY	9.6 L		

SPECIFICATION

SIZE & TYPE	MD 210-40	FLUID SIDE CONN.	2" ANSI150# RF
		CHARGE GAS CONN.	MF'S STANDARD
DESIGN TEMP.	70 C		
CAPACITY	39 L		

MATERIAL

BODY	STH80
BLADDER	NBR

SUPPLY OF MANUFACTURER

ACCUMULATOR	YES
TOOLS	YES (SPECIAL TOOLS ONLY)
SPARE PARTS	YES
GAS CHARGING TOOL	YES

TEST

HYDRO TEST PRESS.	YES 15 Kg/cm^2 G	WORKING CAP TEST	YES
TEST REPORT	*REQUIRED	WITNESS	*MHI
MATERIAL CERTIFICATE	YES		
			YES

NO. REQ'D

SERVICE	NO. REQ.	DESIGN PRESS.	CUSTOMER EQUIP. NO	MF'S SERAIL NO	
K-301	1	10 Kg/cm^2 G	V-329	-	535-0852-034
K-303 /K-401	1	=	V-356	-	-035
K-302	1	=	V-342	-	-036
		=			-039(TOOLS)

BOXING	DOMESTIC	EXPORT	
COATING	*PRIMARY	FINISH	

DATA SHEET

Plant: IRAQ EXPANSION UREA UNIT
Customer: M.O.I. IRAQ
Order
Location: Indoor (Outdoor)

Item No. J-501
Service: CARBAMATE RECYCLE EJECTOR
No. Req'd: WORKING 1 SPARE 0 TOTAL 1

OPERATING CONDITION

DRIVING FLUID: LIQUID AMMONIA
TEMP.: 28°C
SPEC. GRAVITY: 598 Kg/m³

SUCTION FLUID: LIQUID CARBAMATE SOLUTION
TEMP.: 155°C
SPEC. GRAVITY: 900 ~ 1100 Kg/m³

CAPACITY AND DIFF. PRESS.

		120% LOAD	110%	100%	90%	80%	70%	50%
NH₃ FLOW	Kg/h	48600	44550	40500	36450	32400	28350	20250
NH₃ SUCT. PRESS.	Kg/cm²A	220	→	→	→	→	→	→
CARB. FLOW	Kg/h	134400	123200	112000	100800	89600	78400	56000
CARB. SUCT PRESS.	Kg/cm²A	153	→	→	→	→	→	→
MIXTURE OUTLET PRESS.	Kg/cm²A	161.5	161.4	161.2	160.9	160.5	159.95	159.38

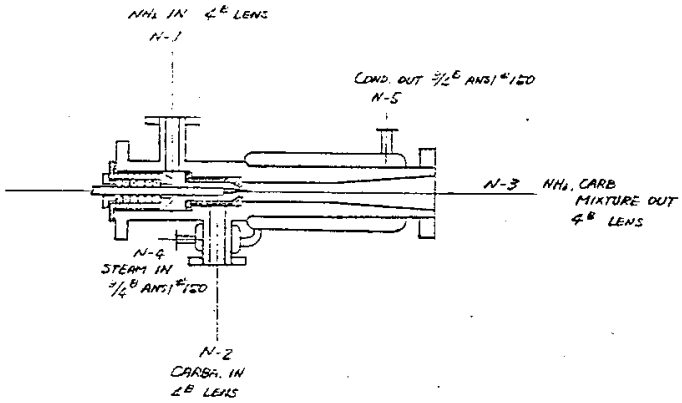
EJECTOR SHALL BE JACKETED SO AS TO OBTAIN THE NH₃ + CARBAMATE MIXTURE AT ABOUT 100°C
CABAMATE FLOW RATIO SHALL BE CONTROLED AUTOMATICALY

DESIGN DATA

DESIGN PRESS.: BODY 270 Kg/cm²G; JACKET 6.5 Kg/cm²G
TEMP.: BODY 200°C; JACKET 200°C
HYDRO TEST PRESS.: BODY 351 Kg/cm²G; JACKET 8.5 Kg/cm²G

MATERIALS

BODY	STAINLESS STEEL	DIN 1.4404
JACKET	CARBON STEEL	DIN St 35.8
NOZZLE	STAINLESS STEEL	DIN 1.4404
SPINDLE	STAINLESS STEEL	DIN 1.4021
GLAND CASING	" "	DIN 1.4404
GLAND PACKING	TEFLON, GRAFOLAN	



Checked by	Designed by	Date

VESSEL AND REACTOR DATA SHEET

Plant	IRAQ EXPANSION UREA UNIT	Item No	J-502
Customer	M.O.I. IRAQ	Service	CARBAMATE MIXER
Order		No. req'd	1
Location	Indoor (Outdoor)	Shell I.D.	mm, Length T.-T. mm
Type		Code	
Regulation	ASME VIII		

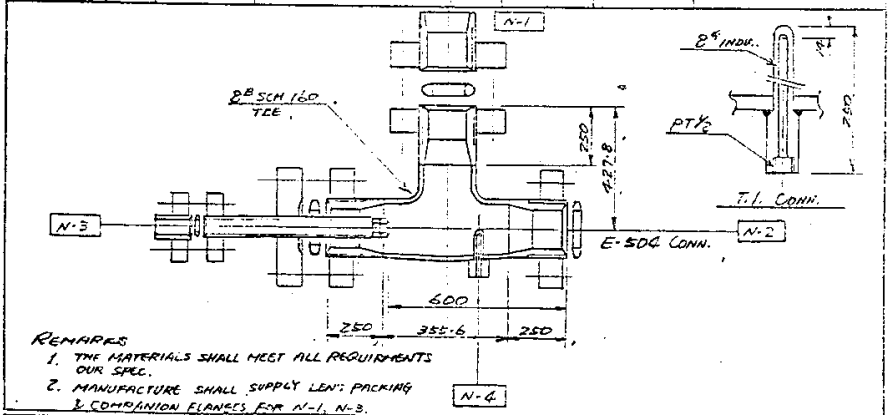
Design Condition

	Shell Side	Jacket/Coil Side	Weight
Fluid	CARBAMATE CO_2 & NH_3		Empty kg
Operating Press.	150 kg/cm²G	kg/cm²G, mmHgA	Full Water kg
" Temp.	200 °C	°C	Operating kg
Design Press.	165 kg/cm²G	kg/cm²G, mmHgA	
Vac. Design	(No) Yes	No, Yes	Painting
Design Temp.	230 °C	°C	No (Yes) FOR C.S.
Hydro Test Press.	kg/cm²G	kg/cm²G	
Pneum. Test Press.	kg/cm²G	kg/cm²G	Insulation
Volume Full	m³		No
Operating	m³		(Hot) , mm
Retention Time	min.		Cold mm
Radiograph	No, Yes %	No, Yes %	
Stress Relief	No, Yes	No, Yes	Accessories
Corrosion Allow.	3 mm	mm	Platform NO.
Materials Shell	SUS 316L MOD.		Ladder NO.
Head			Sight Glass NO.
Nozzle	SUS 316L MOD.		Agitator NO.
Flange	CF 45		
Gasket			
Interior Support	SUS 316L MOD.	TYPE 30°	

SPRAY NOZZLE SPECIFICATION: CAPACITY NOR. 36.8 m³/hr, MAX. 40 m³/hr
FLUID CARBAMATE SOLN
TEMP. 70~100°C, DENSITY 951 kg/m³, VISCOSITY 3 c.p.
TYPE FULL CONE SPRAY ANGLE 30°
DIFF. PRESSURE NOR. 2 kg/cm²
MECHANICAL DESIGN PRESS. 165 kg/cm²G

Remarks

Mark	Q'TY	Size	Rating	Service	Mark	Q'TY	Size	Rating	Service
N-1	1	8B	#1500 LENS	GAS INLET					
N-2	1	8B	" "	GAS OUTLET					
N-3	1	4B	" "	CARBAMATE INLET					
N-4	1	PT½		T.I. CONN.					



1. THE MATERIALS SHALL MEET ALL REQUIREMENTS OUR SPEC.
2. MANUFACTURE SHALL SUPPLY LENS PACKING & COMPANION FLANGES FOR N-1, N-3.

N-4

MITSUBISHI HEAVY INDUSTRIES, LTD.

38/60

VESSEL AND REACTOR DATA SHEET

Rev.	
Date	
Check	

Plant	800 T/D ING UNIT	Item No.	V-305
Customer	M.O.I. IRAQ	Service	1ST. STAGE AIR SEPARATOR
Order	56-321	No. Req'd	1
Location	Indoor (Outdoor)	Shell I.D.	[illegible] mm, Length TL-TL 3350 mm
Type	DEMISTER TYPE	Code	ASME SECT. VIII DIV.1
Regulation	—		

Design Condition

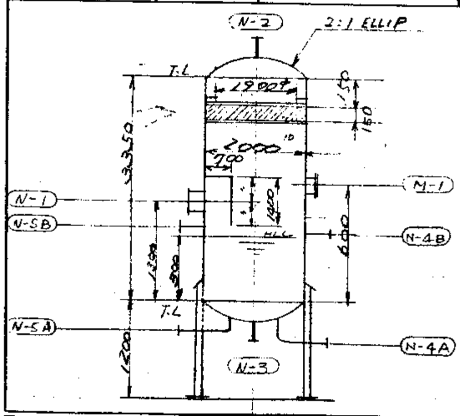
	Shell Side	Jacket/Coil Side	Weight	
Fluid	AIR		Empty:	kg
Operating Press.	1.38 kg/cm²G, ~~mmHgA~~	kg/cm²G, mmHgA	Full Water:	kg
" Temp.	43 °c	°c	Operating:	kg
Design Press.	3.5 kg/cm²G, ~~mmHgA~~	kg/cm²G, mmHgA		
Vac. Design	(No) Yes	No, Yes	Painting	
Design Temp.	60 °c	°c	~~No~~, Yes	
Hydro. Test Press.	5.3 kg/cm²G	kg/cm²G		
Pneum. Test Press.	3.5 kg/cm²G	kg/cm²G	Insulation	
Volume Full	m³		No	
Operating	m³		Hot	mm
Retention Time	Min.		Cold	mm
Radiograph	(No) Yes %	No, Yes %		
Stress Relief	(No) Yes	No, Yes	Accessories	
Corrosion Allow.	3.0 mm	mm	Platform	NO
Materials Shell	SS41		Ladder	NO
Head	SS41		Sight Glass	NO
Nozzle	SS41 & STPG38		Agitator	NO
Flange	SF45			
Gasket	V# 1500 or EQ			
Inter. or Support	SUS304 ... BOLT & NUT			
	SS41 OTHER			

Remarks

(1) DEMISTER : TYPE YORK #421 or EQ

MATERIAL SUS 304

Mark	Q'TY	Size	Rating	Service	Mark	Q'TY	Size	Rating	Service
N-1	1	28B	ANSI 150# SO. RF	GAS-LIQ INLET	M-1	1	18B	ANSI 150# SO. RF	MANHOLE (W/DAVIT)
N-2	1	20B	"	GAS OUTLET					
N-3	1	1B	"	LIQ OUTLET					
N-4A/B	2	2B	"	LA CONN. (C/HEADER)					
N-5A/B	2	3/4B	"	LG CONN.					



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VESSEL AND REACTOR DATA SHEET

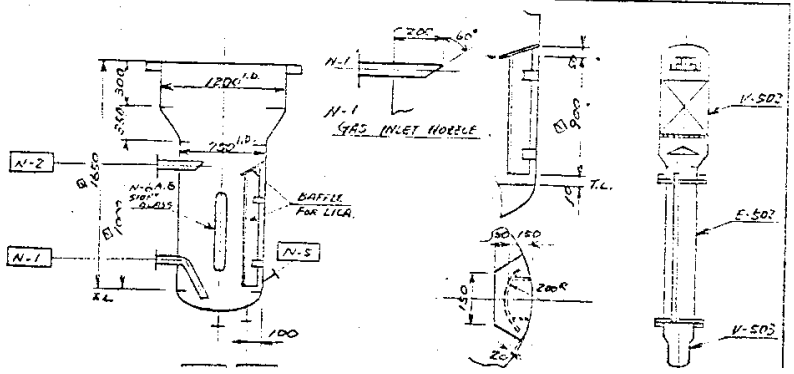
Plant	IRAQ EXPANSION UREA UNIT	Item No.	V-503
Customer	M.O.I. IRAQ	Service	MEDIUM PRESS. UREA SOLUTION HOLDER
Order		No. Req'd	1
Location	Indoor / (Outdoor)	Shell I.D.	750 mm Length T.L.-T.L. 1300 mm
Type		Code	ASME SECT VIII
Regulation			

Design Condition

	Shell Side	Jacket/Coil Side	Weight
Fluid	UREA SOLN & NH3 CO2 GAS		Empty kg
Operating Press.	17 kg/cm²G, mmHgA	kg/cm²G, mmHgA	Full Water kg
" Temp.	155 °C	°C	Operating kg
Design Press.	22 kg/cm²G, mmHgA	kg/cm²G, mmHgA	
Vac. Design	(No) Yes	No, Yes	Painting
Design Temp.	185 °C	°C	No, (Yes)
Hydro Test Press.	33 kg/cm²G	kg/cm²G	UNDER CONT
Pneum. Test Press.	22 kg/cm²G	kg/cm²G	Insulation
Volume Full	m³		No
Operating	m³		(Yes) mm
Retention Time	Min		Coil mm
Radiograph	No, (Yes) 10.0 %	No, Yes %	
Stress Relief	(No) Yes	No, Yes	Accessories
Corrosion Allow.	3 mm	mm	Platform
Materials Shell	SA240M SUS 316 C≤0.06		Ladder
Head	SA403M SUS 316 C≤0.06		Sight Glass
Nozzle	SUS 316 C≤0.06		Agitator
Flange	SF45 + SUS 316 C≤0.06		
Gasket			
Inter. or Support	SUS 316 C≤0.06		

Remarks:

Mark	Q'TY	Size	Rating	Service	Mark	Q'TY	Size	Rating	Service
N-1	1	6B	JIS 10K 50 RF	SOLN OUTLET					
N-2	1	2B	"	GAS INLET					
N-3	1	1½B	"	DRAIN					
N-4	1	1½B	"	LICA CONN.					
N-5	1	1B	"	TC CONN.					
N-6A	2			SIGHT GLASS					



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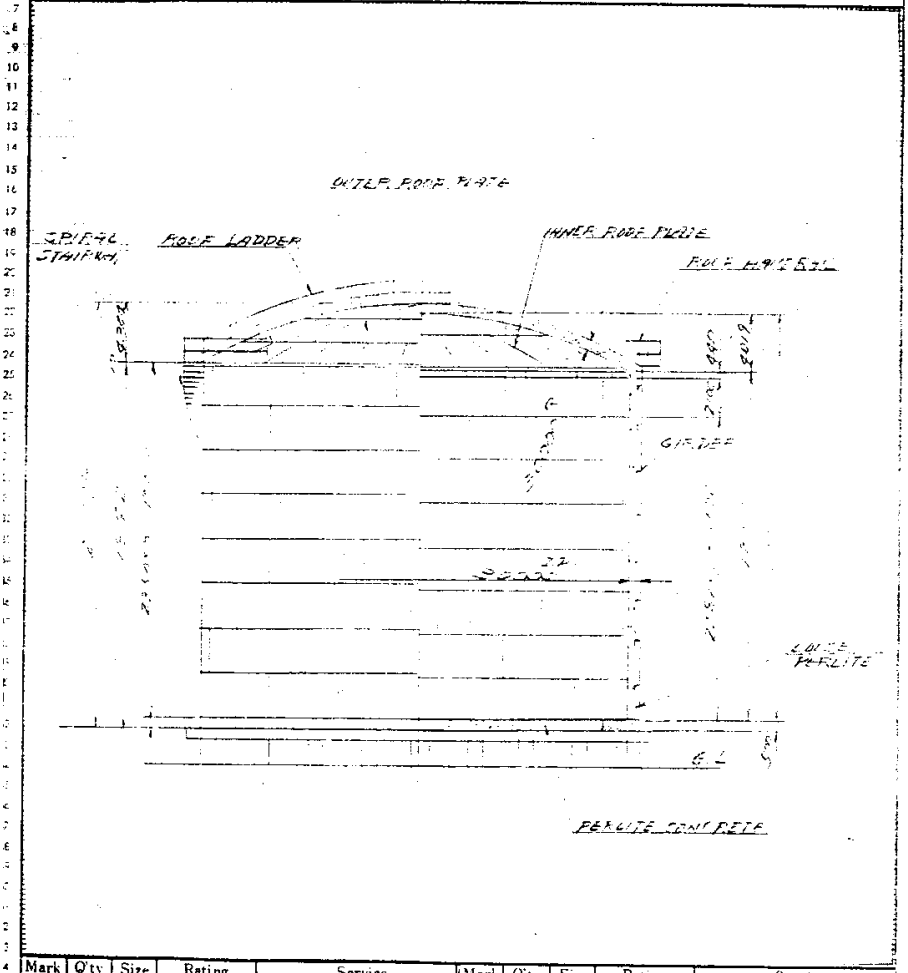
DATA SHEET

Rev.
Date
Check

Plant	[illegible]	Item No.	T-451
Customer	[illegible]		
Order	251603-012	Service	AMMONIA STORAGE TANK
Location	Indoor Outdoor	No. Req'd	
		Code	API STD 620, VER

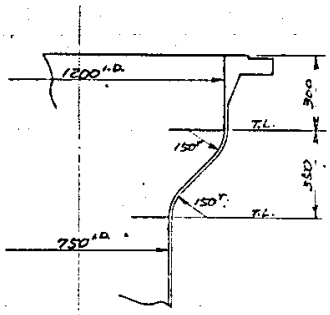


Mark	Q'ty	Size	Rating	Service	Mark	Q'ty	Size	Rating	Service
N-1	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
N-2	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
N-3	1	[illegible]	[illegible]	[illegible]					
N-4	2	[illegible]	[illegible]	[illegible]					
N-5	1	[illegible]	[illegible]	[illegible]					
N-6	1	[illegible]	[illegible]	[illegible]					

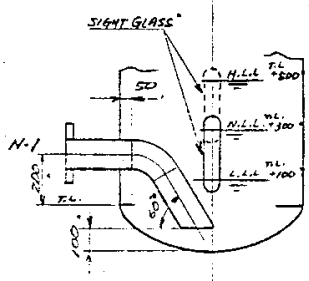
MITSUBISHI HEAVY INDUSTRIES, LTD.

DATA SHEET

Plant: IRAQ EXPANSION UREA UNIT	Item No.: V-503
Customer: M.O.I. IRAQ	Service: MEDIUM PRESS. UREA SOL'N HOLDER
Order	No. Req'd: 1
Location: Indoor (Outdoor)	



TOP SECT



LIQUID LEVEL
& N-1, SOL'N OUTLET NOZZLE.

REMARKS.

1. MIN. SUS. TH'K SHALL NOT BE LESS THAN 3mm.
2. WEEP HOLES SHALL BE PROVIDED ON EXTERNAL SHELL TO CHECK FOR LEAKS FROM LINING WITH A NIPPLE WITCH EXTENDS 20mm BEYOND THE INSULATION.
3. SIGHT GLASS MUST BE FLUSH MOUNTING PAD AND TRANSPARENT TYPE.

Mark		Size	Rating	Service	Mark	Q'ty	Size	Rating	Service

MITSUBISHI HEAVY INDUSTRIES LTD.

VESSEL AND REACTOR DATA SHEET

No.
Date
Check

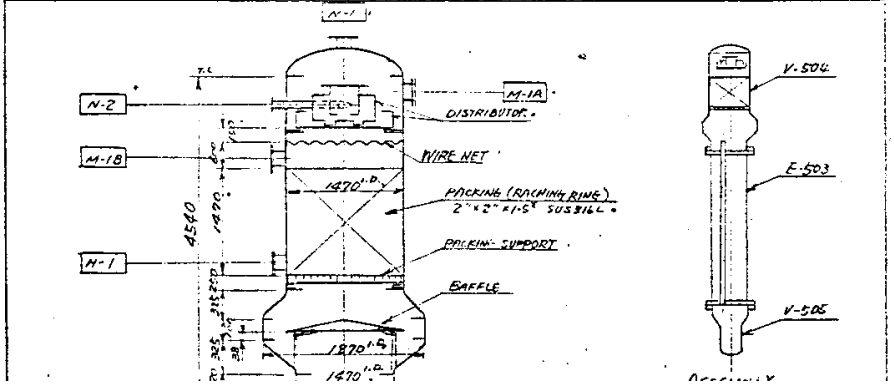
Plant	IRAQ EXPANSION UREA UNIT	Item No.	V-504
Customer	M.O.I. IRAQ	Service	LOW PRESS. SEPARATOR
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shell I.D.	1470 mm, Length T.L.-T.L. 4540 mm
Type		Code	
Regulation	ASME VIII		

Design Condition

	Shell Side	Jacket/Coil Side	Weight
Fluid	UREA SOLN & NH_3 CO_2 GAS		Empty kg
Operating Press.	3.5 kg/cm²G, mmHgA	kg/cm²G, mmHgA	Full Water kg
" Temp.	125 °C	°C	Operating kg
Design Press.	5.5 kg/cm²G, mmHgA	kg/cm²G, mmHgA	
Vac. Design	(No) Yes	No, Yes	Painting
Design Temp.	170 °C	°C	No, (Yes)
Hydro. Test Press.	kg/cm²G	kg/cm²G	
Pneum. Test Press.	kg/cm²G	kg/cm²G	Insulation
Volume Full	m³		No
Operating	m³		(Hot) mm
Retention Time	Min.		Cold mm
Radiograph	No, Yes %	No, Yes %	
Stress Relief	No, Yes	No, Yes	Accessories
Corrosion Allow.	3 mm	mm	Platform YES
Materials Shell	SUS 316 C<0.06		Ladder YES
Head	SUS 316 C<0.06		Sight Glass
Nozzle	SUS 316 C<0.06		Agitator
Flange	SF45 + SUS 316 C<0.06		
Gasket			
Interior Support	SUS 316 C<0.06		

INTERNAL PACKING TYPE & SIZE 2" x 2" x 1.6t RACHING RING
MATERIAL SUS 316L
Remarks PACKING VOLUME 2.5 m³
WIRE NET WIRE DIA. 2φ
SIEVE OPENING 50 mm x 50 mm
MATERIAL SUS 316L

Mark	Q'TY	Size	Rating	Service	Mark	Q'TY	Size	Rating	Service
N-1	1	10B	ANSI #150 SO. RF	GAS OUTLET					
N-2	1	10B	"	SOL'N INLET					
M-1A & 2	2	18B		MANHOLE					
H-1	1	16B		HANDHOLE					



TOWER(COLUMN)DATA SHEET

Rev.	
Date	
Check	

Plant	800 T/D NH3 UNIT	Item No.	T-202
Customer	M.O.I. IRAQ	Service	CO_2 REGENERATOR
Order	S6392/	No. Req'd	1
Location	Indoor (Outdoor)	Shell I.D. TOP 4600 / BOT. 3200	mm
Regulation	Code ASME SEC. VIII DIV.1	Shell Length (T.L-T.L) 45480 mm, Skirt High. 5800	mm
Type	VALVE TRAY TYPE		

Design Condition

Oper. Press.	Top/Btm.	1 / 1.02	kg/cm²G, ~~mmHgA~~
Des'n Press.		-0.35 & 1.4	kg/cm²G, ~~mmHgA~~
Oper. Temp.	Top/Btm.	133 /	°c
Des'n Temp.		175	°c
Press. Test	Hydro./Pneum.	3.0 / —	kg/cm²G
Radiograph	20 %	Stress Relief (Yes) No	
Wind Load	70-114 kg/m²	Seismic Coeff: 0	

Materials	Shell SM50B / SM50B + SUS304L	Head SM50B	
	Support	Nozzle STPG38 / STPG38 + SUS304L	
	Flange SF45 / SF45 + SUS304L	Gasket ♯1,500 or EQ.	
	Skirt SS41		
Corr. Allow.	C.S. 3.0 SUS 0 mm	INTERNAL 3mm (TOTAL)	
Painting	YES		
Insulation	No. (Yes)	(Hot), Cold	mm
Weight	Shell kg	Internal	kg
	Empty kg	Operation	kg

Internal Construction

Tray Type	Bubble Cap, Sieve, (Valve)		
No.of Tray	WASHING ♯41~♯43	TOTAL 3 STAGES	
	SEMI LEAN ♯15~♯40	〃 26 〃	
	LEAN ♯1~♯14	〃 14 〃	
Tray Spacing	Manhole 945 mm		
	Other LEAN 600 WASHING 600 SEMI LEAN 635 mm		
Materials	Tray SUS 304		
	Valve SUS 304		
	Bolting SUS 304		
	Gasket —		
Packing	Size Type & Mat'l		
Distributor	Type	Mat'l	
Redistributor	Type	Mat'l	
Demister	Type YORK 421 EQ Size TH'K 150 mm	Mat'l SUS 304	
Spray Nozzle	Materiol		
	Type Size	No.	
Liq. Hold up			
Remarks			

Arrangement Sketch

REFER TO SKELETON

NOTE

1. TRAY

♯2~14 LEAN SECTION
3200♯ 2 PASS VALVE TRAY
MATERIAL
TRAY PLATE SUS304
VALVE SUS304
WEIR C.S.
DOWNCOMMER C.S.

♯15~39 SEMI-LEAN SECTION
4600♯ 4 PASS VALVE TRAY
MATERIAL
TRAY PLATE SUS304
VALVE SUS304
WEIR C.S.
DOWNCOMMER C.S.

♯1 LEAN SECTION
♯40 SEMI-LEAN SECTION
♯41~43 WASHING SECTION
4600♯ 1 PASS
MATERIAL
ALL PARTS SUS304

2. DEMISTER
YORK TYPE ♯421 OR EQ
MATERIAL SUS304

3. SHELL MATERIAL
TOP & BOTTOM SECTION SHALL BE USED. SUS304L
(REFER TO ATTACHED DWG.)

4. PROVIDED YORTEX BREAKER FOR LEAN SOL'N OUTLET NOZZLE.

5. ALL TRAYS AND DEMISTER TO BE REMOVABLE THROUGH 18B MANHOLES.

Mark	Q'ty	Size	Rating	Service
N-1	1	16B	ANSI♯150 S.F.	RICH SOL'N INLET
N-2	1	14B	〃	SEMI-LEAN SOL'N OUTLET
N-3	1	8B	〃	LEAN SOL'N OUTLET
N-4	1	48B	API♯5L 50 RE	ACID GAS OUTLET
N-5	1	8B	ANSI♯150 SO RF	C.W. TO GAS REB.
N-6	1	30B	API♯5L 50 RE	STEAM FROM GAS REB.
N-7	1	6B	ANSI♯150 SO RF	L.W. FROM GAS REB.
N-8	1	4B	〃	L.W. TO STEAM REB.
N-9	1	18B	〃	STEAM FROM STEAM REB.
M-1 A/B	6	18B	ANSI♯150 SO.RF	MANHOLE
N-10	1	4B	ANSI♯150 SO RF	REFLAX INLET
N-11		1½B	〃	PDRA CONN.
N-12 A/B	2	¾B	〃	PIC & PG CONN.
N-14 A/B	4	2B	〃	LG CONN.
N-15 B	2	3B	〃	LRA CONN.
N-15 C/D	2	1B	〃	LRA CONN.
N-17 C	3	½B	〃	SAMPLE CONN.
N-18	1		〃	REFLAX OUTLET
N-19	1		〃	CONDENSATE INLET

		Checked by	Designed by	Date

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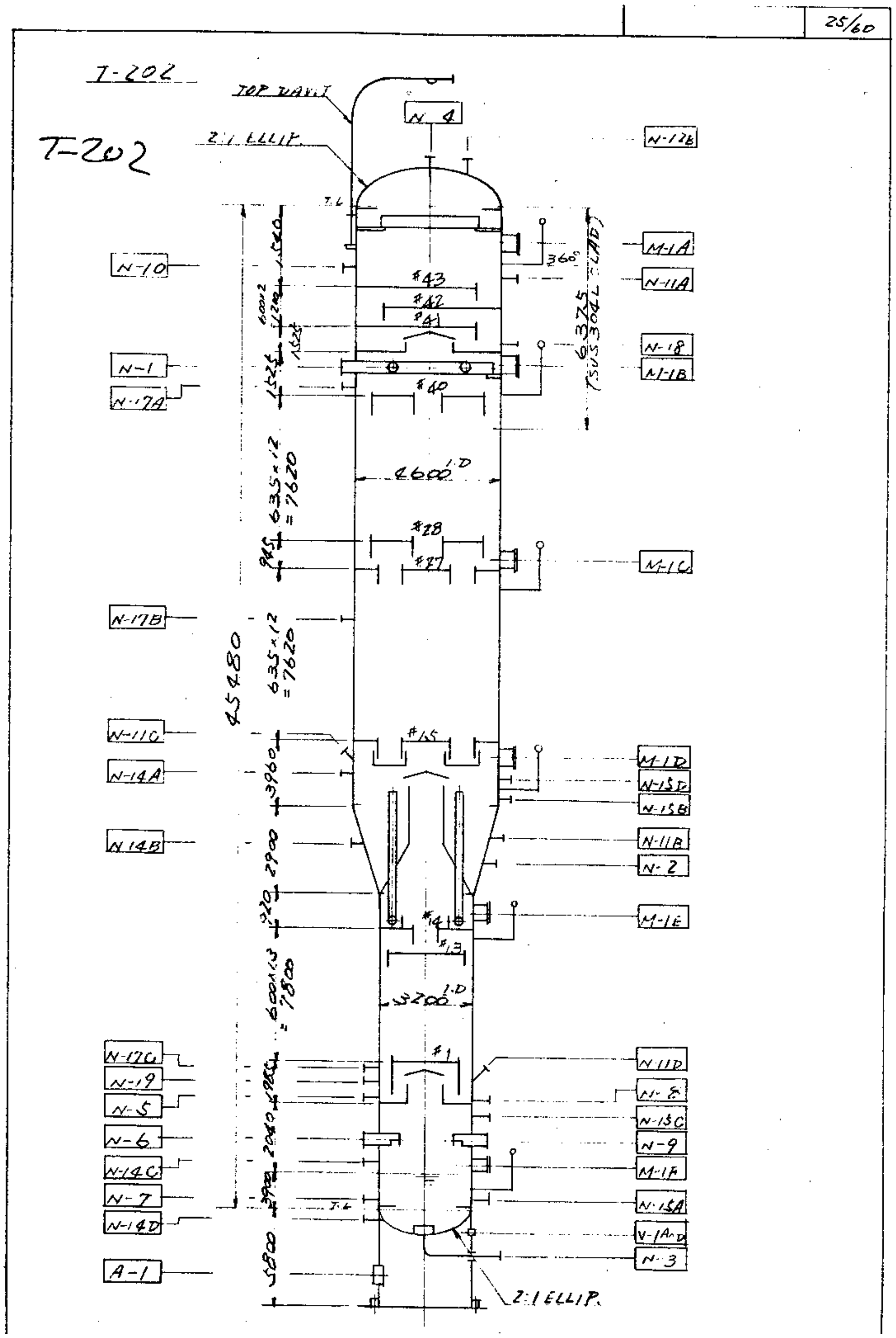
25/60
T-202
T-202
TOP DAVIT
2:1 ELLIP.
N-4
N-12B
M-1A
N-11A
N-18
M-1B
N-10
N-1
N-17A
#43
#42
#41
#40
6375
4600 I.D
635×12 =7620
#28
#27
M-1C
N-17B
45480
635×12 =7620
N-11C
N-14A
N-14B
#15
3960
2900
M-1D
N-15D
N-15B
N-11B
N-2
M-1E
#14
#13
3200 I.D
600×13 =7800
N-12C
N-19
N-5
N-6
N-14C
N-7
N-14D
A-1
#1
N-11D
N-8
N-15C
N-9
M-1F
N-15A
V-1A-D
N-3
2:1 ELLIP.
5800

MITSUBISHI HEAVY INDUSTRIES, LTD.

1/E

Rev.
Date
Check

VESSEL AND REACTOR DATA SHEET

Plant	IRAQ EXPANSION	Item No.	R-501
Customer	M.O.I. IRAQ	Service	UREA REACTOR
Order		No. Req'd	1
Location	Indoor (Outdoor)	Shell I.D.	2040 mm, Length TL-TL 40000 mm
Type		Code	
Regulation	ASME VIII		

Design Condition

	Shell Side	Jacket/Coil Side	Weight
Fluid	UREA & CARBAMATE		Empty: kg
Operating Press.	150 kg/cm²G, ~~mmHgA~~	kg/cm²G, mmHgA	Full Water: kg
" Temp.	185 °C	°C	Operating: kg
Design Press.	165 kg/cm²G, ~~mmHgA~~	kg/cm²G, mmHgA	
Voc. Design	(No) Yes	No, Yes	Painting
Design Temp.	195 °C	°C	No, (Yes)
Hydro. Test Press.	kg/cm²G	kg/cm²G	UNDER COATING
Pneum. Test Press.	kg/cm²G	kg/cm²G	Insulation
Volume Full	m³		No
Operating	m³		(Hot) mm
Retention Time	Min.		Cold mm
Radiograph	No, (Yes) %	No, Yes %	
Stress Relief	No, Yes	No, Yes	Accessories
Corrosion Allow.	(MIN. 2 SUS SOLID) mm	mm	Platform YES
Materials Shell	A516Gr.70 TO SUS 316L MODIFIED LINING		Ladder YES
Head	A516Gr.70 TO SUS 316L MODIFIED LINING		Sight Glass NO
Nozzle	SUS 316L MODIFIED		Agitator NO
Flange	SF50 + SUS316L MODIFIED		
Gasket			
Inter. or Support	SUS 316L MODIFIED		

Remarks

Mark	Q'TY	Size	Rating	Service	Mark	Q'TY	Size	Rating	Service
N-1	1	8B	LENS 1500#	NH_3 INLET	M-1	1	500mm		MAN HOLE
N-2	1	6B	" "	CO_2 INLET					
N-3	1	8B	LENS "	UREA SOL'N OUTLET					
N-4	3	½B	FF COUPLING	TI CONN. SEE ATT. PKG					
N-5	1	"	" "	TI CONN. "					

REMARKS

1. WEEP HOLES SHALL BE PROVIDED ON EXTERNAL SHELL TO CHECK FOR LEAKS FROM INTERNAL LINING WITH A NIPPLE WHICH EXTENDS 20 mm BEYOND THE INSULATION.
2. 3 HOLES SHALL BE PROVIDED FOR THERMOCOUPLES TO CHECK INTERNAL LINING TEMPERATURE.
3. ALL PARTS CONTACTING UREA SOLUTION SHALL BE, SUS316L MODIFIED LINING.
4. ALLOY WELD DEPOSIT MUST BE LIMITED TO THE MINIMUM NECESSARY.
5. ALL REMOVABLE INTERNALS SHALL PASS THROUGH A 20B MANHOLE
6. PLATFORM & DUVIT SHALL LOCATE ON REACTOR TOP.
7. THE NOMINAL THICKNESS FOR SUS316L MOD. LINING SHALL NOT BE LESS THAN 5 mm.
8. IN MECHANICAL CALCULATION STAINLESS TH'K FOR LINING AND OVERLAY SHALL BE CONSIDERED AS CORROSION ALLOWANCE ONLY.

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ANNEX NO.3

Piping and Fittings

1-The piping and Fittings required for the rehabilitation are listed in the following attachments

2- The bidder shall take in consideration that there is nothing available at the site for Urea Unit shall estimate the piping and Fittings for Unit.

3- All piping and fittings for the new packages such as R/O unit, Instrument Air package, Nitrogen generation unit, etc shall be included in these packages.

4- The scope of supply in the attached tables are concerning the followings:

4-1 Piping
4-2 Fittings
4-3 Studs, Bolts & Nuts
4-4 Ammonia valves
4-5 Urea valves
4-6 Polisher Piping
4-7 Safety valves
4-8 Expansion joints
4-9 Spring hungers
4-10 Boiler valves
4-11 Dematerialized water piping
4-12 Steam traps
4-13 Gaskets

SIZE	MAT	QTY
3/8”	STPG38-SCH80	23
1/2”	STPG38-SCH80	1462
1/2”	SGP-3.2MM	79
1/2”	SUS304-SCH40	347
1/2”	STPT38-SCH80	117
1/2”	SGP GALV.-2.8MM	202
1/2”	SUS304TP-SCH160	30.20
1/2”	STPT42-SCH160	110.90
1/2”	STPT42-SCH80	70
1/2”	STPA12-SCH80	30
1/2”	SUS304-SCH80	20
3/4”	STPG38-SCH80	2129
3/4”	SUS304-SCH40	467
3/4”	SUS304-SCH80	50
3/4”	FCMB GALV.	24
3/4”	SGP-2.3MM	140
3/4”	STPA12-SCH80	190
3/4”	STPT42-SCH160	56.5
3/4”	SUS304TP-SCH160	10.40
3/4”	SGP-2.8MM	95
3/4”	SGP-2.8MM/TYPE WELDED	750
3/4”	SGP GALV.-2.8MM/CLASS NO.BA1	160
3/4”	STPT38-SCH80	350
1”	STPG38-SCH40	22
1”	SGP-3.2MM	785
1”	STPG38-SCH80	1796
1”	SUS304-SCH40	128
1”	STPT38-SCH80	246
1”	STPA12-SCH80	69
1”	STPT38-SCH100	4
1”	SUS304TP-3.5MM	14
1”	SUS304TP-SCH160	13.75
1”	SUS304TP-SCH80	12.80
1”	STPT42-SCH160	198
1”	SUS304TP-SCH60	78
1”	STPL 39-S-SCH80	189.5
1”	STPT42-SCH80	30
1 1/2”	STPG38-SCH40	739
1 1/2”	STPG38-SCH120	12
1 1/2”	SGP-3.5MM	1111

1 1/2”	SUS304L-3MM	150
1 1/2”	STPT38-SCH40	65
1 1/2”	SUS304TP-SCH160	41
1 1/2”	SUS304TP-SCH10S	87.2
1 1/2”	STPG38-SCH80	88
1 1/2”	STPT42-SCH160	18
1 1/2”	SUS304TP-XXS	20
1 1/2”	SUS304TP-SCH20S	75
1 1/2”	SUS304TP-SCH60	30
1 1/2”	STPA24-S-21MM	3
1 1/2”	STPL 39-SCH80	38
1 1/2”	STPT38-SCH80	170
1 1/2”	STPL 39-SCH40	48.5
2”	STPG38-SCH40	1313
2”	STPG38-SCH80	150
2”	SGP-3.8MM	584
2”	SUS304-3.5MM	3
2”	SUS304L-3.5MM	25
2”	STPT38-SCH40	69
2”	STPA12-SCH80	70
2”	SGP GALV.-3.5MM	34
2”	STPT38-SCH80	106
2”	STPT42-SCH160	27
2”	SUS304TP-SCH160	72
2”	SUS304TP-SCH80	40
2”	SUS304TP-SCH10S	114.8
2”	STPT42-XXS	20
2”	SUS304TP-XXS	30
2”	SUS304TP-SCH20S	20
2”	STPL 39-S-SCH40	15.5
2”	HITEN 55-S-7MM	40
2”	HITEN 55-S-20MM	4
2”	SUS304-3MM	60
2”	AS-2-7MM	57
2 1/2”	STPG38-SCH80	15
2 1/2”	STPG38-SCH40	108
2 1/2”	SUS304-3MM	12
2 1/2”	STPL 39-S-SCH40	16
3”	STPG38-SCH40	1207
3”	SGP-4.2MM	97
3”	SUS304-4MM	3
3”	SUS304L-4MM	27
3”	SUS304-3MM	218
3”	AS-2-6.5MM	10

3”	SUS304-SCH10	170
3”	STPT38-SCH40	167
3”	SUS304TP-SCH160	55
3”	STPT42-XXS	10
3”	HITEN 55-S-8.5MM	0.8
3”	HITEN 55-S-9.5MM	7.1
3”	STPL 39-S-SCH40	114.5
3”	SGP GALV./CLASS NO. BA4	260
3”	STPG38-SCH80	10
4”	STPT38-SCH80	25
4”	STPA12-SCH40	100
4”	STPT38-SCH40	134
4”	STPG38-SCH40	857
4”	STPA12-S-SCH80	85
4”	SGP-4.5MM	478
4”	SUS304L-3MM	25
4”	SUS304TP-3.5MM	69
4”	SUS304TP-SCH10S	15
4”	STPL 39-S-SCH40	391
4”	STPG38-SCH60	3.6
6”	STPG38-SCH40	695
6”	STPT38-S-SCH120	97
6”	SUS304L-5MM	48
6”	SUS304-3.5MM	70
6”	SGP-5MM	237
6”	SUS304-15MM	25
6”	AS-2-10.5MM	120
6”	STPG38-SCH80	10
6”	SUS304-7MM	10
6”	STPT38-SCH40	28
6”	HITEN 55-S-16.5MM	2
6”	STPA24-S-21MM	26
6”	STPL39-S-SCH40	109
6”	STPG38-SCH120	15
6”	AS-S-16.5MM	58
6”	SGP GALV. –C/S-6MM	380
6”	STPA12-SCH80	68
8”	SGP-5.8MM	396
8”	STPA12-S-SCH20	45
8”	STPG38-SCH40	469
8”	STPT38-SCH40	212
8”	SUS304L-4MM	15
8”	SUS304L-6.5MM	10
8”	SUS304L-3.5MM	10

8”	STPA12-SCH80	50
8”	STPG38-SCH80	83
8”	SUS304-6.5MM	15
8”	AS-2-21.5MM	66
8”	SUS304-4MM	5
8”	STPG38-SCH20	83
8”	STPL39-S-SCH20	42.6
8”	STPT38-SCH80	30.5
8”	STPT38-SCH120	15
10”	STPG38-SCH40	360
10”	SGP-6.6MM	120
10”	STPG38-SCH120	10
10”	SUS304-4MM	415
10”	SUS304L-4.5MM	10
10”	SUS304L-4MM	15
10”	AS-2-25.5MM	70
10”	STPA12-SCH40	15
10”	STPT38-SCH40	4
10”	STPG38-SCH20	149
10”	HITEN 55-S-25.5MM	26
10”	STPA24-S-33.6MM	12.8
10”	STPT38-SCH120	30.5
10”	STPG38-SCH80	45
10”	STPA12-14MM	50
10”	STPA24-S-SCH80	15
10”	STPA12-SCH20	25.5
10”	STPA24-S-39.5MM	15
12”	SGP-6.9MM	197
12”	STPG38-SCH40	216
12”	SUS304L-6.5MM	10
12”	STPA12-16MM	50
12”	STPT38-SCH40	60
12”	STPG38-SCH20	92
12”	AS-2-30MM	30.5
12”	STPA24-S-39.5MM	12
12”	HITEN 55-S-30MM	15
12”	STPG38-SCH20	25
14”	SGP-7.9MM	114
14”	STPG38-SCH40	212
14”	SUS304L-8MM	11
14”	SUS304L-4.5MM	30
14”	SUS304-4.5MM	10
14”	STPG38-SCH20	30
14”	STPL39-S-SCH40	19

14”	STPA12-SCH30	27.5
14”	SGP-9MM	15
16”	STPA12-20MM	36
16”	SM41B-9.5MM	79
16”	SM41B-7.9MM	85
16”	SUS304L-6.5MM	3.5
16”	SM41B-9MM	42
16”	SUS304L-9MM	3
16”	SUS304L-6MM	11
16”	SUS304-6MM	20
16”	STPY41-7.9MM	42
16”	STPA12-9.5MM	58
16”	SM41B-6MM	27.5
18”	SM41B-11.21MM	97
18”	SGP-7.9MM	6
18”	SM41B-12MM	40
18”	SUS304L-9MM	56
18”	SM41B-7.9MM	40
18”	SUS304L-6MM	5
18”	STPG38-7.9MM	20
18”	SM41B-6MM	65
18”	STPA12-22.5MM	37
18”	STPT41-7.9MM	16.5
20”	STPA12-10MM	43
20”	SGP-7.9MM	46
20”	SM41B-12MM	1
20”	STPG38-SCH20	5
20”	SM41B-6MM	27.5
20”	STPY41-7.9MM	87.5
24”	SGP-7.9MM	36
24”	SUS304-6MM	8
24”	SM41B-7.9MM	10
24”	SM41B-7MM	22
28”	STPY41-6MM	30
30”	SUS304-6MM	10
30”	SM41B-7.9MM	82
36”	SM41B-8MM	5
36”	STPY41-7.9MM	15
48”	SM41B-11MM	45

SIZE	MAT	QTY
25MM	TU37-O-2.3MM	100
32MM	A33-4.85MM	130
40MM	A33-5.08MM	120
50MM	C/S-A33-3.91MM	3
50MM	TU37-O-2.9MM	30
50.8MM	A213 GR T22	25
60MM	TU37-O-3.2MM	2
65MM	C/S-API-SL A33-5.16MM	290
65MM	TU37-O-2.9MM	20
80MM	TU37-O-3.2MM	30
100MM	TU37-O-3.6MM	40
165.2MM	A106 GRA	15
216.3MM	A106GRA	12
216.3MM	A335 GR P22-12.7MM	8
250MM	C/S-TU37-O-6.3MM	40

ITEM	SIZE (INCH)	MAT	QTY
ELBOW/90LR	3/8	STPG38-SCH80	2
ELBOW	½	STPT38-SCH80	4
ELBOW/90LR	½	SGP-2.8MM	5
ELBOW/90LR	½	STPG38-SCH80	117
ELBOW/90LR	½	FCMB-2.8MM	26
ELBOW/90SR	½	STPG38-SCH80-SW	24
ELBOW/90SR	½	STPT42-SCH80-BW	23
ELBOW/90SR	½	SUS304TP-SCH160-BW	6
ELBOW/90SR	½	SUS304TP-SCH40-SW	18
ELBOW/90LR	½	STPT42-SCH160-BW	23
ELBOW/45LR	½	STPG38-SCH80	14
ELBOW/90LR	½	S25C-SCH80-SW-FORGED	208
ELBOW/90LR	½	STPA12-ACH80	12
ELBOW/90LR	½	STPT38-SCH80	16
ELBOW/90LR	½	SUS304-SCH80	32
ELBOW/90LR	¾	STPG38-SCH80	51
ELBOW/90LR	¾	STPG38-SCH40	11
ELBOW/90LR	¾	SUS304-SCH40	47
ELBOW/90LR	¾	SUS304-SCH80	12
ELBOW/90LR	¾	FCMB GALV.-2.8MM	137

ELBOW/90LR	**¾**	**S25C-SCH80**	240
ELBOW/90LR	**¾**	**A182LF-SCH80**	5
ELBOW/90LR	**¾**	**S25C-SW-SCH160**	16
ELBOW/90LR	**¾**	**FCMB-2.8MM-SCR'D**	85
ELBOW/90LR	**¾**	**A182F1-SCH80-SW-FORGED**	33
ELBOW/90LR	**¾**	**S25C-SCH80-SW-FORGED**	40
ELBOW/90LR	**¾**	**FCMB-JIS10K-SCR'D**	45
ELBOW/90LR	**¾**	**STPA12-SCH80**	10
ELBOW/90LR	**¾**	**F11-SCH80**	20
ELBOW/45	**¾**	**S25C-SCH80**	4
ELBOW	**1**	**STPT42-SCH80**	4
ELBOW	**1**	**STPT38-SCH80**	4
ELBOW/90LR	**1**	**SUS304-SCH40**	20
ELBOW/90LR	**1**	**S25C-SCH80**	230
ELBOW/90LR	**1**	**A182LF-SCH80**	2
ELBOW/90LR	**1**	**S25C-SCH160-BW**	77
ELBOW/90LR	**1**	**STPG38-SCH40-SW**	68
ELBOW/90LR	**1**	**A350LF1-SCH80**	17
ELBOW/90LR	**1**	**SGP-3.2MM**	45
ELBOW/90LR	**1**	**STPG38-SCH80**	75
ELBOW/90LR	**1**	**FCMB-3.2MM-SCR'D**	66
ELBOW/90LR	**1**	**S25C-SCH80-SW-FORGED**	12
ELBOW/90LR	**1 1/2**	**STPG38-SCH80**	28

ELBOW/90LR	1 1/2	STPG38-SCH40	256
ELBOW/90LR	1 1/2	STPG38-SCH120	6
ELBOW/90LR	1 1/2	SUS304L-3MM	15
ELBOW/90LR	1 1/2	SGP-3.5MM	110
ELBOW/90LR	1 1/2	STPT38-SCH40	36
ELBOW/90LR	1 1/2	FCMB-GALV.	12
ELBOW/90LR	1 1/2	SUS304TP-SCH40	13
ELBOW/90LR	1 1/2	SUS304TP-SCH160-BW	6
ELBOW/90LR	1 1/2	S25C-SCH160-SW	7
ELBOW/90LR	1 1/2	STPT38-SCH80	36
ELBOW/90LR	1 1/2	STPT42-SCH160-BW	14
ELBOW/90LR	1 1/2	STPA24-S-21MM	2
ELBOW/90LR	1 1/2	A350LF-SCH40	23
ELBOW/90LR	1 1/2	STPL39-S-SCH20	12
ELBOW/90LR	1 1/2	FCMB-3.5MM-SCR'D	45
ELBOW/90LR	1 1/2	STPL39-SCH40	7
ELBOW/90LR	2	SGP-3.8MM	112
ELBOW/90LR	2	SUS304L-3.5MM	8
ELBOW/90LR	2	STPA12-SCH80	34
ELBOW/90LR	2	STPT38-SCH40	89
ELBOW/90LR	2	STPG38-SCH40	222
ELBOW/90LR	2	FCMB-GALV.	3
ELBOW	2	STPT38-SCH80-BW	29

ELBOW/90LR	2	STPT42-SCH160-BW	32
ELBOW/90LR	2	SUS304TP-SCH160	25
ELBOW/90LR	2	SUS304TP-SCH105	7
ELBOW/90LR	2	STPL39-S-SCH40	4
ELBOW/90LR	2	HITEN 55-S-7MM	23
ELBOW/90LR	2	HITEN 55-S-20MM	10
ELBOW/90LR	2	SUS304-3MM-BW-WELDED	18
ELBOW/90LR	2	AS-2-7MM-BW-SEAMLESS	10
ELBOW	2 1/2	STPG38-SCH40	4
ELBOW	2 1/2	SUS304-3MM	6
ELBOW/90LR	3	STPG38-SCH40	256
ELBOW/90LR	3	SUS304-4MM	3
ELBOW/90LR	3	SUS304-3.5MM	1
ELBOW/90LR	3	SGP-4.2MM	45
ELBOW/90LR	3	SUS304-3MM	30
ELBOW/90LR	3	AS-2-6.5MM	5
ELBOW/90LR	3	SUS304-SCH10	8
ELBOW/90LR	3	STPT38-SCH40	10
ELBOW/90LR	3	SUS304TP-SCH160	12
ELBOW	3	SUS304TP-SCH105	11
ELBOW/90LR	3	HITEN 55-S-8.5MM	2
ELBOW/45LR	3	HITEN 55-S-2.5MM	2
ELBOW/90LR	3	HITEN 55-S-9.5MM	4

ELBOW/90LR	**3**	**STPL39-S-SCH40**	27
ELBOW/90LR	**3**	**STPT38-SCH40-BW-SEAMLESS**	10
ELBOW/90LR	**3**	**SUS304-3MM-BW-WELDED**	10
ELBOW/90LR	**3**	**STPG38-SCH40**	4
ELBOW/90LR	**4**	**STPA12-SCH80**	12
ELBOW	**4**	**STPG38-SCH80**	6
ELBOW/90LR	**4**	**SUS304L-3MM**	15
ELBOW/45	**4**	**STPG38-SCH40**	5
ELBOW/45	**4**	**STPT38-SCH40**	3
ELBOW/90LR	**4**	**STPT38-SCH40**	30
ELBOW/90LR	**4**	**SGP-4.5MM**	80
ELBOW/90LR	**4**	**STPG38-SCH40**	189
ELBOW/90LR	**4**	**SUS304TP-SCH105-BW**	9
ELBOW/90LR	**4**	**STPL39-S-SCH40**	45
ELBOW/45LR	**4**	**SGP-4.5MM-BW**	10
ELBOW/90LR	**4**	**STPL39-SCH40-BW-SEAMLESS**	8
ELBOW/90	**4**	**STPA12-SCH80**	20
ELBOW/90LR	**5**	**SUS304L-3.5MM**	2
ELBOW/90LR	**6**	**STPG38-SCH40**	140
ELBOW/45LR	**6**	**STPG38-SCH40**	6
ELBOW/90LR	**6**	**SUS304-3.5MM**	15
ELBOW/90LR	**6**	**SUS304-15MM**	12

ELBOW/90LR	**6**	**SUS304-7MM**	5
ELBOW/90LR	**6**	**STPG38-SCH80**	16
ELBOW/90LR	**6**	**SGP-5MM**	90
ELBOW/90LR	**6**	**STPL39-SCH40**	10
ELBOW/90LR	**6**	**STPT38-SCH120**	35
ELBOW/90LR	**6**	**STPA24-S-21MM**	4
ELBOW/90LR	**6**	**STPT38-SCH40-BW-SEAMLESS**	17
ELBOW/90LR	**6**	**STPT38-SCH120-SEAMLESS**	7
ELBOW/90LR	**6**	**AS-2-16.5MM-BW-SEAMLESS**	18
ELBOW/45LR	**6**	**SGP-5MM-BW**	7
ELBOW/90LR	**6**	**STPA12-SCH80-BW-SEAMLESS**	5
ELBOW/90LR	**6**	**SUS304L-5MM-BW-WELDED**	3
ELBOW/90LR	**8**	**STPG38-SCH40**	135
ELBOW/45	**8**	**STPG38-SCH40**	21
ELBOW/90LR	**8**	**SUS304L-4MM**	4
ELBOW/90LR	**8**	**SUS304L-6.5MM**	4
ELBOW/90LR	**8**	**SGP-5.8MM**	54
ELBOW/90LR	**8**	**SUS304-6.5MM**	8
ELBOW/90LR	**8**	**STPT38-SCH40**	15
ELBOW/90LR	**8**	**STPA12-SCH20**	35
ELBOW/90LR	**8**	**STPA12-SCH80**	21

ELBOW/90LR	8	STPG38-SCH80	25
ELBOW/90LR	8	AS-2-21.5MM	8
ELBOW/90LR	8	STPG38-SCH20-BW	13
ELBOW/45LR	8	SGP-5.8MM	4
ELBOW/90LR	8	STPL39-SCH20	24
ELBOW/90LR	8	STPT38-SCH120-BW-SEAMLESS	3
ELBOW/90LR	8	SS41-5.8MM-BW	6
ELBOW/45	10	SUS304L-4MM	2
ELBOW/90LR	10	SUS304-4MM	55
ELBOW/90LR	10	STPG38-SCH40	194
ELBOW/45LR	10	STPG38-SCH40	4
ELBOW/90LR	10	STPA24-SCH80	5
ELBOW/90LR	10	SGP-6.6MM	9
ELBOW/90LR	10	STPT38-SCH120	7
ELBOW/90LR	10	AS-2-25.5MM	16
ELBOW/90LR	10	STPA12-SCH80-14MM	10
ELBOW/90LR	10	STPT38-SCH40	2
ELBOW/90LR	10	STPG38-SCH20-BW	20
ELBOW/90LR	10	STPA24-33.6MM	9
ELBOW/90LR	10	HITEN55-S-25.5MM	14
ELBOW/45LR	10	HITEN55-S-25.5MM	5
ELBOW/90LR	10	STPG38-SCH80-BW-SEAMLESS	5

ELBOW/45LR	**10**	**STPG38-SCH20-WELDED**	5
ELBOW/90LR	**10**	**STPA12-SCH20-BW-SEAMLESS**	3
ELBOW/90LR	**10**	**STPA12-39.5MM**	2
ELBOW/45LR	**10**	**STPA12-39.5MM**	1
ELBOW/90LR	**12**	**SUS304L-6.5MM**	5
ELBOW/90LR	**12**	**STPG38-SCH40**	53
ELBOW/45LR	**12**	**STPG38-SCH40**	4
ELBOW/90LR	**12**	**SGP-6.9MM**	29
ELBOW/45LR	**12**	**SGP-6.9MM**	6
ELBOW/90LR	**12**	**STPA12-16MM-BW-SEAMLESS**	5
ELBOW/90LR	**12**	**STPG38-SCH20-BW-WELDED**	14
ELBOW/90LR	**12**	**AS-2-30MM-SEAMLESS**	1
ELBOW/90LR	**12**	**STPA12-39.5MM**	3
ELBOW/90LR	**12**	**HITEN55-S-30MM-BW**	3
ELBOW/45LR	**12**	**HITEN55-S-30MM-BW**	1
ELBOW/90LR	**14**	**SUS304L-8MM**	3
ELBOW/90LR	**14**	**SUS304L-4.5MM**	8
ELBOW/45LR	**14**	**SUS304L-4.5MM**	2
ELBOW/90LR	**14**	**STPG38-SCH40**	55
ELBOW/45	**14**	**STPG38-SCH40**	6
ELBOW/90LR	**14**	**SUS304-4.5MM**	6

ELBOW/90LR	14	SGP-7.9MM	33
ELBOW/90LR	14	STPG38-SCH20	3
ELBOW/90LR	14	STPL39-SCH40	3
ELBOW/90LR	16	SM41B-9.5MM	10
ELBOW/45	16	SM41B-9.5MM	4
ELBOW/90LR	16	SM41B-7.9MM	13
ELBOW/45LR	16	SUS304L-6MM	3
ELBOW/90LR	16	SUS304-6MM	3
ELBOW/45	16	SUS304-6MM	2
ELBOW/90LR	16	SM41B-25MM	21
ELBOW/90LR	16	STPT12-8MM	7
ELBOW/90LR	16	SM41B-28MM	1
ELBOW/90LR	16	SM41B-6MM	6
ELBOW/45	16	SM41B-6MM	5
ELBOW/90LR	16	STPA12-9.5MM	11
ELBOW/90LR	16	SGP-7.9MM	6
ELBOW/90LR	16	SM41B-6MM-BW-WELDED	7
ELBOW/90LR	16	SS41-7.9MM-BW	5
ELBOW/45LR	16	SM41B-6MM-BW-WELDED	4
ELBOW/90LR	18	SM41B-12MM	9
ELBOW/45	18	SM41B-12MM	5
ELBOW/90LR	18	SUS304L-9MM	12
ELBOW/45LR	18	SM41B-6MM	2

ELBOW/90LR	18	SM41B-7.9MM	6
ELBOW/90LR	18	SM41B-28MM	10
ELBOW/90LR	18	SM41B-12.5MM	6
ELBOW/90LR	18	SM41B-11.1MM	15
ELBOW/90LR	18	SS41-7.9MM	4
ELBOW/90LR	18	STPG38-SCH40	6
ELBOW/90LR	18	SM41B-6MM	17
ELBOW/45	18	SM41B-11.1MM	1
ELBOW/90LR	18	STPA12-22.5MM-BW-SEAMLESS	5
ELBOW/90LR	20	SM41B-12MM	1
ELBOW	20	STPA12-10MM	16
ELBOW/90LR	20	SGP-7.9MM	13
ELBOW/90LR	20	SM41B-6MM-BW-WELDED	6
ELBOW/90LR	20	SS41-7.9MM-BW	13
ELBOW/90LR	24	SGP-7.9MM	4
ELBOW/90LR	24	SM41B-7MM-BW-WELDED	2
ELBOW/90LR	30	SM41B-7.9MM	6
ELBOW/90LR	30	SM41B-6MM	3
ELBOW/90LR	36	SM41B-8MM	2
ELBOW/45	36	STPY41-7.9MM	2
ELBOW/90LR	48	SM41B-11MM	6
ELBOW	32	A33	30

ELBOW	40	A33	25
ELBOW	50	C/S-A33	1
ELBOW	50	TU37-A	14
ELBOW	65	C/S-API-SL-A33	4
ELBOW	65	C/S-API-SL-A33	12
ELBOW	65	TU37-A	3
ELBOW	80	TU37-A	1
ELBOW	80	TU37-A	10
ELBOW	100	TU37-A	12
ELBOW/90LR	165.2	A106-GRA	3
ELBOW/90LR	216.3	A106-GRA	2
ELBOW/90LR	216.3	A335-GR-P22	1
ELBOW	250	TU37-A	4

ITEM	SIZE (INCH)	MAT	QTY
TEE	10*10*4	TU37-A	10
TEE	10*10*10	TU37-A	8
TEE	8*10*10	TU37-A	9
TEE	8*8*6	TU37-A	10
TEE	6*6*4	TU37-A	12
TEE	4*4*2	TU37-A	14
TEE	12*12*10	TU37-A	6
TEE	12*12*8	TU37-A	5

TEE	216MM*16	A106-GRA-12.7*1	1
TEE	6*6	STPT38-SCH120	20
TEE	6*4	STPT38-SCH120	10
TEE	3/4*3/4	A182F1-SCH80	6
TEE	3/4*3/4	F11-SCH80	6
TEE	4*4	STPA12-SCH80	4
TEE	1*1/2	FCMB	6
TEE	8*8	STPT38-SCH40	1
TEE	12*12	STPA12-16MM	2
TEE	12*8	STPA12-SCH80	1
TEE	8*8	STPA12-SCH80	2
TEE	4*4	STPA12-SCH80	1
TEE	8*6	STPT38-SCH120	4
TEE	8*8	STPG38-SCH20	1
TEE	12*12	STPG38-SCH20	1
TEE	8*4	SGP-5MM	1
TEE	3/4*3/4	SUS304-SCH80	6
TEE	1/2	SUS304-SCH40	6
TEE	1/2	STPG38-SCH80	31
TEE	1/2*3/4	FCMB GALV.	1
TEE	1/2	S25C-SCH80-SW	13
TEE	3/4	SUS304-SCH40	19
TEE	3/4	FCMB GALV.-2.8MM	6

TEE	**3/4**	**STPG38-SCH80**	14
TEE	**3/4*1/2**	**STPG38-SCH80**	4
TEE	**3/4**	**S25C-SCH80**	29
TEE	**3/4**	**A182LF-SW-SCH80**	1
TEE	**3/4*1/2**	**SUS304TP-SCH105-SW**	6
TEE	**3/4**	**SGP-2.8MM**	6
TEE	**3/4**	**S25C-SCH80-SW-FORGED**	5
TEE	**3/4*3**	**SGP-4.2MM-BW**	21
TEE	**3/4*1/2**	**FCMB GALV.-SCR'D**	4
TEE	**1**	**STPG38-SCH80**	29
TEE	**1*1/2**	**STPG38-SCH80**	6
TEE	**1*1/2**	**STPG38-SCH40**	1
TEE	**1**	**SGP-3.2MM**	11
TEE	**1*3/4**	**S25C-SCH80**	5
TEE	**1**	**S25C-SW-SCH80**	15
TEE	**1*2**	**STPT38-BW-SCH40**	1
TEE	**1**	**FCMB-3.2MM**	2
TEE	**1*2**	**FCMB GALV.-3.8MM**	1
TEE	**1*1/2**	**S25C-SCH80-SW**	12
TEE	**1*1 1/2**	**STPG38-SCH40-BW**	6
TEE	**1*3/4**	**STPG38-SCH40**	1
TEE	**1**	**STPL39-SCH80**	6

TEE	1	FCMB-3.2MM	1
TEE	1*3/8	STPG38-SCH80	1
TEE	1*3/4	STPG38-SCH80	12
TEE	1*3/4	SGP-3.2MM	6
TEE	2	STPG38-SCH80	3
TEE	2	STPG38-SCH40	45
TEE	2*1	SGP-3.8MM	1
TEE	2*1 1/2	STPG38-SCH40	17
TEE	2*1	STPG38-SCH40	13
TEE	2	SUS304L-3.5MM	4
TEE	2*2	STPT38-SCH40	12
TEE	2*1	STPT38-SCH40	6
TEE	2*1 1/2	SGP-3.8MM	16
TEE	2*3/4	FCMBGALV. -3.8MM	4
TEE	2	SUS304TP-SCH160-BW	3
TEE	2	SUS304TP-SCH80-BW	4
TEE	2	SUS304TP-SCH105-BW	6
TEE	2*3/4	STPG38-SCH40-BW	4
TEE	2	STPL39-SCH40	1
TEE	2*1/2	STPL39-SCH80	2
TEE	2*1	STPG38-SCH80	2
TEE	2*2*1	STPG38-SCH40	8
TEE	2*2*1	SGP-3.8MM-BW	11

TEE	**1 1/2**	**SGP-3.5MM**	3
TEE	**1 1/2**	**STPG38-SCH40**	7
TEE	**1 1/2**	**SUS304L-3MM**	6
TEE	**1 1/2*1**	**STPG38-SCH40**	10
TEE	**1 1/2*1**	**SGP-3.5MM**	6
TEE	**1 1/2*1**	**STPT38-SCH40**	8
TEE	**1 1/2*3**	**FCMB GALV.**	6
TEE	**1 1/2*1**	**FCMB GALV.-3.5MM**	3
TEE	**1 1/2**	**SUS304TP-SCH105-BW**	4
TEE	**1 1/2*3**	**SUS304TP-SCH105-BW**	3
TEE	**1 1/2*3**	**STPG38-SCH80**	4
TEE	**1 1/2**	**FCMB GALV.-3.5MM-SCR'D**	10
TEE	**1 1/2*1**	**FCMB-3.5MM-SCR'D**	3
TEE	**2 1/2*2**	**STPL39-S-SCH40**	10
TEE	**2 1/2*3**	**STPG38-SCH80**	10
TEE	**3**	**STPG38-SCH40**	57
TEE	**3*2**	**STPG38-SCH40**	32
TEE	**3*1 1/2**	**STPG38-SCH40**	1
TEE	**3*2 1/2**	**STPG38-SCH40**	22
TEE	**3**	**STPT38-BW-SCH40**	11
TEE	**3*2**	**STPT38-SCH40**	5
TEE	**3**	**SUS304TP-SCH160**	3

TEE	**3*1/2**	**STPG38-SCH80**	5
TEE	**3*3*2**	**SGP-4.2MM**	2
TEE	**3*3*2**	**STPG38-SCH40**	3
TEE	**3*3*1**	**SGP GALV.-4.2MM-BW-WELDED**	17
TEE	**4*4**	**SUS304-SCH40**	9
TEE	**4**	**SGP-4.5MM**	6
TEE	**4*3**	**STPG38-SCH40**	27
TEE	**4**	**SUS304L-3MM**	4
TEE	**4*3**	**SGP-4.2MM**	11
TEE	**4*2**	**SGP-4.2MM**	9
TEE	**4*3**	**STPT38-SCH40**	10
TEE	**4**	**STPG38-SCH40**	19
TEE	**4**	**STPT38-SCH40**	3
TEE	**4*2**	**STPT38-BW-SCH40**	7
TEE	**4*2**	**SUS304TP-SCH105-BW**	4
TEE	**4*1 1/2**	**SUS304TP-SCH105-BW**	3
TEE	**4*3**	**SUS304TP-SCH105-BW**	3
TEE	**4**	**STPL39-S-SCH40**	3
TEE	**4*3**	**STPL39-SCH40**	5
TEE	**4*1**	**S25C-SCH80**	2
TEE	**6*3**	**STPG38-SCH40**	2
TEE	**6**	**STPG38-SCH40**	10

TEE	**6**	**SM41B-6.9MM**	3
TEE	**6*4**	**STPG38-SCH40**	1
TEE	**6*3**	**AS-2-10.5MM*4.3MM**	2
TEE	**6*3**	**STPG38-SCH80**	8
TEE	**6**	**SGP-5MM**	7
TEE	**6*4**	**SGP-5MM**	4
TEE	**6*4**	**STPL39-S-SCH40**	8
TEE	**6*6*2**	**STPT38-SCH120**	3
TEE	**6*6*1**	**STPT38-SCH120-BW-SEAMLESS**	3
TEE	**6*8*8**	**STPT38-SCH40**	2
TEE	**8**	**STPG38-SCH40**	8
TEE	**8*6**	**STPG38-SCH40**	3
TEE	**8*4**	**STPG38-SCH40**	15
TEE	**8*8**	**STPA12-SCH20**	8
TEE	**8*6**	**STPA12-SCH20*SCH40**	4
TEE	**8*4**	**STPG38-SCH80**	6
TEE	**8*3**	**STPG38-SCH40**	5
TEE	**8*6**	**SGP-5MM**	2
TEE	**8**	**STPL39-S-SCH20**	2
TEE	**8*8*2**	**STPT38-SCH40**	2
TEE	**8*8*3**	**STPT30-SCH40-BW-SEAMLESS**	3
TEE	**10*16**	**STPA12-10MM**	1

TEE	10*6	SUS304-4MM*3.5MM	1
TEE	10*10	SUS304-4MM	2
TEE	10*10	STPG38-SCH20	2
TEE	10*10	SGP-6.6MM	2
TEE	10*10	STPA12-10MM	1
TEE	12	SGP-6.9MM	10
TEE	12	STPG38-SCH40	3
TEE	12*8	STPG38-SCH40	4
TEE	12*6*1	SS41-7.9MM	1
TEE	14	SGP-7.9MM	1
TEE	14*8	STPG38-SCH40	1
TEE	14	STPG38-SCH40	1
TEE	14*14	SGP-7.9MM*7.9MM	2
TEE	16	SM41B-9.5MM	2
TEE	16	SM41B-7.9MM	2
TEE	16*16	STPY41-7.9MM*6.9MM	2
TEE	16*8	STPT38-SCH40	1
TEE	18*16	S25C-28MM*25MM	3
TEE	18*14	SM41B-12.5MM	1
TEE	18*14	SM41B-11.1MM	2
TEE	18*12	SM41B-11.1MM	1
TEE	18	S25C-28MM	2
TEE	18	SM41B-6MM	9

TEE	**20*19**	**STPA12-10MM**	1
TEE	**20**	**SGP-7.9MM**	1
TEE	**30**	**SM41B-7.9MM**	1

ITEM	SIZE (INCH)	MAT	QTY
FLANGE	1/2	ANSI900-WN-RJ-S30C	3
FLANGE	1/2	ANSI150-SW-RF-SS41	52
FLANGE	1/2	ANSI400-WN-RF-S25C	6
FLANGE	1/2	ANSI1500-SO-FF-SS41	14
FLANGE	1/2	ANSI300-SO-RF-S25C	31
FLANGE	1/2	ANSI600-SW-S25C	20
FLANGE	1/2	JIS10K-FCMB	6
FLANGE	1/2	JIS10K-SO-FF-SS41	8
FLANGE	1/2	ANSI150-SO-RF-S25C	150
FLANGE	1/2	ANSI125-FF-S20C	2
FLANGE	1/2	ANSI800-SW-S25C	9
FLANGE	1/2	ANSI1500-WN-RJ-S25C	4
FLANGE	1/2	ANSI300-WN-RJ-S25C	27
FLANGE	1/2	ANSI600-WN-RF-S25C	62
FLANGE	1/2	ANSI2500-WN-RJ-S25C	8
FLANGE	1/2	ANSI150-SCR'D-FF-FCMB GALV.	16
FLANGE	1/2	ANSI300-SW-RF-S25C	27
FLANGE	3/4	ANSI900-WN-RJ-S30C	2
FLANGE	3/4	ANSI150-SW-RF-SS41	114
FLANGE	3/4	ANSI150-SO-RF-SUS304	30

FLANGE	**3/4**	**ANSI125-SW-RF-SS41**	3
FLANGE	**3/4**	**ANSI150-LAP JOINT-SS41**	4
FLANGE	**3/4**	**ANSI150-SCR'D-FF-FCMB**	74
FLANGE	**3/4**	**ANSI300-SO-RF-S25C**	25
FLANGE	**3/4**	**ANSI400-WN-RF-S25C**	66
FLANGE	**3/4**	**ANSI600-SW-S25C**	20
FLANGE	**3/4**	**ANSI900-SW-S25C**	2
FLANGE	**3/4**	**ANSI300-SO-RJ-S25C**	2
FLANGE	**3/4**	**ANSI150-SO-RF-S25C**	166
FLANGE	**3/4**	**JIS10K-SO-FF-SS41**	70
FLANGE	**3/4**	**JIS10K-FCMB**	2
FLANGE	**3/4**	**ANSI600-WN-RF-S25C**	16
FLANGE	**3/4**	**ANSI125-FF-S20C**	2
FLANGE	**3/4**	**ANSI1500-WN-RJ-S25C**	19
FLANGE	**3/4**	**ANSI600-WN-RJ-S25C**	17
FLANGE	**3/4**	**ANSI300-WN-RF-S25C**	4
FLANGE	**3/4**	**ANSI125-SO-FF-SS41**	120
FLANGE	**3/4**	**ANSI900-WN-RJ-A182F1**	53
FLANGE	**1**	**ANSI900-WN-RJ-S25C**	8
FLANGE	**1**	**ANSI150-SO-RF-SS41**	30
FLANGE	**1**	**ANSI125-SO-FF-SS41**	34

FLANGE	**1**	**ANSI300-SO-RF-S25C**	29
FLANGE	**1**	**ANSI150-SO-RF-SUS304L**	10
FLANGE	**1**	**ANSI150-SO-RF-S25C**	83
FLANGE	**1**	**ANSI600-SW-S25C**	13
FLANGE	**1**	**ANSI600-WN-RF-S25C**	39
FLANGE	**1**	**ANSI300-SW-RF-S25C**	80
FLANGE	**1**	**ANSI300-SW-RF-A350LF1**	20
FLANGE	**1**	**ANSI300-SO-FF-SS41**	6
FLANGE	**1**	**ANSI150-SW-RF-SS41**	67
FLANGE	**1**	**ANSI150-SO-FF-SS41**	100
FLANGE	**1**	**ANSI150-SCR'D-FF-FCMBGALV.**	14
FLANGE	**1 1/2**	**ANSI300-SW-RF-S25C**	10
FLANGE	**1 1/2**	**ANSI900-WN-RJ-S25C**	51
FLANGE	**1 1/2**	**ANSI150-SW-RF-SS41**	63
FLANGE	**1 1/2**	**ANSI125-SW-RF-SS41**	2
FLANGE	**1 1/2**	**ANSI300-SO-RF-SUS304L**	6
FLANGE	**1 1/2**	**ANSI150-SW-RF-S25C**	18
FLANGE	**1 1/2**	**JIS10K-SO-RF-SS41**	12
FLANGE	**1 1/2**	**ANSI600-WN-RF-S25C**	30
FLANGE	**1 1/2**	**ANSI150-SO-FF-SS41**	54
FLANGE	**1 1/2**	**ANSI150-SO-RJ-S25C**	4

FLANGE	**1 1/2**	**ANSI150-SO-RF-S25C**	58
FLANGE	**1 1/2**	**ANSI300-SO-RF-S25C**	5
FLANGE	**1 1/2**	**ANSI125-FF-S20C**	2
FLANGE	**1 1/2**	**ANSI1500-WN-RJ-S25C**	70
FLANGE	**1 1/2**	**ANSI1500-WN-RF-S25C-9.5MM**	4
FLANGE	**1 1/2**	**ANSI300-SO-RFA350LF1**	4
FLANGE	**1 1/2**	**JIS10K-SO-FF-SS41**	21
FLANGE	**1 1/2**	**ANSI150-SCR'D-FF-FCMB GALV.**	75
FLANGE	**2**	**ANSI600-WN-RF-S25C**	30
FLANGE	**2**	**ANSI150-LOOSE-SS41**	9
FLANGE	**2**	**ANSI900-WN-RJ-S25C**	8
FLANGE	**2**	**ANSI300-SO-RF-S25C**	78
FLANGE	**2**	**ANSI150-SO-RF-SS41**	138
FLANGE	**2**	**ANSI300-LOOSE-S25C**	4
FLANGE	**2**	**ANSI300-LAP JOINT-SUS304L**	13
FLANGE	**2**	**JIS10K-SO-RF-SS41**	7
FLANGE	**2**	**ANSI1500-WN-RJ-S25C**	47
FLANGE	**2**	**ANSI1500-SO-RF-S20C**	4
FLANGE	**2**	**ANSI400-WN-RF-S25C**	11
FLANGE	**2**	**ANSI400-WN-RJ-S25C**	6
FLANGE	**2**	**ANSI150-SO-RF-S25C**	181

FLANGE	**2**	**ANSI125-SO-FF-S20C**	2
FLANGE	**2**	**ANSI150-SO-RJ-S25C**	12
FLANGE	**2**	**ANSI300-SO-RF-A350F1**	7
FLANGE	**2**	**ANSI150-WN-RF-S25C-7MM**	1
FLANGE	**2**	**ANSI300-SO-RF-S25C/BLIND**	1
FLANGE	**2**	**ANSI900-WN-RJ-A182F1**	8
FLANGE	**2**	**ANSI150-LAP JOINT-SS41+SUS304**	12
FLANGE	**2**	**JIS10K-SO-FF-SS41**	28
FLANGE	**2 1/2**	**ANSI2500-A182GRF11**	4
FLANGE	**2 1/2**	**ANSI125-SO-FF-SUS304**	5
FLANGE	**2 1/2**	**ANSI125-SO-FF-SS41**	6
FLANGE	**2 1/2**	**ANSI150-SO-RF-SS41**	6
FLANGE	**2 1/2**	**ANSI600-WN-RF-S25C**	5
FLANGE	**2 1/2**	**ANSI300-SO-RF-S25C**	4
FLANGE	**3**	**ANSI150-SO-FF-SS41**	61
FLANGE	**3**	**ANSI400-WN-RF-S25C**	7
FLANGE	**3**	**ANSI300-SO-RF-S25C**	67
FLANGE	**3**	**ANSI300-LOOSE-SUS304**	1
FLANGE	**3**	**ANSI300-LOOSE-S25C**	8

FLANGE	**3**	**ANSI300-LAP JOINT-S25C**	5
FLANGE	**3**	**ANSI150-LOOSE-SS41**	29
FLANGE	**3**	**ANSI150-LAP JOINT0SUS304**	31
FLANGE	**3**	**ANSI150-SO-RF-SS41**	124
FLANGE	**3**	**JIS10K-SO-FF-SS41**	8
FLANGE	**3**	**ANSI150-SO-RF-S25C**	150
FLANGE	**3**	**ANSI600-WN-RF-S20C**	2
FLANGE	**3**	**ANSI400-WN-RF-S20C**	2
FLANGE	**3**	**ANSI400-WN-RJ-S20C**	6
FLANGE	**3**	**ANSI1500-WN-RJ-S25C**	19
FLANGE	**3**	**ANSI300-SO-RF-A350LF1**	11
FLANGE	**3**	**ANSI150-LAP JOINT-SS41+SUS304**	16
FLANGE	**4**	**ANSI1500-A182GRF11**	6
FLANGE	**4**	**ANSI1500-WN-RJ-A182F11**	12
FLANGE	**4**	**ANSI400-WN-RF-S25C**	9
FLANGE	**4**	**ANSI150-SO-FF-SS41**	57
FLANGE	**4**	**ANSI400-SO-FF-SS41**	3
FLANGE	**4**	**ANSI600-WN-RJ-S25C**	3
FLANGE	**4**	**ANSI300-SO-RF-SS41**	3
FLANGE	**4**	**ANSI150-SO-RF-SS41**	36

FLANGE	**4**	**ANSI300-LOOSE-S25C**	15
FLANGE	**4**	**ANSI300-LAP JOINT-S25C**	12
FLANGE	**4**	**ANSI150-LOOSE-SS41**	13
FLANGE	**4**	**ANSI300-LAP JOINT-SS41**	6
FLANGE	**4**	**ANSI150-SO-RF-S25C**	101
FLANGE	**4**	**ANSI150-LAP JOINT-SUS304L**	9
FLANGE	**4**	**ANSI300-LAP JOINT-SUS304**	3
FLANGE	**4**	**ANSI600-WN-RF-S25C**	3
FLANGE	**4**	**ANSI300-SO-RF-S25C**	67
FLANGE	**4**	**ANSI300-SW-RF-A350F1**	2
FLANGE	**4**	**ANSI300-SO-RF-A350F1**	35
FLANGE	**4**	**ANSI150-WN-RF-S25C-11.5MM**	1
FLANGE	**4**	**ANSI150-SO-RF-A350LF1**	5
FLANGE	**4**	**JIS10K-SO-FF-SS41**	70
FLANGE	**5**	**ANSI150-LOOSE-S25C**	2
FLANGE	**5**	**ANSI150-SO-RF-S25C**	3
FLANGE	**6**	**ANSI900-WN-RJ-S25C**	21
FLANGE	**6**	**ANSI300-WN-RF-S25C**	14
FLANGE	**6**	**ANSI150-SO-RF-SS41**	46

FLANGE	**6**	**ANSI400-WN-RF-S25C**	25
FLANGE	**6**	**ANSI300-LOOSE-S25C**	5
FLANGE	**6**	**ANSI300-LAP JOINT-SUS304L**	5
FLANGE	**6**	**ANSI150-LOOSE-SS41**	10
FLANGE	**6**	**ANSI150-LAP JOINT-SUS304**	10
FLANGE	**6**	**JIS10K-SO-RF-SS41**	9
FLANGE	**6**	**ANSI600-WN-RF-S25C**	4
FLANGE	**6**	**ANSI300-SO-RF-S25C**	15
FLANGE	**6**	**ANSI600-WN-RF-SUS304**	6
FLANGE	**6**	**JIS10K-SO-RF-SS41**	20
FLANGE	**6**	**ANSI150-SO-RF-S25C**	28
FLANGE	**6**	**ANSI300-SO-RF-A350F1**	24
FLANGE	**6**	**ANSI2500-WN-RJ-A182F22**	1
FLANGE	**6**	**ANSI150-WN-RF-S25C-16.5MM**	4
FLANGE	**6**	**ANSI150-SO-FF-SS41**	55
FLANGE	**6**	**ANSI900-WN-RJ-A182F1**	2
FLANGE	**6**	**ANSI1500-WN-RJ-S25C**	4
FLANGE	**8**	**ANSI900-WN-RJ-S25C**	6
FLANGE	**8**	**ANSI400-WN-RF-S25C**	2

FLANGE	**8**	**ANSI900-WN-RJ-S30C**	4
FLANGE	**8**	**ANSI300-SO-RF-S25C**	29
FLANGE	**8**	**ANSI150-SO-RF-SS41**	25
FLANGE	**8**	**ANSI400-SO-RF-SS41**	2
FLANGE	**8**	**ANSI150-LOOSE-S25C**	8
FLANGE	**8**	**ANSI150-LAP JOINT-SUS304L**	8
FLANGE	**8**	**ANSI150-SO-LOOSE-SS41**	3
FLANGE	**8**	**ANSI150-SO-LAP JOINT-SUS304**	3
FLANGE	**8**	**ANSI300-LOOSE FLANGE-S25C**	4

ITEM	SIZE (INCH)	MAT	QTY
FLANGE	8	ANSI300-LAP JOINT-SUS304L	2
FLANGE	8	ANSI2500-WN-RJ-S25C	8
FLANGE	8	ANSI400-WN-RF-A182LF1	4
FLANGE	8	ANSI300-WN-RF-A182LF1	2
FLANGE	8	ANSI900-WN-RJ-A182LF1	10
FLANGE	8	ANSI1500-WN-RJ-S25C	4
FLANGE	8	ANSI600-WN-RF-S25C	12
FLANGE	8	JIS10K-SO-FF-SS41	36
FLANGE	8	ANSI150-SO-RF-S25C	22
FLANGE	8	JIS10K-SO-FF-SS41	6
FLANGE	8	ANSI150-SO-RF-A350LF1	8
FLANGE	8	ANSI400-WN-RF-S25C	12
FLANGE	8	ANSI150-SO-FF-SS41	18
FLANGE	10	ANSI150-LOOSE-SS41	7
FLANGE	10	ANSI150-SO-RF-SS41	52
FLANGE	10	ANSI300-LOOSE-S25C	4
FLANGE	10	ANSI300-LAP JOINT-SUS304L	4
FLANGE	10	ANSI150-LAP JOINT-	4

		SUS304	
FLANGE	10	ANSI1500-WN-RJ-S25C	9
FLANGE	10	ANSI300-SO-RF-S25C	20
FLANGE	10	ANSI2500-WN-RJ-S25C	4
FLANGE	10	ANSI150-SO-RF-S25C	16
FLANGE	10	ANSI900-WN-RJ-S25C	1
FLANGE	10	ANSI150-LAP JOINT-SS41+SUS304	16
FLANGE	10	ANSI600-WN-RF-S25C	2
FLANGE	10	ANSI300-WN-RF-A182F1	2
FLANGE	10	ANSI900-WN-RJ-A182F1	6
FLANGE	10	JIS10K-SO-FF-S20C	8
FLANGE	12	ANSI300-SO-RF-S25C	3
FLANGE	12	ANSI150-SO-FF-SS41	18
FLANGE	12	ANSI125-SO-FF-SS41	6
FLANGE	12	ANSI900-WN-RF-S25C	3
FLANGE	12	ANSI400-WN-RF-S25C	6
FLANGE	12	ANSI300-LOOSE-S25C	8
FLANGE	12	ANSI300-LAP JOINT-SUS304L	8
FLANGE	12	ANSI150-SO-RF-SS41	16
FLANGE	12	ANSI150-SO-RF-S25C	4
FLANGE	12	ANSI900-WN-RJ-S25C	3

FLANGE	**12**	**JIS10K-SO-FF-SS41**	16
FLANGE	**12**	**ANSI300-SO-FF-SS41**	2
FLANGE	**12**	**ANSI1500-WN-RJ-S25C**	2
FLANGE	**12**	**ANSI900-WN-RJ-A182F1**	4
FLANGE	**14**	**ANSI300-SO-RF-SS41**	9
FLANGE	**14**	**ANSI300-LINING-SS41-SUS304L**	3
FLANGE	**14**	**ANSI150-LINING-SS41-SUS304L**	1
FLANGE	**14**	**ANSI300-SO-RF-S25C**	11
FLANGE	**14**	**ANSI150-SO-RF-SS41**	3
FLANGE	**14**	**ANSI300-WN-RJ-S25C**	2
FLANGE	**14**	**ANSI150-LINING-SS41-SUS304**	3
FLANGE	**14**	**JIS10K-SO-FF-SS41**	45
FLANGE	**14**	**ANSI300-WN-RF-S25C**	6
FLANGE	**14**	**ANSI150-SO-RF-S25C**	14
FLANGE	**14**	**ANSI300-SO-RF-A350LF1**	2
FLANGE	**14**	**ANSI400-WN-RF-S25C**	4
FLANGE	**14**	**ANSI400-WN-RF-A182F1**	3
FLANGE	**14**	**JIS5K-SO-FF-SS41**	6
FLANGE	**16**	**ANSI900-WN-RF-S25C**	3
FLANGE	**16**	**ANSI600-WN-RF-S25C**	20

FLANGE	**16**	**ANSI300-WN-RF-A182F1**	3
FLANGE	**16**	**ANSI300-SO-RF-S25C**	13
FLANGE	**16**	**ANSI150-SO-RF-SS41**	14
FLANGE	**16**	**ANSI300-LINING-S25C-SUS304L**	3
FLANGE	**16**	**ANSI300-LINING-SS41-SUS304L**	3
FLANGE	**16**	**ANSI150-LINING-SS41-SUS304L-**	4
FLANGE	**16**	**ANSI150-LINING-SS41-SUS304**	5
FLANGE	**16**	**ANSI400-WN-RF-A182LF1**	8
FLANGE	**16**	**JIS10K-SO-FF-SS41**	6
FLANGE	**18**	**ANSI150-SO-RF-SS41**	14
FLANGE	**18**	**ANSI300-SO-RF-S25C**	19
FLANGE	**18**	**ANSI600-WN-RF-S25C**	8
FLANGE	**18**	**ANSI300-LINING-S25C-SUS304L**	4
FLANGE	**18**	**ANSI150-LINING-SS41-SUS304L**	3
FLANGE	**18**	**ANSI150-SO-RF-S25C**	2
FLANGE	**18**	**ANSI150-SO-FF-0S25C**	6
FLANGE	**18**	**ANSI300-S25C+SUS304L-LINING**	2
FLANGE	**18**	**ANSI900-WN-RJ-A182F1**	1

FLANGE	**20**	**ANSI150-SO-RF-SS41**	6
FLANGE	**20**	**ANSI300-WN-RF**	6
FLANGE	**20**	**ANSI150-LINING-SS41-SUS304L**	1
FLANGE	**20**	**JIS10K-SO-FF-SS41**	16
FLANGE	**20**	**ANSI150-SO-FF-S25C**	2
FLANGE	**24**	**ANSI150-SO-FF-SS41**	2
FLANGE	**24**	**ANSI300-WN-RF-S25C**	1
FLANGE	**28**	**ANSI150-SO-RF-SS41**	3
FLANGE	**30**	**ANSI150-LINING-SS41-SUS304**	1
FLANGE	**30**	**ANSI150-SO-RF-S25C**	3
FLANGE	**30**	**ANSI150-SO-RF-SS41**	1
FLANGE	**36**	**ANSI150-SO-RF-S25C**	2
FLANGE	**36**	**ANSI125-SO-RF-SS41**	1
CAP	**1 1/2**	**S25C-SCH80-SW**	28
CAP	**1**	**S25C-SCH80-SW**	29
CAP	**2**	**STPG38-SCH40-BW**	21
CAP	**3**	**STPG38-SCH40-BW**	12
CAP	**4**	**STPG38-SCH40-BW**	24
CUP	**1 1/2**	**S25C-SCH80-SW**	4
CUP	**1/2**	**S25C-SCH80-SW**	8
CUP	**1/2**	**FCMB GALV**	6
CUP	**3/4**	**FCMB GALV.**	4

CUP	**3/4**	**S25C-SCH80-SW**	8
CUP	**1**	**S25C-SCH80-SW**	6
SOCKET	**1/2**	**STPG38-SCH80**	40
SOCKET	**3/4**	**STPG38-SCH80**	78
SOCKET	**3/4**	**SGP-2.8MM**	75
SOCKET	**1**	**STPG38-SCH80**	62
SOCKET	**1**	**SGP-3.2MM**	68

ITEM	SIZE INCH	MATERIAL	QTY
REDUCER	1 * ½	S25C SCH80	8
REDUCER ER	1 * ½	FCMB-3.2mm* 2.8mm, SCRD	14
REDUCER CR	1* ¾	STPG38-SCH80	2
REDUCER ER	1 * ¾	S25C-SW-SCH80	3
REDUCER CR	1 * ¾	S25C-SW-SCH160	31
REDUCER	1 * ¾	S25C-SW-SCH80	9
REDUCER	1 *3/4	STPG38-SW-SCH40	11
REDUCER CR	1 ½ * 1	STPG38-SCH40	25
REDUCER CR	1 ½ * 1	STPG38-SCH80	14
REDUCER CR	1 ½ * 1	STPT 42-SCH160	3
REDUCER CR	1 ½ * 1	SUS304-SCH105	4
REDUCER CR	¾ * ½	SUS304-SW-SCH160	5
REDUCER ER	2 * ¾	STPG38-SCH40	2
REDUCER ER	2 *1 ½	STPG38-SCH40	22
REDUCER CR	2 * 1 ½	STPG38-SCH40	13
REDUCER ER	2 * 1 ½	SGP-3.8mm*3.5mm	2
REDUCER ER	2 *1 ½	STPT38-SCH40	6
REDUCER	2 * 1	STPT38-SCH80	3
REDUCER CR	2 * 1 ½	SUS304-SCH80	4
REDUCER CR	2 * 1 ½	SUS304-SCH105	23
REDUCER CR	2 * 1 ½	SUS304-SCH160	3
REDUCER CR	2 * 1	STPG38-SCH40	15
REDUCER CR	2 * 1 ½	STPG38-SCH 60	1
REDUCER ER	2 * 1	STPG38-SCH40	15
REDUCER	1 ½ * 1	STPT38-SCH80	10
REDUCER	1 ½ * 1	FCMB	6
REDUCER ER	1 ½ * 1	STPG38-SCH40	9
REDUCER ER	2 ½ * 2	STPG38-SCH40	5
REDUCER CR	2 ½ * 1	STPG38-SCH40	3
REDUCER ER	2 ½ * 1	STPG38-SCH40	8
REDUCER	¾ * ½	SGP GALV.	4
REDUCER	3/8 * ½	S25C-SW-SCH80	15
REDUCER ER	¾ * ½	S25C-SW-SCH80	5
REDUCER ER	3 * 2	STPT38-SCH40	8
REDUCER CR	3 * 2	STPG38-SCH40	8
REDUCER CR	3 * 1 ½	SUS304-SCH40	17
REDUCER CR	3 * 1	STPG38-SCH40	21

REDUCER CR	3 * 2	SUS304-SCH105	3
REDUCER ER	3 * ½	HITEN55-S-8.5mm	1
REDUCER ER	3/8 * ¾	STPG38-SCH80	1
REDUCER ER	3 * 2	AS-2-6.5 mm*4.5mm	2
REDUCER CR	3 * ½	HITEN55-S-8.5mm	1
REDUCER	3 * 1 ½	STPG38-SCH40	2
REDUCER ER	3 * 2	SGP GALV.-4.2mm	5
REDUCER ER	3 * 1 ½	SGP-4.2 mm	2
REDUCER	3 * 2 ½	STPT38-SCH40	3
REDUCER	3 * 2	STPG38-SCH40	28
REDUCER	3 * 2 ½	SUS304-3 mm	5
REDUCER	4 * 2 ½	STPT38-SCH40	1
REDUCER ER	4 * 2	STPT38-SCH40	4
REDUCER CR	4 * 2 ½	STPG38-SCH40	3
REDUCER ER	4 * 3	STPG-SCH40	12
REDUCER CR	4 * 3	STPG38 –SCH40	5
REDUCER ER	4 * 2	STPG-SCH80	2
REDUCER CR	4 * 2	STPA12-SCH80	2
REDUCER ER	4 * 2	STPG38-SCH40	2
REDUCER CR	4 * 3	SUS304-SCH105	2
REDUCER CR	4 * 2	STPG-SCH40	6
REDUCER ER	4 * 2 ½	STPL39-SCH40	4
REDUCER ER	4 * 3	STPL39-SCH40	5
REDUCER CR	4 * 1	STPL39-SCH40	1
REDUCER	4* 3	SGP 2mm	2
REDUCER ER	4 * 3	STPT38-SCH40	8
REDUCER	6 * 4	STPT38-SCH120	12
REDUCER	6 * 5	STPT38-SCH120	4
REDUCER	6 * 4	SGP-5 mm	4
REDUCER	6 * 4	STPT38-SCH40	2
REDUCER ER	6 * 2	SGP-5mm*3.8mm	4
REDUCER ER	6 * 4	STPL39-SCH40	2
REDUCER ER	6 * 3	STPG38-SCH40	12
REDUCER ER	6 * 4	SUS304L-15 mm	1
REDUCER CR	6 * 4	STPG38-SCH40	26
REDUCER ER	6 * 5	STPG-SCH40	3
REDUCER	6 * 8	STPG38-SCH40	2
REDUCER	6 * 10	STPT38-SCH40	2
REDUCER ER	8 * 4	SGP-5.8 mm*4.5 mm	2
REDUCER	8 * 6	STPL39-SCH20	2
REDUCER	8 * 4	STPT38-SCH40	2
REDUCER	8 * 6	STPT38-SCH40	6
REDUCER	8 *5	SUS304L-4 mm	3
REDUCER ER	8 * 6	SUS304L-6.5mm*5mm	2

REDUCER CR	8 * 6	SUS304L-3.5 mm	3
REDUCER ER	8 * 6	STPG38-SCH80	2
REDUCER ER	8 * 4	STPG38-SCH40	11
REDUCER ER	8 * 6	STPG38-SCH40	2
REDUCER	10 * 6	SUS304-4mm*3mm	4
REDUCER	10 * 8	STPT38-SCH40	1
REDUCER ER	10 * 8	STPG38-SCH80	1
REDUCER ER	10 * 6	STPG38-SCH40	1
REDUCER ER	10 * 2	STPG38-SCH80	1
REDUCER	10 * 8	STPA12-SCH80	1
REDUCER	12 * 6	STPG38-SCH40	1
REDUCER CR	14 * 12	STPG38-SCH40	1
REDUCER	12 * 8	STPA12-6 mm	1
REDUCER ER	12 * 10	STPT38-SCH40	2
REDUCER ER	12 * 10	SGP-6.9 mm*6.6mm	3
REDUCER	12 * 8	STPT38-SCH40	1
REDUCER ER	12 * 10	STPG38-SCH40	3
REDUCER	14 * 12	STPG38-SCH80	3
REDUCER	14 * 8	SGP-7.9mm	3
REDUCER ER	14 * 12	SUS304L-8mm*6.5mm	1
REDUCER ER	14 * 10	STPA12-SCH 40	1
REDUCER	16 * 10	SM41B-25mm	3
REDUCER	16 * 6	SM41B-6 mm	1
REDUCER	16 * 14	STPA12-SCH20	3
REDUCER ER	16 * 12	SUS304L-9mm*6.5mm	4
REDUCER ER	16 * 10	SUS304L-9mm* 6.5mm	2
REDUCER	16 * 14	SM41B-6mm-SCH20	1
REDUCER ER	16 * 12	STPY41-7.9mm* 6.9mm	2
REDUCER ER	16 * 12	SGP-7.9mm*6.9mm	1
REDUCER	18 * 16	SGP-7.9mm	1
REDUCER	18 * 12	SM41B-11.1mm	1
REDUCER	18 * 12	SGP-7, 9mm	1
REDUCER CR	18 * 14	SUS304L-6mm*4.5mm	2
REDUCER	18 *14	SM41B-6mm-SCH20	1
REDUCER CR	20 * 18	SUS304L-6mm	1
REDUCER	20 * 12	SS41-7.9mm	1
REDUCER ER	24 * 10	SGP-7.9mm	1
REDUCER	24 * 16	SGP-7.9 mm	1
REDUCER	24 * 18	SGP-7.9 mm	1
REDUCER ER	30 * 24	SUS304-6mm	1
REDUCER	30 * 24	SM41B-6mm	1
REDUCER	40 * 24	SGP	1
REDUCER ER	48 * 36	SM41B-11mm	2
REDUCER	216.3*16	A106 GRA	1

REDUCER	267.4*21	A53GR.B	1

EXPANSION JOINTS

	DESCRIPTION	QTY	REMARK
1	EXPANSION JOINT, JAVICO SLIP ON TYPE COUPLING STYLE: 101-60, OD = 1524 WITH SLEEVE, MATERIAL JIS SS41 FLANGE, = = RUBBER RING NBR BOLTS NUTS, SS41	1 1 2 2 2	**D38**
2	EXPANSION JOINT, JAVICO SLIP ON TYPE COUPLING STYLE: 101-30”, OD= 762 TP: 10 Kg/cm2 WITH SLEEVE, MATERIAL SS41 FLANGE = = RUBBER RINGS NBR BOLTS NUTS JIS SS41 (M16 X 260 mm)	1 1 2 2 16	**037**
3	EXPANSION JOINT, JAVICO SLIP ON TYPE COUPLING STYLE: 101-36”, OD= 914.4	1	DWG.J74-037

	TP. 10 Kg/cm2 WITH SLEEVE MATERIAL SS41 FLANGE = = RUBBER RING NBR BOLTS NUTS JIS SS41 (M16 X 260 mm)	 1 2 2 18	
4	EXPANSION JOINT, EXJ-MA TYPE NOMINAL DIA=18", ASSEMBLY L=430 mm SET L=430 mm, DESIGN PRESS= 600 mmHg DESIGN TEMP. = 70~120 C, COMRESSION=20 mm WITH FLANGE, ANSI 150-RF-SO-SS41 END PIPE, STPG 38,SCH 30 18" INNER SLEEVE SS41 BELLOWS, SUS304 70x 2 SET FITTING SS41 SETTING BOLTS SS41 (M16 X 410 mm)	1 2 2 1 1 8 4 SET	DWG.SS-431120-159
	DESCRIPTION	**QTY**	**REMARK**

5	EXPANSION JOINT – TYPE EXJ-RA RUBBER EXPANSION JOINT Z ARCH TYPE INSIDE COVER RUBBER MATERIAL: NEOP REINFORCING DUCK: VINYLAN REIN FORCING WIRE: WIRE ROPE OUT SIDE COVER RUBBER: NEOPRENE RETAINING RING: SS41 FOR SIZE = 6" 8" 10" 12" 14" 16" 18" 20" 24" 28"	 2 6 10 4 12 5 8 8 6 6	DWG.KE-1395

SEQ.	Description	QTY (PC'S)
1	GASKET (SHEETS)	
	ASBESTOS (ANTI CORROSIVE) 1600MM *1600MM 3.2 TH'K	250
	ASBESTOS (ANTI CORROSIVE) 1600MM *1600MM 1.6 TH'K	180
	ASBESTOS (ANTI CORROSIVE) 1000MM *1000MM 3.2 TH'K	420
	Asbestos (anti corrosive) 1000mm *1000mm 1.6 th'k	120
	ASBESTOS (ANTI CORROSIVE) 1000MM *1000MM 1 TH'K	100
	REINFORCED EPT SUBBER 1000MM *1000MM 3.2 TH'K	150
	REINFORCED EPT SUBBER 1000MM *1000MM 1.6 TH'K	150
	WHITE TEFLON 1600MM *1000MM 3.2 TH'K	100
	WHITE TEFLON 1000MM *1000MM 1.6 TH'K	50
2	OCT. RING ANSI1500 SOFT STEEL VALQUA 550SEQ.	
	8"	26
	6"	128
	4"	56
	3"	124
	2"	136
	1"	142
	3/4"	235
	1/2"	220
	1 1/2"	68
	10"	51
	20"	20
3	OCT. RING ANSI 900 SOFT STEEL VALQUA 550SEQ.	
	1/2"	240
	3/4"	190
	1"	200
	1 1/2"	264
	2"	177
	3"	52
	4"	80
	6"	102
	8"	100
	10"	68
	12"	72
	14"	68
4	OCT. RING ANSI 2500 SCR- 1/2 MO VALQUA 554SEQ.	
	1/2"	50
	1"	50
	6"	44
	10"	52
	12"	26

SEQ.	Description	QTY (PC'S)
5	OCT. RING ANSI 2500 SOFT STEEL VALQUA 550SEQ.	
	1/2"	150
	2 1/2"	12
	3"	80
	6"	30
	8"	30
	SPIRAL WOUND GASKET	
6	ASBESTOS WITH SUS304 VALQUA 596SEQ. SP-WD ANSI 600	
	1/2"	678
	3/4"	270
	1"	180
	1 1/2"	158
	2"	100
	3"	18
	4"	74
	6"	126
	8"	12
	10"	26
	16"	236
	18"	14
7	SPIRAL WOUND GASKET WITH SUS304 HOOPS WITH ASBESTOS FILLER VALQUA596 ANSI 400	
	1/4"	286
	1/2"	2730
	3/4"	2440
	1"	474
	1 1/2"	1324
	2"	316
	3"	422
	4"	385
	6"	344
	8"	372
	10"	126
	12"	164
	14"	163
	16"	92
	18"	74
	20"	80

SEQ	DESCRIPTION	QTY (PC'S)
8	SPIRAL WOUND GASKET WITH SUS304 HOOPS,FILLER ASBESTOS VALQUA596 ANSI 300	
	3/4"	
	1/2"	54
	1"	200
	2"	200
	2 1/2"	200
	3"	40
	6"	139
	8"	80
	12"	68
	24"	25
	LENS GASKET	10
	NOTES	
	MATERIAL ASTM A182F 316L MODIFIED OR JIS 316L MODIFIED (CL=0.03) HARDNESS =NO. 160MAX. (BRINELL HARDDNESS) MARKING= NOMINAL SIZE(EX. 3/4" OR 6" ETC…) DESIGN CONDITION: 300KG/CM^2 AT 75 C 260 KG/CM^2 AT 200 C 166 KG/CM^2 AT 200 C	
	1/4"	
	1/2"	
	3/4"	300
	1"	120
	2"	50
	3"	5
	4"	30
	6"	42
	8"	36
		21
		33

AMMONIA VALVES

NAME	SIZE	MAT	QTY
GATE	1/2	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	55
GATE	3	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	325
GATE	1	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	280
GATE	1 1/2	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	75
GATE	1/2	ANSI(150/125)-FCMB-13CR-UB-ISRS-SCR'D	342
GATE	3/4	ANSI(150/125)-FCMB-13CR-UB-ISRS-SCR'D	63
GATE	1	ANSI(150/125)-FCMB-13CR-UB-ISRS-SCR'D	50
GATE	1 1/2	ANSI(150/125)-FCMB-13CR-UB-ISRS-SCR'D	30
GATE	2	ANSI(150/125)-FC20-13CR/FC20-BB/OS & Y-FF	5
GATE	4	ANSI(150/125)-FC20-13CR/FC20-BB/OS & Y-FF	3
GATE	2	JIS10K-FC20-13CR/FC20-BB/OS & Y -FF	121
GATE	1/2	JIS10K-FC20-13CR/FC20-BB/OS & Y -FF	36
GATE	3	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	75
GATE	4	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	26
GATE	6	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	80
GATE	8	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	30
GATE	10	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	30
GATE	12	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	6
GATE	14	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	40
GATE	16	JIS10K-FC20-13CR/FC20-BB/OS&Y-FF	20
BUTTER FLY	4	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	15
BUTTER FLY	6	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	12
BUTTER FLY	8	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	12
BUTTER FLY	10	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	20
BUTTER FLY	12	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	12
BUTTER FLY	14	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	15
BUTTER FLY	16	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	11
BUTTER FLY	20	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	30
BUTTER FLY	24	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	14
BUTTER FLY	30	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	10
BUTTER FLY	28	JIS10K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	6
BUTTER FLY	28	JIS5K-FC20-FCD RUBBER-F FOR FLANGELESS-FF	6
GLOBE	1/2	JIS10K-FCMB-13CR-UB/ISRS-SCR'D	325
GLOBE	3/4	JIS10K-FCMB-13CR-UN/ISRS-SCR'D	570
GLOBE	1	JIS10K-FCMB-13CR-UB/ISRS-SCR'D	148
GLOBE	1 1/2	JIS10K-FCMB-13CR-UB/ISRS-SCR'D	118
CHECK	4	JIS10K-FC20-13CR/FC20-BC/SWING-FF	15
CHECK	6	JIS10K-FC20-13CR/FC20-BC/SWING-FF	17
CHECK	10	JIS10K-FC20-13CR/FC20-BC/SWING-FF	12
GLOBE	1/2	ANSI(150/125)-FCMB-13CR-UB/ISRS-SCR'D	250
GLOBE	3/4	ANSI(150/125)-FCMB-13CR-UB/ISRS-SCR'D	50
GLOBE	1	ANSI(150/125)-FCMB-13CR-UB/ISRS-SCR'D	50
GLOBE	1 1/2	ANSI(150/125)-FCMB-13CR-UB/ISRS-SCR'D	50
GLOBE	4	JIS10K-FC20-13CR/FC20-BB/OS & Y-FF	26
GLOBE	1/4	API800-S25C-13CR-BB/OS&Y-SW	200
GLOBE	1/2	API800-S25C-13CR-BB/OS&Y-SW	850
GLOBE	3/4	API800-S25C-13CR-BB/OS&Y-SW	165

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NAME	SIZE	MAT	QTY
GLOBE	1	API800-S25C-13CR-BB/OS&Y-SW	750
GLOBE	1 1/2	API800-S25C-13CR-BB/OS&Y-SW	572
GATE	1/2	API800-S25C-13CR-BB/OS&Y-SW	850
GATE	1/4	API800-S25C-13CR-BB/OS&Y-SW	80
GATE	3/4	API800-S25C-13CR-BB/OS&Y-SW	600
GATE	1	API800-S25C-13CR-BB/OS&Y-SW	375
GATE	1 1/2	API800-S25C-13CR-BB/OS&Y-SW	375
GATE	1/2	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	88
GATE	3/4	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	65
GATE	1	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	35
GATE	1 1/2	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	41
GATE	1/2	ANSI900-S30C-13CR/HFS-BB/OS&Y-SW	93
GATE	3/4	ANSI900-S30C-13CR/HFS-BB/OS&Y-SW	50
GATE	1	ANSI900-S30C-13CR/HFS-BB/OS&Y-SW	28
GATE	1 1/2	ANSI900-S30C-13CR/HFS-BB/OS&Y-SW	152
GATE	2	ANSI900-SCPH2-13CR/HFS-BB/OS&Y-BW(RJ)	50
GATE	3	ANSI900-SCPH2-13CR/HFS-BB/OS&Y-BW(RJ)	16
GATE	6	ANSI900-SCPH2-13CR/HFS-BB/OS&Y-BW(RJ)	32
GATE	10	ANSI900-SCPH2-13CR/HFS-BB/OS&Y-BW(RJ)	10
GLOBE	2	ANSI900-SCPH2-13CR/HFS-BB/OS&Y-BW(RJ)	34
GLOBE	4	ANSI900-SCPH2-13CR/HFS-BB/OS&Y-BW(RJ)	5
GLOBE	10	ANSI900-SCPH2-13CR/HFS-BB/OS&Y-BW(RJ)	18
GLOBE	2	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	14
GLOBE	3	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	62
GLOBE	4	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	65
GATE	2	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	77
GATE	3	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	52
GATE	4	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	38
GATE	6	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	50
GATE	8	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	37
GATE	10	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	20
GATE	12	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	15
GATE	14	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	10
GATE	16	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	8
GATE	18	ANSI300-SCPH2-13CR/HFS-BB/OS&Y-RF(BW)	14
CHECK	2	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	42
CHECK	3	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	22
CHECK	6	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	28
CHECK	8	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	13
CHECK	10	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	5
CHECK	14	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	6
CHECK	16	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	9
CHECK	18	ANSI300-SCPH2-13CR-BC/SWING-RF(BW)	4
GATE	2	ANSI150-SCPH2-13CR-BB/OS&Y-RF	144
GATE	1/2	ANSI150-SCPH2-13CR-BB/OS&Y-RF	40
GATE	3	ANSI150-SCPH2-13CR-BB/OS&Y-RF	115
GATE	6	ANSI150-SCPH2-13CR-BB/OS&Y-RF	72

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AMMONIA VALVES

NAME	SIZE	MAT	QTY
GATE	8	ANSI150-SCPH2-13CR-BB/OS&Y-RF	29
GATE	10	ANSI150-SCPH2-13CR-BB/OS&Y-RF	65
GATE	12	ANSI150-SCPH2-13CR-BB/OS&Y-RF	19
GATE	4	ANSI150-SCPH2-13CR-BB/OS&Y-RF	128
GATE	16	ANSI150-SCPH2-13CR-BB/OS&Y-RF	20
GATE	18	ANSI150-SCPH2-13CR-BB/OS&Y-RF	17
CHECK	2	ANSI600-SCPH2-13CR-BC/SWING-BW(RF)	19
CHECK	3	ANSI600-SCPH2-13CR-BC/SWING-BW(RF)	30
CHECK	6	ANSI600-SCPH2-13CR-BC/SWING-BW(RF)	33
CHECK	10	ANSI600-SCPH2-13CR-BC/SWING-BW(RF)	10
CHECK	16	ANSI600-SCPH2-13CR-BC/SWING-BW(RF)	14
CHECK	3	ANSI400-SCPH2-13CR-BC/SWING-BW(RF)	12
CHECK	6	ANSI400-SCPH2-13CR-BC/SWING-BW(RF)	5
CHECK	12	ANSI400-SCPH2-13CR-BC/SWING-BW(RF)	10
BUTTER FLY	6	ANSI300-SCPH2-13CR-FLANGELESS	12
BUTTER FLY	14	ANSI300-SCPH2-13CR-FLANGELESS	6
BUTTER FLY	18	ANSI300-SCPH2-13CR-FLANGELESS	7
BUTTER FLY	6	ANSI2500-A217WCG-SUS304-FLANGELESS	15
GLOBE	1/2	ANSI1500-A350LF1-SUS304ST.-BB/OS&Y-SW	44
GLOBE	3/4	ANSI1500-A350LF1-SUS304ST.-BB/OS&Y-SW	58
GLOBE	1	ANSI1500-A350LF1-SUS304ST.-BB/OS&Y-SW	53
GLOBE	1/2	ANSI2500-A182F22-SUS304ST.-NB/OS&Y-SW	27
GLOBE	1	ANSI2500-A182F22-SUS304ST.-NB/OS&Y-SW	30
GLOBE	1 1/2	ANSI2500-A182F22-SUS304ST.-NB/OS&Y-SW	5
GATE	10	ANSI2500-A217WCG/SCPH2-SUS304ST.-PSB/OS&Y-BW(RJ)	10
GATE	12	ANSI2500-A217WCG/SCPH2-SUS304ST.-PSB/OS&Y-BW(RJ)	7
GLOBE	2	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	30
GLOBE	3	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	26
GLOBE	4	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	30
GATE	2	ANSI300-SCS13-SUS304-BB/OS&Y-RF	55
GATE	3	ANSI300-SCS13-SUS304-BB/OS&Y-RF	25
GATE	4	ANSI300-SCS13-SUS304-BB/OS&Y-RF	15
GLOBE	2	ANSI300-SCS13-SUS304-BB/OS&Y-RF	33
GLOBE	3	ANSI300-SCS13-SUS304-BB/OS&Y-RF	25
GATE	2	ANSI150-SCS13-SUS304-BB/OS&Y-RF	75
GATE	3	ANSI150-SCS13-SUS304-BB/OS&Y-RF	80
GATE	4	ANSI150-SCS13-SUS304-BB/OS&Y-RF	30
GATE	6	ANSI150-SCS13-SUS304-BB/OS&Y-RF	26
GATE	8	ANSI150-SCS13-SUS304-BB/OS&Y-RF	26
GATE	10	ANSI150-SCS13-SUS304-BB/OS&Y-RF	27
GATE	14	ANSI150-SCS13-SUS304-BB/OS&Y-RF	5
GLOBE	1/2	ANSI150-SUS304-BB/OS&Y-SW	280
GLOBE	3/4	ANSI150-SUS304-BB/OS&Y-SW	90
GLOBE	1	ANSI150-SUS304-BB/OS&Y-SW	82
GLOBE	1 1/2	ANSI150-SUS304-BB/OS&Y-SW	42
GLOBE	1/2	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	85
GLOBE	3/4	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	250

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AMMONIA VALVES

NAME	SIZE	MAT	QTY
GLOBE	1	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	53
GLOBE	1 1/2	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	20
GLOBE	1/2	API800-A350LF1-13CR-BB/OS&Y-SW	60
GLOBE	3/4	API800-A350LF1-13CR-BB/OS&Y-SW	90
GLOBE	1	API800-A350LF1-13CR-BB/OS&Y-SW	100
GLOBE	1 1/2	API800-A350LF1-13CR-BB/OS&Y-SW	31
GATE	1/2	API800-A350LF1-13CR-BB/OS&Y-SW	66
GATE	1	API800-A350LF1-13CR-BB/OS&Y-SW	55
GATE	1 1/2	API800-A350LF1-13CR-BB/OS&Y-SW	18
GATE	2	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	33
GATE	3	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	30
GATE	4	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	30
GATE	6	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	4
GATE	14	ANSI300-SCPL1-13CR/HFS-BB/OS&Y-RF	17
GLOBE	1/2	ANSI1500-S30C-SUS304ST.-NB/OS&Y-SW	50
GLOBE	3/4	ANSI1500-S30C-SUS304ST.-NB/OS&Y-SW	95
GLOBE	1	ANSI1500-S30C-SUS304ST.-NB/OS&Y-SW	50
GLOBE	1 1/2	ANSI1500-S30C-SUS304ST.-NB/OS&Y-SW	28
CHECK	3	ANSI300-SCS13-SUS304-BB/OS&Y-RF	30
GATE	2	ANSI300-SCPH11-13CR/HFS-RF	30
GATE	8	ANSI300-SCPH11-13CR/HFS-RF	10
GATE	12	ANSI300-SCPH11-13CR/HFS-RF	4
GLOBE	1/2	JPI600N-A182F1-13CR/HFS-BB/OS&Y-SW	60
GLOBE	3/4	JPI600N-A182F1-13CR/HFS-BB/OS&Y-SW	60
GLOBE	1	JPI600N-A182F1-13CR/HFS-BB/OS&Y-SW	20
GLOBE	1 1/2	JPI600N-A182F1-13CR/HFS-BB/OS&Y-SW	10
GATE	1/2	JPI600N-A182F1-13CR/HFS-BB/OS&Y-SW	60
GATE	3/4	JPI600N-A182F1-13CR/HFS-BB/OS&Y-SW	50
GATE	1 1/2	JPI600N-A182F1-13CR/HFS-BB/OS&Y-SW	50
CHECK	3/4	ANSI300-SUS304-BC LIFT-SW	25
CHECK	1	ANSI300-SUS304-BC LIFT-SW	33
CHECK	1 1/2	ANSI300-SUS304-BC LIFT-SW	44
CHECK	4	ANSI300-SCPL1-13CR-BC SWING-RF	40
GLOBE	3	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-SW	30
GLOBE	2	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-SW	8
GLOBE	4	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-SW	27
GATE	2	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-BW(RJ)	16
GATE	3	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-BW(RJ)	10
GATE	4	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-BW(RJ)	17
GATE	6	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-BW(RJ)	15
GATE	8	ANSI1500-A352LCB-SUS304ST.-BB/OS&Y-BW(RJ)	10
NEEDLE	1/2	ANSI900-S30C-SUS304-BB/OS&Y-BW(RJ)	25
NEEDLE	1	ANSI900-S30C-SUS304-BB/OS&Y-BW(RJ)	44
NEEDLE	1 1/2	ANSI900-S30C-SUS304-BB/OS&Y-BW(RJ)	25
GATE	2	ANSI150-SCPL1-13CR-BB/OS&Y-RF	25
GATE	3	ANSI150-SCPL1-13CR-BB/OS&Y-RF	6
GATE	4	ANSI150-SCPL1-13CR-BB/OS&Y-RF	5

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AMMONIA VALVES

NAME	SIZE	MAT	QTY
GATE	6	ANSI150-SCPL1-13CR-BB/OS&Y-RF	22
GATE	8	ANSI150-SCPL1-13CR-BB/OS&Y-RF	12
BUTTER FLY	2	ANSI150-SCS13-SUS304-FLANGELESS	28
BUTTER FLY	3	ANSI150-SCS13-SUS304-FLANGELESS	30
BUTTER FLY	10	ANSI150-SCS13-SUS304-FLANGELESS	7
GLOBE	4	ANSI150-SCPL1-13CR-BB/OS&Y-RF	14
GLOBE	1/2	ANSI300-SUS304-SUS304-BB/OS&Y-SW	89
GLOBE	3/4	ANSI300-SUS304-SUS304-BB/OS&Y-SW	58
GLOBE	1	ANSI300-SUS304-SUS304-BB/OS&Y-SW	30
GLOBE	1 1/2	ANSI300-SUS304-SUS304-BB/OS&Y-SW	50
GATE	1/2	ANSI300-SCS13-SUS304-BB/OS&Y-RF	55
GATE	3/4	ANSI300-SCS13-SUS304-BB/OS&Y-RF	58
GATE	1	ANSI300-SCS13-SUS304-BB/OS&Y-RF	30
GATE	1 1/2	ANSI300-SCS13-SUS304-BB/OS&Y-RF	57
GATE	1/2	ANSI150-SUS304-SUS304-BB/OS&Y-SW	60
GATE	3/4	ANSI150-SUS304-SUS304-BB/OS&Y-SW	180
GATE	1	ANSI150-SUS304-SUS304-BB/OS&Y-SW	77
GATE	1 1/2	ANSI150-SUS304-SUS304-BB/OS&Y-SW	48
CHECK	2	ANSI150-SCS13-SUS304-BC SWING-RF	13
CHECK	3	ANSI150-SCS13-SUS304-BC SWING-RF	46
CHECK	8	ANSI150-SCS13-SUS304-BC SWING-RF	20
CHECK	16	ANSI150-SCS13-SUS304-BC SWING-RF	20
CHECK	10	ANSI150-SCS13-SUS304-BC SWING-RF	18
GLOBE	2	ANSI150-SCS13-SUS304-BB/OS&Y-RF	12
GLOBE	1	ANSI150-SCS13-SUS304-BB/OS&Y-RF	5
GLOBE	3	ANSI150-SCS13-SUS304-BB/OS&Y-RF	26
GLOBE	1/4	ANSI150-SCS13-SUS304-BB/OS&Y-RF	52
GLOBE	1/2	ANSI150-SCS13-SUS304-BB/OS&Y-RF	26
BALL	1/4	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	80
BALL	1/2	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	77
BALL	3/4	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	80
BALL	1	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	50
BALL	1 1/2	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	69
BALL	2	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	44
BALL	3	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	50
BALL	6	ANSI150-SUS304/SCS13-SEAT P.T.F.E-RF(FF)	50
GLOBE	2	ANSI150-SCPH2-13CR-BB/OS&Y-RF	30
GLOBE	3	ANSI150-SCPH2-13CR-BB/OS&Y-RF	39
GLOBE	4	ANSI150-SCPH2-13CR-BB/OS&Y-RF	36
GLOBE	12	ANSI150-SCPH2-13CR-BB/OS&Y-RF	11
GLOBE	1/2	ANSI600-SUS304-SUS304ST.-BB/OS&Y-SW	200
GLOBE	3/4	ANSI600-SUS304-SUS304ST.-BB/OS&Y-SW	21
GLOBE	1	ANSI600-SUS304-SUS304ST.-BB/OS&Y-SW	88
GLOBE	1/2	JPI600N-A182F22-SUS304ST.-BB/OS&Y-SW	45
GLOBE	3/4	JPI600N-A182F22-SUS304ST.-BB/OS&Y-SW	77
GLOBE	1	JPI600N-A182F22-SUS304ST.-BB/OS&Y-SW	67
GATE	1/2	ANSI600-SUS304-SUS304ST.-BB/OS&Y-SW	66

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AMMONIA VALVES

NAME	SIZE	MAT	QTY
GATE	3/4	ANSI600-SUS304-SUS304ST.-BB/OS&Y-SW	55
GATE	1	ANSI600-SUS304-SUS304ST.-BB/OS&Y-SW	45
NEEDLE	1	ANSI900-A182F1-13CRST.-BB/OS&Y-SW	33
GLOBE	2	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	20
GLOBE	4	JPI600N-S25C-13CR/HFS-BB/OS&Y-SW	11
GATE	2	ANSI600-SC49/SCPH2-13CR/HFS-BB/OS&Y-BW	5
GATE	16	ANSI600-SC49/SCPH2-13CR/HFS-BB/OS&Y-BW	22
GATE	4	ANSI900-SCPH11-13CR/HFS-BB/OS&Y	5
GATE	10	ANSI900-SCPH11-13CR/HFS-BB/OS&Y	50
GATE	12	ANSI900-SCPH11-13CR/HFS-BB/OS&Y	6
GATE	14	ANSI900-SCPH11-13CR/HFS-BB/OS&Y	5
GLOBE	1/2	SPECIAL-A182F21-SUS304ST.-NB/OS&Y-SW	25
GLOBE	1	SPECIAL-A182F21-SUS304ST.-NB/OS&Y-SW	22
BUTTER FLY	14	ANSI300-SCPH11-13CR/HFS-FLANGELESS	9
BUTTER FLY	20	ANSI300-SCPH11-13CR/HFS-FLANGELESS	7
GATE	2	ANSI400-SCPH2-13CR/HFS-NB/OS&Y-BW(RF)	25
GATE	3	ANSI400-SCPH2-13CR/HFS-NB/OS&Y-BW(RF)	45
GATE	4	ANSI400-SCPH2-13CR/HFS-NB/OS&Y-BW(RF)	41
GATE	6	ANSI400-SCPH2-13CR/HFS-NB/OS&Y-BW(RF)	40
GATE	8	ANSI400-SCPH2-13CR/HFS-NB/OS&Y-BW(RF)	15
GATE	10	ANSI400-SCPH2-13CR/HFS-NB/OS&Y-BW(RF)	16
GATE	12	ANSI400-SCPH2-13CR/HFS-NB/OS&Y-BW(RF)	20
CHECK	12	ANSI900-A182F1-13CR/HFS-BC LIFT-SW	4
CHECK	2	ANSI150-SCPH2-13CR-BC SWING-RF	46
CHECK	3	ANSI150-SCPH2-13CR-BC SWING-RF	19
CHECK	4	ANSI150-SCPH2-13CR-BC SWING-RF	36
CHECK	6	ANSI150-SCPH2-13CR-BC SWING-RF	10
CHECK	10	ANSI150-SCPH2-13CR-BC SWING-RF	50
CHECK	18	ANSI150-SCPH2-13CR-BC SWING-RF	13
CHECK	14	ANSI150-SCPH2-13CR-BC SWING-RF	6
GATE	2	ANSI300-SCPH11-13CR/HFS-BB/OS&Y-RF	10
GATE	8	ANSI300-SCPH11-13CR/HFS-BB/OS&Y-RF	6
GATE	12	ANSI900-SCPH11-13CR/HFS-BB/OS&Y-BW(RJ)	4
GATE	3/4	ANSI1500-S30C-SUS304ST.-NB/OS&Y-SW	20
GATE	1/2	ANSI1500-S30C-SUS304ST.-NB/OS&Y-SW	5
GATE	2	ANSI1500-SCPH2-SUS304ST.-PSB/OS&Y-BW(RJ)	5
GATE	3	ANSI1500-SCPH2-SUS304ST.-PSB/OS&Y-BW(RJ)	5
GATE	6	ANSI1500-SCPH2-SUS304ST.-PSB/OS&Y-BW(RJ)	11
GATE	10	ANSI1500-SCPH2-SUS304ST.-PSB/OS&Y-BW(RJ)	5
CHECK	2	ANSI1500-SCPH2-SUS304ST.-PSC SWING-BW(RJ)	20
CHECK	6	ANSI1500-SCPH2-SUS304ST.-PSC SWING-BW(RJ)	13
CHECK	10	ANSI1500-SCPH2-SUS304ST.-PSC SWING-BW(RJ)	49
GLOBE	3	ANSI150-SCS13-SUS304-BB/OS&Y-RF	72
GLOBE	10	ANSI900-SCPH11-13CR/HFS-BB/PSB-BW(RJ)	50
GLOBE	3/4	ANSI1500-S30C-SUS304ST.-NB/OS&Y-SW	30
GLOBE	1		20
GATE	8	ANSI900-SCPH11-13CR-BB/OS&Y-RF	4

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AMMONIA VALVES

NAME	SIZE	MAT	QTY
BUTTER FLY	8	ANSI900-SCPH2-13CR-FLANGELESS	6
GLOBE	1	ANSI900-S30C-13CR/HFS-BB/OS&Y-SW	15
GLOBE	3/4	ANSI900-S30C-13CR/HFS-BB/OS&Y-SW	20
BALL	1/2	S25C-13CR	384
GLOBE	1/2	ANSI900-A182F1-13CR/HFS-BB/NB/OS&Y-SW	72
GLOBE	3/4	ANSI900-A182F1-13CR/HFS-BB/NB/OS&Y-SW	25
GLOBE	1	ANSI900-A182F1-13CR/HFS-BB/NB/OS&Y-SW	21
GATE	1/2	ANSI2500-S30C-SUS304ST.-NB/OS&Y-SW	34
GLOBE	1/2	ANSI2500-S30C-SUS304ST.-NB/OS&Y-SW	55
GATE	4	ANSI150-SC49-13CR-FLANGELESS/RF	16
GATE	3	ANSI150-SC49-13CR-FLANGELESS/RF	29
GATE	2	ANSI150-SC49-13CR-FLANGELESS/RF	12
GATE	6	ANSI150-SC49-13CR-FLANGELESS/RF	4
GATE	2	ANSI300-SC49-13CR-FLANGELESS/RF	3
GATE	4	ANSI300-SC49-13CR-FLANGELESS/RF	1
GATE	3	ANSI300-SC49-13CR-FLANGELESS/RF	1
GATE	8	ANSI300-SC49-13CR-FLANGELESS/RF	1
GATE	2	ANSI150-SCPH2-13CR-FLANGELESS/RF	12
GATE	3	ANSI150-SCPH2-13CR-FLANGELESS/RF	16
GATE	4	ANSI150-SCPH2-13CR-FLANGELESS/RF	8
GATE	6	ANSI150-SCPH2-13CR-FLANGELESS/RF	3
GATE	8	ANSI150-SCPH2-13CR-FLANGELESS/RF	4
GATE	10	ANSI150-SCPH2-13CR-FLANGELESS/RF	2
WEDGE GATE	3	JIS10K~100-FC20-FC20-FF	6
WEDGE GATE	4	JIS10K~100-FC20-FC20-FF	12
WEDGE GATE	6	JIS10K~300-FC20-FC20-FF	8
WEDGE GATE	1 1/2	ANSI800LB-S28C-SW	12
GLOBE	2	ANSI150-SC49-13CR-FLANGELESS/RF	2
GLOBE	3		1
GLOBE	2	ANSI300-SC49-13CR-FLANGELESS/RF	1
GATE	2	ANSI600LB-SC49-13CR-FLANGELESS/RF	4
GLOBE	3/4	ANSI600-SUS304-SUS304-SW	3
GLOBE	2	ANSI150LB-SCPH2-13CR-RF	8
GLOBE	3		4
GLOBE	3	ANSI2500-SC49-SUS304-BW	2
GLOBE	1/2	ANSI2500-S25C-SUS304-SW	55
GLOBE	3/4		20
GLOBE	1		26
GLOBE	1 1/2		10
GLOBE	2	ANSI2500-SC49-SUS304-SW	8
GLOBE	1/2	ANSI600-S28C-SW	235
GLOBE	3/4		119
GLOBE	1		35
GLOBE	1 1/2		16
SWING CHECK	3	ANSI150-SC49-13CR-FLANGELESS/RF	8
SWING CHECK	2	ANSI300-SC49-13CR-FLANGLESS/RF	2
SWING CHECK	4	ANSI150-SC49-13CR-FLANGELESS/RF	7

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AMMONIA VALVES

NAME	SIZE	MAT	QTY
SWING CHECK	2	ANSI600-SC49-13CR-FLANGELESS/RF	2
SWING CHECK	3	ANSI150-SCPH2-13CR-RF	4
SWING CHECK	4		4
SWING CHECK	2	ANSI2500-S25C-SUS304-BW	2
LIFT CHECK	1 1/2	ANSI1500-S25C-SUS304-SW	2
LIFT CHECK	1		2
LIFT CHECK	3/4	ANSI600-S28C-SW	3
LIFT CHECK	1		1
LIFT CHECK	1 1/2		4

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BOILER VALVE

ITEM	SIZE	DESCR	BODY	TRIM	QTY
GATEVALVE	2"	ANSI-900-BW(RJ)	SCPH2	13CR HFS	6
GLOBE VALVE	1/2"	ANSI-900-SW	S30C	13CR HFS	5
GLOBE VALVE	1/2"	ANSI-900-SW	A182F1	13CR HFS	10
GATE VALVE	2"	ANSI-900-BW(RJ)	SCP PH11	13CR HFS	4
NEEDLE VALVE	1"	ANSI-900-SW	A182F1	13CR ST	3
GLOBE VALVE	3/4"	ANSI-900-SW	A182F1	13CR HFS	20
GLOBE VALVE	1"	ANSI-900-SW	A182F1	13CR HFS	4
GATE VALVE	12"	ANSI-900-BW(RJ)	SCP H11	13CR HFS	21
GATE VALVE	6"	ANSI-900-BW(RJ)	SCP H11	13CR HFS	3
GATE VALVE	14"	ANSI-900-BW(RJ)	SCP H11	13CR HFS	2
GATE VALVE	10"	ANSI-900-BWW(RJ)	SCP H11	13CR HFS	2
GLOBE VALVE	2"	ANSI-900-BW(RJ)	SCP H11	13CR HFS	6
GATE VALVE	1/2"	ANSI-900-SW	A182F1	13CR HFS	4
GLOBE VALVE	1"	ANSI-900-SW	A182F1	13CR HFS	3
GATE VALVE	14"	ANSI-900-BW-(RJ)	SCP H11	13CR HFS	2
GATE VALVE	8"	ANSI-900-BW(RJ)	SCP H11	13CR HFS	2
GATE VALVE	2"	ANSI-300-RF	SCP H11	13CR HFS	4
GLOBE VALVE	3/4"	JPS-600-SW	A182F1	13CR HFS	6
CHECK VALVE	2"	ANSI-300-RF(BW)	SCP H2	13CR	3
GATE VALVE	2"	ANSI-300-RF (BW)	SCP H2	13CR	4
GATE VALVE	2"	ANSI-400-BW	SCP H11	13CR HFS	3
GLOBE VALVE	3/4"	ANSI-900-SW	S30C	13CR HFS	5
NEEDLE VALVE	1 1/2"	ANSI-900-SW	S30C	SUS304	4
GATE VALVE	3/4"	API-800-SW	S25C	13CR	10
GLOBE VALVE	3/4"	API-800-SW	S25C	13CR	27
GLOBE VALVE	1"	API-800-SW	S25C	13CR	20
GLOBE VALVE	1/2"	API-800-SW	S25C	13CR	37
GATE VALVE	10"	ANSI-150-RF	SCP H2	13CR	5
GATE VALVE	8"	ANSI-150-RF	SCP H2	13CR	4
GATE VALVE	10"	ANSI-400-BW(RF)	SCP H2	13CR HFS	2
GATE VALVE	3"	ANSI-400-BW(RF)	SCP H2	13CR HFS	10
GATE VALVE	12"	ANSI-150-RF	SCP H2	13CR	2
GATE VALVE	2"	ANSI-150-RF	SCP H2	13CR	10
GATE VALVE	1/2"	API-800	S25C	13CR	12
GATE VALVE	4"	ANSI-150-RF	SCP H2	13CR	6
GATE VALVE	6"	ANSI-150-RF	SCP H2	13CR	4
GATE VALVE	16"	ANSI-150-RF	SCP H2	13CR	2
GATE VALVE	3"	ANSI-150-RF	SCP H2	13CR	8
GATE VALVE	1"	API-800-SW	S25C	13CR	10
GATE VALVE	1 1/2"	API-800-SW	S25C	13CR	10
GATE VALVE	2"	ANSI-400-BW(RF)	SCP H2	13CR	6
GLOBE VALVE	1/2"	JPI-600-SW	S25C	13CR HFS	4
GLOBE VALVE	3/4"	JPI-800-SW	S25C	13CR HFS	4
GLOBE VALVE	1"	JPI-800-SW	S25C	13CR HFS	4
GLOBE VALVE	1/2"	JPI-800-SW	S25C	13CR HFS	6
GATE VALVE	1/2"	JPI-800-SW	S25C	13CR HFS	6
GATE VALVE	3/4"	JPI-800-SW	S25C	13CR HFS	5

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Urea Valve

NAME	SIZE	MAT	QTY
GATE	1/2	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	8
GATE	3/4	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	17
GATE	1	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	11
GATE	1 1/2	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	4
GLOBE	1/2	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	5
GLOBE	3/4	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	4
GLOBE	1	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	9
GLOBE	1 1/2	JIS10K-FCMB-13CR-UB-ISRS-SCR'D	4
GATE	2	JIS10K-FC20-13CR/FC20-BB/OS & Y-FF	9
GATE	4	JIS10K-FC20-13CR/FC20-BB/OS & Y -FF	4
GATE	6	JIS10K-FC20-13CR/FC20-BB/OS & Y -FF	2
GATE	12	JIS10K-FC20-13CR/FC20-BB/OS & Y -FF	1
CHECK	2	JIS10K-FC20-13CR/FC20-BC/SWING-FF	4
BUTTER FLY	10	JIS10K-FC20-FCD RUBBER-F FOR FLANGELSS	7
BUTTER FLY	12	JIS10K-FC20-FCD RUBBER-F FOR FLANGELSS	2
BUTTER FLY	14	JIS10K-FC20-FCD RUBBER-F FOR FLANGELSS	2
BUTTER FLY	18	JIS10K-FC20-FCD RUBBER-F FOR FLANGELSS	2
GLOBE	1/2	ANSI(150/125)-FCMB-13CR-UB ISRS-SCR'D	22
GLOBE	1	ANSI(150/125)-FCMB-13CR-UB ISRS-SCR'D	5
GLOBE	1/4	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	15
GLOBE	1/2	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	87
GLOBE	3/4	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	125
GLOBE	1	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	25
GLOBE	1 1/2	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	10
GATE	1/2	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	35
GATE	3/4	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	72
GATE	1	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	11
GATE	1 1/2	API800(COMPACT)-S25C-13CR-BB OS&Y-SW	13
GATE	2	ANSI300-SCPH2-13CR/HFS-BB OS & Y-RF(BW)	10
GATE	3	ANSI300-SCPH2-13CR/HFS-BB OS&Y-RF(BW)	10
GATE	4	ANSI300-SCPH2-13CR/HFS-BB OS&Y-RF(BW)	6
GATE	6	ANSI300-SCPH2-13CR/HFS-BB OS&Y-RF(BW)	11
GATE	8	ANSI300-SCPH2-13CR/HFS-BB OS&Y-RF(BW)	3
GATE	12	ANSI300-SCPH2-13CR/HFS-BB OS&Y-RF(BW)	1
GATE	2	ANSI150-SCPH2-13CR-BB OS&Y-RF	6
GATE	3	ANSI150-SCPH2-13CR-BB OS&Y-RF	12
GATE	4	ANSI150-SCPH2-13CR-BB OS&Y-RF	9
GATE	6	ANSI150-SCPH2-13CR-BB OS&Y-RF	2
GATE	8	ANSI150-SCPH2-13CR-BB OS&Y-RF	1
GATE	18	ANSI150-SCPH2-13CR-BB OS&Y-RF	2
GLOBE	2	API800(COMPACT)-S25C-13CR-BB OS &Y-RF	2
GLOBE	3	API800(COMPACT)-S25C-13CR-BB OS&Y-RF	4
GLOBE	2	ANSI300-SCPH2-13CR/HFS-BB OS &Y-RF(BW)	6
GLOBE	3	ANSI300-SCPH2-13CR/HFS-BB OS&Y-RF(BW)	1
GLOBE	4	ANSI300-SCPH2-13CR/HFS-BB OS &Y-RF(BW)	2
GATE	6	ANSI400-SCPH2-13CR/HFS-BB OS &Y- RF(BW)	1
CHECK	1/2	API800(COMPACT)-S25C-13CR-BC LIFT-SW	7

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Urea Valve

NAME	SIZE	MAT	QTY
CHECK	1 1/2	API800(COMPACT)-S25C-13CR-BC LIFT-SW	4
CHECK	2	ANSI300-SCPH2-13CR-BC SWING-RF(BW)	3
CHECK	4	ANSI300-SCPH2-13CR-BC SWING-RF(BW)	2
CHECK	6	ANSI300-SCPH2-13CR-BC SWING-RF(BW)	2
CHECK	8	ANSI300-SCPH2-13CR-BC SWING-RF(BW)	1
CHECK	1 1/2	ANSI300-SUS304-BC LIFT-SW	3
CHECK	2	ANSI1500-SCPH2-SUS304ST.-PSC SWING-BW(RJ)	3
CHECK	6	ANSI1500-SCPH2-SUS304ST.-PSC SWING-BW(RJ)	2
CHECK	2	ANSI300-SCS13-SUS304-BC SWING-RF	3
CHECK	3	ANSI300-SCS13-SUS304-BC SWING-RF	1
GATE	1/2	ANSI150-SUS304-BB OS & Y-SW	12
GATE	3/4	ANSI150-SUS304-BB OS & Y-SW	27
GATE	1	ANSI150-SUS304-BB OS &Y-SW	5
GATE	1 1/2	ANSI150-SUS304-BB OS & Y-SW	5
GATE	1/2	ANSI300-SUS304-BB OS & Y-SW	5
GATE	3/4	ANSI300-SUS304-BB OS & Y-SW	10
GATE	1	ANSI300-SUS304-BB OS & Y-SW	5
GATE	1 1/2	ANSI300-SUS304-BB OS & Y-SW	4
GLOBE	1/2	JPI600N-S25C-13CR/HFS-BB OS &Y-SW	5
GLOBE	3/4	JPI600N-S25C-13CR/HFS-BB OS &Y-SW	7
GLOBE	1/2	ANSI1500-S30C-SUS304ST.-NB OS&Y-SW	16
GLOBE	3/4	ANSI1500-S30C-SUS304ST.-NB OS&Y-SW	5
GLOBE	1	ANSI1500-S30C-SUS304ST.-NB OS&Y-SW	3
GATE	1/2	ANSI1500-S30C-SUS304ST.-NB OS&Y-SW	12
GATE	1	ANSI1500-S30C-SUS304ST.-NB OS&Y-SW	6
GATE	3/4	ANSI1500-S30C-SUS304ST.-NB OS&Y-SW	7
GATE	2	ANSI1500-SCPH2-SUS304ST.-PSB OS&Y-BW(RJ)	2
GATE	3	ANSI1500-SCPH2-SUS304ST.-PSB OS&Y-BW(RJ)	2
GATE	6	ANSI1500-SCPH2-SUS304ST.-PSB OS&Y-BW(RJ)	1
GATE	2	ANSI300-SCS13-SUS304-BB OS&Y-RF	4
GATE	3	ANSI300-SCS13-SUS304-BB OS&Y-RF	2
GATE	1/2	JPI600N-S25C-13CR/HFS-BB OS &Y-BW(RF)	4
GLOBE	1/2	ANSI300-SUS304-BB OS&Y-SW	11
GLOBE	1 1/2	ANSI300-SUS304-BB OS&Y-SW	3
GLOBE	3/4	ANSI300-SUS304-BB OS&Y-SW	5
GLOBE	2	ANSI300-SCS13-SUS304-BB OS&Y-RF	1
GLOBE	1/4	ANSI150-SUS304-BB OS &Y-SW	3
GLOBE	1/2	ANSI150-SUS304-BB OS &Y-SW	7
GLOBE	1	ANSI150-SUS304-BB OS &Y-SW	2
GLOBE	3/4	ANSI150-SUS304-BB OS &Y-SW	5
GLOBE	3/4	ANSI600-SUS304-BB OS&Y-SW	5
GLOBE	1	ANSI600-SUS304-BB OS&Y-SW	10
GATE	3/4	ANSI600-SUS304-BB OS&Y-SW	6
GATE	1/2	ANSI2500-S30C-SUS304ST.-BB OS&Y-SW	9
GLOBE	1/2	ANSI2500-S30C-SUS304ST.-NB OS&Y-SW	16
GLOBE 180	1/4	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	50

Urea Valve

NAME	SIZE	MAT	QTY
GLOBE 180	1/2	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	10
GLOBE 180	2	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	6
GLOBE 180	3	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	5
GLOBE 180	4	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	3
GLOBE 180	6	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	2
GLOBE 180	8	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	2
GLOBE 180	1 1/2	SPECIAL-SUS316L-SUS316L/HFS-BW(LENS)	3
CHECK	1 1/2	SPECIAL-SUS316L-LIFT-BW(LENS)	5
CHECK	1/4	SPECIAL-SUS316L-LIFT-BW(LENS)	7
CHECK	3	SPECIAL-SUS316L-LIFT-BW(LENS)	3
CHECK	4	SPECIAL-SUS316L-LIFT-BW(LENS)	2
CHECK	6	SPECIAL-SUS316L-LIFT-BW(LENS)	1
CHECK	8	SPECIAL-SUS316L-LIFT-BW(LENS)	1
CHECK	14	SPECIAL-SUS316L-LIFT-BW(LENS)	2
GATE	1/2	ANSI300-SUS316L-BB OS&Y-SW	15
GATE	3/4	ANSI300-SUS316L-BB OS&Y-SW	8
GATE	1 1/2	ANSI300-SUS316L-BB OS&Y-SW	5
GLOBE	1/2	ANSI300-SUS316L-BB OS &Y-SW	10
GLOBE	1 1/2	ANSI300-SUS316L-BB OS &Y-SW	2
GLOBE	2	ANSI300-SCS16/ASTM CF3M-SUS316L-BB OS &Y-RF	2
GATE	1/2	ANSI150-SUS316L-BB OS&Y-SW	5
GATE	3/4	ANSI150-SUS316L-BB OS&Y-SW	5
GATE	1 1/2	ANSI150-SUS316L-BB OS&Y-SW	2
GLOBE	1/2	ANSI150-SUS316L-BB OS&Y-SW	4
GLOBE	3/4	ANSI150-SUS316L-BB OS&Y-SW	7
GLOBE	1	ANSI150-SUS316L-BB OS&Y-SW	2
GATE	4	ANSI150-SCS16/ASTM CF3M-SUS316L-BB OS &Y-RF	2
GATE	6	ANSI150-SCS16/ASTM CF3M-SUS316L-BB OS &Y-RF	1
CHECK	2	ANSI300-SCS316L/ASTM CF3M-SUS316L-BB OS &Y-RF	1
GATE	2	ANSI300-SCS316L-ASTM CF3M-SUS316L-BB OS&Y-RF	3
GATE	3	ANSI300-SCS316L-ASTM CF3M-SUS316L-BB OS&Y-RF	2
GATE	4	ANSI300-SCS316L-ASTM CF3M-SUS316L-BB OS&Y-RF	1
GATE	8	ANSI300-SCS316L-ASTM CF3M-SUS316L-BB OS&Y-RF	3
GLOBE	2	ANSI300-SCS316L-ASTM CF3M-SUS316L-BB OS&Y-RF	1
GATE	3	ANSI2500-SC49-SUS304ST.-PSB OS&Y-BW(RJ)	1
GATE	6	ANSI2500-SC49-SUS304ST.-PSB OS&Y-BW(RJ)	2
GATE	8	ANSI2500-SC49-SUS304ST.-PSB OS&Y-BW(RJ)	1
GLOBE	3	ANSI2500-SC49-SUS304ST.-PSB OS&Y-BW(RJ)	4
GLOBE	6	ANSI2500-SC49-SUS304ST.-PSB OS&Y-BW(RJ)	2
CHECK	8	ANSI150-SCS13-SUS304-BC/SWING-RF	1
GLOBE	2	ANSI300-SCPL1-13CR/HFS-BB OS&Y-RF	1
GLOBE	3	ANSI300-SCPL1-13CR/HFS-BB OS&Y-RF	2
GLOBE	4	ANSI300-SCPL1-13CR/HFS-BB OS&Y-RF	2
GATE	1 1/2	ANSI900-S30C-13CR/HFS-BB OS &Y-SW	5
GATE	1/2	ANSI900-A182F1-13CR/HFS-BB OS &Y-SW	7
GATE	3/4	ANSI900-A182F1-13CR/HFS-BB OS &Y-SW	3
GATE	2	ANSI900-SCPH11-13CR/HFS-BB OS&Y-BW(RJ)	2
GATE	2	ANSI300-SCPH11-13CR/HFS-BB OS&Y-RF	2
GATE	6	ANSI900-SCPH11-13CR/HFS-BB OS &Y-BW(RJ)	2

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DEMI PIPE

ITEM	MATERIAL	SIZE	QTY
pipe	c/s,api,5l,lining hard rubber with a33	1"	45
pipe	c/s,api,5l,lining hard rubber a33	1 1/2"	30
pipe	c/s,api,5l,lining hard rubber a33	2"	200
pipe	c/s,api,5l,lining hard rubber a33	2 1/2"	25
pipe	c/s,api,5l,lining hard rubber a33	3"	100
pipe	c/s,api,5l,lining hard rubber a33	4"	450
pipe	c/s,api,5l,lining hard rubber a33	5"	3
pipe	c/s,api,5l,lining hard rubber a33	6"	150
pipe	c/s,api,5l,lining hard rubber a33	8"	54
tee	c/s,api,5l,lining with hard rubber,flgd,a33-gard a	8"	3
tee	c/s,api,5l,lining with hard rubber,flgd,a33-grad a	2"	5
tee	c/s,api,5l,lining with hard rubber,flgd,a33-grad a	4"	2
tee	c/s,api,5l,lining with hard rubber,flgd,a33-grad a	4"*2"*2"	3
tee	c/s,api,5l,lining with hard rubber,flgd,a33-grad a	6"*8"*8"	2
manual valve	lining with 150ibs,a33-a polypropylene	1"	18
manual valve	lining with 150ibs a33-a polypropylene	1 1/2"	2
manual valve	lining with 150ibs a33-a polypropylene	2"	30
manual valve	lining with 150ibs a33-a polypropylene	2 1/2"	3
manual valve	lining with 150ibs a33-a polypropylene	3"	3
manual valve	lining with 150ibs a33-a polypropylene	4"	19
manual valve	lining with 150ibs a33-a polypropylene	5"	1
manual valve	lining with 150ibs a33-a polypropylene	6"	12
manual valve	lining with 150ibs a33-a polypropylene	8"	6
check valve	lining with a33-a	4"	6
check valve	lining with a33-a	6"	4
flow indicator		4"	6
flow indicator		6"	4
pipe	c/s,apt 5l,sch40,seamless	1/2"	30
pipe	c/s,apt 5l,sch40,seamless	1"	28
pipe	c/s,apt 5l,sch40,seamless	1 1/2"	25
pipe	c/s,apt 5l,sch40,seamless	2"	70
pipe	c/s,apt 5l,sch40,seamless	3"	27
pipe	c/s,apt 5l,sch40,seamless	4"	73
pipe	c/s,apt 5l,sch40,seamless	6"	36
pipe	c/s,apt 5l,sch40,seamless	8"	78
elbow 90	c/s bw,sch40	1/2"	17
elbow 90	c/s bw,sch40	1"	13
elbow 90	c/s bw,sch40	1 1/2"	14
elbow 90	c/s bw,sch40	2"	27
elbow 90	c/s bw,sch40	3"	11
elbow 90	c/s bw,sch40	4"	15
elbow 90	c/s bw,sch40	6"	12
elbow 90	c/s bw,sch40	8"	14
coupling	c/s sw,300#	1/2"	20
flange	c/s wn,rf,150#	1/2"	7
flange	c/s wn,rf,150#	1"	11
flange	c/s wn,rf,150#	1 1/2"	9

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DEMI PIPE

ITEM	MATERIAL	SIZE	QTY
flange	c/s wn,rf,150#	2"	21
flange	c/s wn,rf,150#	3"	9
flange	c/s wn,rf,150#	4"	15
flange	c/s wn,rf,150#	6"	18
flange	c/s,so,rf,150#	1/2"	12
flange	c/s,so,rf,150#	1"	7
flange	c/s,so,rf,150#	1 1/2"	8
flange	c/s,so,rf,150#	2"	9
flange	c/s,so,rf,150#	3"	8
flange	c/s,so,rf,150#	4"	32
flange	c/s,so,rf,150#	6"	12
flange	c/s,so,rf,150#	2 1/2"	6
pnumatic valve		2"	7
pnumatic valve		3"	5
pnumatic valve		4"	10
pnumatic valve		6"	9
manual valve		2"	6
manual valve		4"	12
manual valve		3"	5
manual valve		6"	12
check valve		2"	4
check valve		4"	6
flow indicator		2"	4
flow indicator		4"	6
con.red.	c/s,bw,sch40	8"*4"	3
con.red.	c/s,bw,sch40	6"*4"	8
con.red.	c/s,bw,sch40	4"*3"	3
con.red.	c/s,bw,sch40	4"* 2 1/2"	8
ecc.red.	c/s,bw,sch40	8"*4"	3
con.red.	c/s,lining with a33-a hard rubber	8"*6"	4
con.red.	c/s,lining with a33-a hard rubber	8"*5"	4
con.red.	c/s,lining with a33-a hard rubber	4"*2"	6
con.red.	c/s,lining with a33-a hard rubber	8"*3"	6
conred.	c/s,lining with a33-a hard rubber	3"*2 1/2"	4
con.red.	c/s,lining with a33-a hard rubber	4*2 1/2"	4
con.red.	c/s,lining with a33-a hard rubber	4"*6"	9
con.red.	c/s,lining with a33-a hard rubber	6"*5"	5
ecc.red.	c/s,lining with a33-a hard rubber	6"*4	3
ecc.red.	c/s,lining with a33-a hard rubber	4"*2 1/2"	4
ecc.red.	c/s,lining with a33-a hard rubber	8"*4"	2
panumatic valve	lining with a33-a hard rubber	1"	2
panumatic valve	lining with a33-a hard rubber	1 1/2"	8
panumatic valve	lining with a33-a hard rubber	2"	6
panumatic valve	lining with a33-a hard rubber	2 1/2"	4
panumatic valve	lining with a33-a hard rubber	3"	8
panumatic valve	lining with a33-a hard rubber	4"	50
panumatic valve	lining with a33-a polypropylene	6"	6

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DEMI PIPE

ITEM	MATERIAL	SIZE	QTY
panumatic valve	lining with a33-a polypropylene	8"	2
elbow 90	c/s,bw,lining with a33-a hard rubber	1 1/2"	11
elbow 90	c/s,bw,lining with a33-a hard rubber	2"	60
elbow 90	c/s,bw,lining with a33-a hard rubber	2 1/2"	6
elbow 90	c/s,bw,lining with a33-a hard rubber	3"	25
elbow 90	c/s,bw,lining with a33-a hard rubber	4"	95
elbow 90	c/s,bw,lining with a33-a hard rubber	6"	120
elbow 90	c/s,bw,lining with a33-a hard rubber	8"	9
elbow 45	c/s,bw,lining with a33-a hard rubber	4"	15
flange	c/s wn,rf,150# lining with a33-a hard rubber	1/2"	12
flange	c/s,wn,rf,150# lining with a33-a hard rubber	1"	6
flange	c/s,wn,rf,150# lining with a33-a hard rubber	1 1/2"	12
flange	c/s,wn,rf,150# lining with a33-a hard rubber	2"	50
flange	c/s,wn,rf,150# lining with a33-a hard rubber	2 1/2"	6
flange	c/s,wn,rf,150#,lining with a33-a	3"	40
flange	c/s,wn,rf,150# lining with a33-a	4"	125
flange	c/s,wn,rf,150# lining with a33-a	6"	100
flange	c/s,wn,rf,150# lining with a33-a	5"	6
flange	c/s,wn,rf,150# lining with a33-a	8"	16
flange	c/s,so,rf,150#,lining hard rubber with a33-a	1/2"	10
flange	c/s,so,rf,150# lining hard rubber with a33-a	1"	25
flange	c/s,so,rf,150# lining hard rubber with a33-a	1 1/2"	30
flange	c/s,so,rf,150# lining hard rubber with a33-a	2"	130
flange	c/s,so,rf,150# lining hard rubber with a33-a	2 1/2"	20
flange	c/s,so,rf,150# lining hard rubber with a33-a	3"	60
flange	c/s,so,rf,150# lining hard rubber with a33-a	4"	375
flange	c/s,so,rf,150# lining hard rubber with a33-a	5"	4
flange	c/s,so,rf,150# lining hard rubber with a33-a	6"	160
flange	c/s,so,rf,150# lining hard rubber with a33-a	8"	20
tee	c/s,api,5l,lining with a33-a	6"*6"	25
tee	c/s,api,5l,lining with a33-a	1 1/2"*1 1/2	10
tee	c/s,api,5l,lining with a33-a	3"*2 1/2"	4
tee	c/s,api,5l,lining with a33-a	6"*3"	5
stud bolt with nut		1/2"*70	200
stud bolt with nut		5/8"*105	5100
stud bolt with nut		3/4"*120	400
stud bolt with nut		3/4"*200	200

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POLISHER

TYPE	SIZE	MAT	THIC	QTY	SPECIF
PIPE	65	C/S API-5L A33	5.16	130	-
FLANG	65	C/S API-SL A33	-	11	SLIPON 150 IBS
ELBOW	65	C/S API-SL A33	-	4	ANGLE 90
FLANG	65	C/S API-SL A33	-	4	WELD NECK150IPS
PIPE	65	C/S API-SL A33	5.16	160	-
FLANG	65	C/S API-SL A33	-	11	SLIPON 150 IBS
ELBOW	65	C/S API-SL A33	-	12	90
FLANG	65	C/S API-SL A33	-	10	WELD NECK150IBS
PIPE	50	C/S A33	3.91	3	-
FLANG	50	C/S A33	-	1	WELD NECK150IPS
ELBOW	50	C/S A33	-	1	90
PIPE	75	POLYPROPYLEME	6.8	180	-
FLANG	75	A42	-	4	150 IBS
ELBOW	75	POLYPROPYLEME	-	7	90
PIPE	250	TV37-A	6.3	40	-
FLANG	250	TV37-A	-	5	SLIPON 150 IBS
ELBOW	250	TV37-A	-	4	90
FLANG	250	TV37-A	-	1	WELD NECK150IBS
PIPE	65	TV37-A	2.9	20	-
FLANG	65	TV37-A	-	1	SLIPON 150IBS
ELBOW	65	TV37-A	-	3	90
PIPE	50	TV37-A	2.9	30	-
FLANG	50	TV37-A	-	4	SLIPON 150IBS
FLANG	50	TV37-A	-	3	WELD NECK
ELBOW	50	TV37-A	-	14	90
PIPE	60	TV37-A	3.2	2	-
FLANG	80	TV37-A	-	1	SLIPON 150 IBS
FLANG	80	TV37-A	-	1	WELD NECK150IBS
ELBOW	80	TV37-A	-	1	90
PIPE	80	TV37-A	3.2	30	-
FLANG	80	TV37-A	-	18	SLIPON 150 IBS
FLANG	80	TV37-A	-	18	WELD NECK150IBS
ELBOW	80	TV37-A	-	10	90
PIPE	100	TV37-A	3.6	40	-
FLANG	100	TV37-A	-	16	SLIPON 150IBS
FLANG	100	TV37-A	-	14	WELD NECK150IBS
ELBOW	100	TV37-A	-	12	90
PIPE	40	PVC	5	100	-
FLANG	40	PVC	-	20	IPS 150
ELBOW	40	PVC	-	15	-
PIPE	50	PVC	5	100	-
FLANG	50	PVC	-	14	IBS150
ELBOW	50	PVC	-	12	-
PIPE	100	PVC	8.8	80	-
FLANG	100	PVC	-	16	IBS15O
ELBOW	100	PVC	-	16	-
PIPE	25	TV37-A	2.3	100	-

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POLISHER

TYPE	SIZE	MAT	THIC	QTY	SPECIF
FLANG	25	TV37-A	-	30	SLIPON 150IBS
FLANG	25	TV37-A	-	20	WELD NECK150IBS
PIPE	12	PVC	2.3	120	-
FLANG	12	PVC	-	30	180IBS
ELBOW	12	PVC	-	46	90
PIPE	32	A33	4.85	130	-
FLANG	32	A33	-	30	SLIPON 150 IBS
FLANG	32	A33	-	26	WELD NECK150IBS
ELBOW	32	A33	-	30	90
PIPE	40	A33	5.08	120	-
FLANG	40	A33	-	40	SLIPON 150 IBS
FLANG	40	A33	-	20	WELD NECK150IBS
ELBOW	40	A33	-	25	90
PIPE	6"	SGP LINING WITH POLYETH	-	1200	-
FLANGE	6"	SGP LINING WITH POLYETH	-	150	WELDED LINING
ELBOW	6"	SGP WITH POLYETHLEN	=	45	90
PIPE	14"	STPG-38	SCH2	20	SCH 20
FLANGE	14"	STPG-38	-	10	150 IBS S.O
ELBOW	14"	STPG 38	-	6	90
PIPE	1"	STPG 38	SCH8	45	-
FLANGE	1"	STPG 38	-	22	150 IBS S.O
ELBOW	1"	STPG 38	-	40	90
PIPE	3/4	STPG 38	SCH8	60	
FLANGE	3/4	STPG 38	-	34	150IBS S.O
ELBOW	3/4	STPG 38	-	4	90
PIPE	1 1/2	SGP GALV	SCH4	180	-
FLNGE	1 1/2	SGP GALV	-	50	150 IBS S.O
ELBOW	1 1/2	SGP	-	27	-
PIPE	10"	SUS 304	4	40	-
FLANGE	10"	SUS304	-	15	150IBS,S.O
ELBOW	10"	SUS304	-	12	-
PIPE	10"	STPG38	SCH2	40M	
FLANGE	10"	STPG38	-	6	150IBS,S.O
ELBOW	10"	STPG38	SCH2	6	-
REDUCER*		TV-37-A	-	10	
REDUCER*		TV-37-A	-	12	-
REDUCER*		TV-37-A	-	14	-
REDUCER*		TV-37-A	-	12	-
REDUCER*		TV-37-A	-	6	-
REDUCER*		TV-37-A	-	10	-
REDUCER*		TV-37-A	-	12	-
TEE	10"*10"*4"	TV-37-A	-	10	-
TEE	10"*10"*10"	TV-37-A	-	8	-
TEE	8"*10"*10"	TV-37-A	-	9	-
TEE	8"*8"*6"	TV-37-A	-	10	-
TEE	6"*6"*4"	TV-37-A	-	12	-
TEE	4"*4"*2"	TV-37-A	-	14	-

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DEMI PIPE

ITEM	MATERIAL	SIZE	QTY
panumatic valve	lining with a33-a polypropylene	8"	2
elbow 90	c/s,bw,lining with a33-a hard rubber	1 1/2"	11
elbow 90	c/s,bw,lining with a33-a hard rubber	2"	60
elbow 90	c/s,bw,lining with a33-a hard rubber	2 1/2"	6
elbow 90	c/s,bw,lining with a33-a hard rubber	3"	25
elbow 90	c/s,bw,lining with a33-a hard rubber	4"	95
elbow 90	c/s,bw,lining with a33-a hard rubber	6"	120
elbow 90	c/s,bw,lining with a33-a hard rubber	8"	9
elbow 45	c/s,bw,lining with a33-a hard rubber	4"	15
flange	c/s wn,rf,150# lining with a33-a hard rubber	1/2"	12
flange	c/s,wn,rf,150# lining with a33-a hard rubber	1"	6
flange	c/s,wn,rf,150# lining with a33-a hard rubber	1 1/2"	12
flange	c/s,wn,rf,150# lining with a33-a hard rubber	2"	50
flange	c/s,wn,rf,150# lining with a33-a hard rubber	2 1/2"	6
flange	c/s,wn,rf,150#,lining with a33-a	3"	40
flange	c/s,wn,rf,150# lining with a33-a	4"	125
flange	c/s,wn,rf,150# lining with a33-a	6"	100
flange	c/s,wn,rf,150# lining with a33-a	5"	6
flange	c/s,wn,rf,150# lining with a33-a	8"	16
flange	c/s,so,rf,150#,lining hard rubber with a33-a	1/2"	10
flange	c/s,so,rf,150# lining hard rubber with a33-a	1"	25
flange	c/s,so,rf,150# lining hard rubber with a33-a	1 1/2"	30
flange	c/s,so,rf,150# lining hard rubber with a33-a	2"	130
flange	c/s,so,rf,150# lining hard rubber with a33-a	2 1/2"	20
flange	c/s,so,rf,150# lining hard rubber with a33-a	3"	60
flange	c/s,so,rf,150# lining hard rubber with a33-a	4"	375
flange	c/s,so,rf,150# lining hard rubber with a33-a	5"	4
flange	c/s,so,rf,150# lining hard rubber with a33-a	6"	160
flange	c/s,so,rf,150# lining hard rubber with a33-a	8"	20
tee	c/s,api,5l,lining with a33-a	6"*6"	25
tee	c/s,api,5l,lining with a33-a	1 1/2"*1 1/2	10
tee	c/s,api,5l,lining with a33-a	3"*2 1/2"	4
tee	c/s,api,5l,lining with a33-a	6"*3"	5
stud bolt with nut		1/2"*70	200
stud bolt with nut		5/8"*105	5100
stud bolt with nut		3/4"*120	400
stud bolt with nut		3/4"*200	200

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POLISHER

TYPE	SIZE	MAT	THIC	QTY	SPECIF
TEE	12*12"*10"	TV-37-A	-	6	-
TEE	12"*12"*8"	TV-37-A	-	5	-
VALVE	1/2"	PVC	-	30	150IBS
VALVE	1/2"	A33	-	25	HV DIAPHRAM VALVE 150IBS
BALL VAL	3/4"	PVC	-	24	150IBS
VALVE	3/4"	A33	-	30	DIAPHRAM 150IBS
VALVE	1"	A33	-	25	DIAPHRAM 150IBS
VALVE	1 1/2"	A33	-	20	DIAPHRAME VALVE 150IBS
VALVE	2"	A33	-	40	DIAPHRAME VALVE/150IBS
VALVE	2 1/2"	TV-37-A	-	25	DIAPHRAME VALVE/150IBS
VALVE	3"	TV-37-A	-	15	SIAPHRAME VALVE/150IBS
VALVE	4"	TV-37-A	-	20	DIAPHRAME VALVE/150IBS
VALVE	6"	TV-37-A	-	23	DIAPHRAME VALVE/150IBS
VALVE	8"	TV-37-A	-	19	DIAPHRAME VALVE/150IBS
VALVE	10"	TV-37-A	-	18	DIAPHRAME VALVE/150IBS
VALVE	12"	TV-37-A	-	14	DIAPHRAME VALVE/150IBS
VALVE	8"	TV-37-A	-	6	BUTTER FLY VALVE/150IBS
VALVE	10"	TV-37-A	-	8	BUTTER FLY VALVE/150IBS
VALVE	12"	TV-37-A	-	10	BUTTER FLY VALVE/150IBS
VALVE	6"	TV-37-A	-	9	BUTTER FLY VALVE/150IBS

P3

TEY VALVES OF AMMONIA & UREA

E E	NO. REQ.	BON-NET TYPE	LIFT	INLET SIZE & RATING	OUTLET SIZE & RATING	MOL-WT/ SP-GR	REQ. CAPA-CITY-KG/H	OPER-ATING TEMP. C	SET PRESS KG/ CM^2G	BACK PRESS KG/ CM^2G	BLOW DOWN PRESS	CLOS-ING PRESS. CM^2G	ACC-MULA-TION %	ORIFICE AREA (CALC./ SELEC.) CM^2G	BODY MATER-IAL	FLUID
B	2		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	21.58	112000/ 50440+87230	32	17	ATM		15.3	10	41.853	SCPH2	N.G.
B	2		FULL BORE	6" ANSI600-RF	8" ANSI150-RF	16.21	132907/ 79420*2	365	26.3	ATM		24.4	10	72.382	SCPH2	R.G.
B	2		FULL BORE	6" ANSI600-RF	8" ANSI150-RF	16.21	132907/ 79420*2	320	24.5	ATM		22.8	10	72.382	SCPH2	R.G.
	1		FULL BORE	6" ANSI600-RF	8" ANSI150-RF	8.9	39907/ 54570	310	22.3	ATM		20.7	10	72.382	SCPH2	SYN. G.
	1		FULL BORE	(3/4)" ANSI150-RF	1" ANSI150-RF	28	250/520	50	8	ATM		7.2	10	0.785	SCPH2	N2
	1		FULL BORE	6" ANSI150-RF	8" ANSI150-RF	28	22000/ 28320	76	6.9	5.8		6.8	10	72.382	SCPH2	N2
\	1		FULL BORE	4" ANSI900-RF	8" ANSI150-RF	8.01	126/800	286.38 /294	71 / 77	ATM	3		3	39.46 / 41.853	SCPH2	STEAM
\	1		FULL BORE	3" ANSI150-RF	4" ANSI150-RF	18.01	2400	280/310	3.5/4.5	ATM	0.18		3	11.9 / 18.857	SCPH2	STEAM
B	4	OPEN	FULL BORE	6" ANSI900-RF	10" ANSI900-RF	18.01	240000	373 / 425	33.5 / 37.9	ATM	4		3	45.88 60.421	SCPH2	STEAM
	1		FULL BORE	(3/4)" ANSI300-RF	1" ANSI150-RF	21.5	490	152.4/ 152.4	38B,C,D 31 / 39	ATM	3.9		10	0.216/ 0.785	SCPH2	N.G.

AFTEY VALVES OF AMMONIA & UREA

LVE ME	NO. REQ	BON-NET TYPE	LIFT	INLET SIZE & RATING	OUTLET SIZE & RATING	MOL-WT/ SP-GR	REQ. CAPA-CITY-KG/H	OPER-ATING TEMP. C	SET PRESS KG/ CM^2G	BACK PRESS KG/ CM^2G	BLOW DOWN PRESS	CLOS-ING PRESS. CM^2G	ACC-MULA-TION %	ORIFICE AREA (CALC./ SELEC.) CM^2G	BODY MATER-IAL	FLUID
57	1		FULL BORE	3" ANSI150-RF		18.01	3000	260	3.8/ 7	ATM			3	9.1/ 11.341	SCPH2	STEAM
58	1		FULL BORE	4" ANSI150-RF	6" ANSI150-RF	8.01	13	260	3.8/ 7	ATM	0.28		3	39.4/ 45.364	SCPH2	STEAM
9A	1		FULL BORE	(1 1/2)" ANSI300-RF	2" ANSI150-RF	17/ 750		25/ 5	1.4/ 21	ATM	2.1		25	1.05/ 2.01	SCPH2	BOILER F.W.
30	1		FULL BORE	2" ANSI150-RF	3" ANSI150-RF	18.02	1700	288	5.5	ATM			3	7.52	SCPH2	STEAM
31	1		FULL BORE	(2 1/2)" ANSI150-RF	4" ANSI150-RF	18.02	4100	302	5.5	ATM		0.22		18.15	SCPH2	STEAM
32	1		FULL BORE	2" ANSI150-RF	3" ANSI150-RF	18.02	1400	302	5.5	ATM	0.22		3	6.2	SCPH2	STEAM
33	1		FULL BORE	2" ANSI150-RF	3" ANSI150-RF	18.02	1500	302	5.5	ATM			3	6.64	SCPH2	STEAM
A,B, D	4	OPEN	FULL BORE	6" ANSI900-RF	10" ANSI150-RF	18.02	150.000*2= 300000	370/ 450	33/ 37	ATM	1.4		3	70.882	SCPH2	STEAM
35	1		FULL BORE	6" ANSI300-RF	6" ANSI150-RF	18.02	5000	183/ 370	10/ 12.5	ATM	0.5		3	45.364	SCPH2	STEAM
A,B	2		FULL BORE	6" ANSI300-RF	8" ANSI150-RF	18.02	35000	260/ 370	3.5/ 5	ATM	0.18		3	103.862	SCPH2	STEAM

SAFTEY VALVES OF AMMONIA & UREA

O	VALVE NAME	NO. REQ	BON-NET TYPE	LIFT	INLET SIZE & RATING	OUTLET SIZE & RATING	MOL-WT/ SP-GR	REQ. CAPA-CITY-KG/H	OPER-ATING TEMP. C	SET PRESS KG/ CM^2G	BACK PRESS KG/ CM^2G	BLOW DOWN PRESS	CLOS-ING PRESS. CM^2G	ACC-MULA-TION %	ORIFICE AREA (CALC./ SELEC.) CM^2G	BODY MATER-IAL	FLUID
1	167A,B, C	3		FULL BORE	6" ANSI300-RF	8" ANSI150-RF	18.02	35000	370	5	ATM	0.18		3	103.869	SCPH2	STEAM
2	168A,B	2		FULL BORE	6" ANSI300-RF	8" ANSI150-RF		20600	125.5/ 275	1.4/ 4.5	ATM	0.18		3	103.369	SCPH2	
3	176A,B, C	3		FULL BORE	(3/4)" PT MALE	1" PT FEMALE		5700	125.5/ 125.5	1.4/ 5	ATM	0.5		25	.328/ 0.785	SCPH2	BOILER F.W.
4	177	1		FULL BORE	6" ANSI600-RF	8" ANSI150-RF			365.2/ 365.2	26.5 28	ATM	1.12		3	57.39/ 60.821	SCPH2	STEAM
5	201	1	CLO-SED	FULL BORE	6" ANSI600-RF	8" ANSI150-RF	8/81	39907	79.4/ 79.4	20.8/ 23	ATM	7		10	41.7/ 60.821	SCPH2	R.G.
6	203A,B	2		RAP-TLIRE	2" ANSI150-RF		228.9	248.523	2.2/ AMB	0.44	0.35			10			AIR
7	202A,B	2		RUP-TURE	12" ANSI-RF		24/5	102.309	102.2/ 175	.45/ 1.4	ATM			10			ACID GAS
8	301	1		FULL BORE	3" ANSI300-RF	4" ANSI150-RF	21.5	1745.2488	232	39	ATM		35.1	10	11.945	SCPH2	N.G.
9	302	1		FULL BORE	2" ANSI150-RF	3" ANSI150-RF	21.58	3414/ 3820	160	7	ATM		6.3	10	8.552	SCPH2	WATER + N.G.
0	303	1		FULL BORE	3" ANSI300-RF	4" ANSI150-RF	8.9	8363/ 10350	135.7	22.3	ATM		20.1	10	11.945	SCPH2	SYN. GAS

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SAFTEY VALVES OF AMMONIA & UREA

NO	VALVE NAME	NO. REQ	BON-NET TYPE	LIFT	INLET SIZE & RATING	OUTLET SIZE & RATING	MOL-WT/ SP-GR	REQ. CAPA-CITY-KG/H	OPER-ATING TEMP. C	SET PRESS KG/ CM^2G	BACK PRESS KG/ CM^2G	BLOW DOWN PRESS	CLOS-ING PRESS. CM^2G	ACC-MULA-TION %	ORIFICE AREA (CALC./ SELEC.) CM^2G	BODY MATER-IAL	FLUID
41	404	1		FULL BORE	2" ANSI1500-RJ	3" ANSI1500-RJ	9.98	37.863	50	232.6					4.62	SCPH2	SYN.O
42	406A/B	2		FULL BORE	6" ANSI150-RF	8" ANSI150-RF	11.24	23650/ 24490	120	7	ATM		6.3	10	72.382	SCPH2	WATER + SYN.O
43	407	1		FULL BORE	2" ANSI300-RF	3" ANSI150-RF	17.03	5480/ 6130	51	19	ATM		17.1	10	5.309	SCPH2	NH3
44	408	1		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	17.03	19538/ 22860	51	20	ATM		18	10	18.857	SCPH2	NH3
45	409	1		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	15642/ 22860	17.03	5	20	ATM		18	10	18.857	SCPH2	NH3
46	410	1		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	17.03	35170/ 41400	181.8	29	ATM		26.1	10	28.274	SCPH2	NH3
47	411	1		FULL BORE	1" ANSI300-RF	2" ANSI150-RF	0.56	433/ 10380	170	20	2.75		17	10	2.01	SCPH2	NH3
48	412A,B	2		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	17.03	35170/ 50520	54	20	ATM		18	10	41.853	SCPH2	WATER + SYN.O
49	413	1		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	10.97	23629/ 27470	52	20	ATM		18	10	28.274	SCPH2	WATER + SYN.O
50	414A,B	2		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	10.98		41	23	ATM		21.39	10	41.853	SCPH2	NH3
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SAFTEY VALVES OF AMMONIA & UREA

NO	VALVE NAME	NO. REQ	BON-NET TYPE	LIFT	INLET SIZE & RATING	OUTLET SIZE & RATING	MOL-WT/ SP-GR	REQ. CAPA-CITY-KG/H	OPER-ATING TEMP. C	SET PRESS KG/ CM^2G	BACK PRESS KG/ CM^2G	BLOW DOWN PRESS	CLOS-ING PRESS. CM^2G	ACC-MULA-TION %	ORIFICE AREA (CALC./ SELEC.) CM^2G	BODY MATER-IAL	FLUID
51	415	1		FULL BORE	2" ANSI300-RF	3" ANSI150-RF	10.25	4458/ 5371	7.2	20	ATM		18	10	5.309	SCPH2	SYN.G
52	416	1		FULL BORE	2" ANSI300-RF	3" ANSI150-RF	17.03	5480/ 6438	51	20	ATM		18	10	5.309	SCPH2	NH3
53	456	1		FULL BORE	2" ANSI300-RF	3" ANSI150-RF	17.03	4.8	40	20	ATM	2		10	3.97	SCPH2	NH3
54	457	1		FULL BORE	(3/4)" ANSI300-RF	1" ANSI150-RF	17.03	35.7/U.SGAL /MIN	15	27	ATM	2.7		25	0.35 (0.05IN)^2	SCPH2	NH3
55	535	1		SEMI LIFT	1" ANSI300-RF	2" ANSI150-RF	0.959	101000	100	13	ATM	1.3		25	0.711	SCPH2	STEAM CONDE SATE
56	536	1		SEMI LIFT	1" ANSI150-RF	2" ANSI150-RF	0.988	101000	100	7	ATM	0.7			0.983	SCPH2	STEAM CONDE SATE
57	519	1		FULL BORE	(3/4)" ANSI300-RF	1" ANSI150-RF	1	NOMINAL -1060	255	28	VENT STACK	7%		10	0.785	SCPH2	STEAM + NH3
58	531	1		FULL BORE	6" ANSI600-RF	8" ANSI150-RF	18.02	68.5	225	28	ATM	1.1		3	58.4	SCPH2	STEAM
59	509	1		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	18.02	31.6	150	22	FLARE	2.2	19.8	10	28.274	SCS13	GASES
60	512	1		FULL BORE	(3/4)" ANSI150-RF	1" ANSI150-RF	18.98	90	40	5.5	FLARE	0.55	19.8	10	0.785	SCS13	GASES

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SAFTEY VALVES OF AMMONIA & UREA

NO	VALVE NAME	NO. REQ	BON-NET TYPE	LIFT	INLET SIZE & RATING	OUTLET SIZE & RATING	MOL-WT/ SP-GR	REQ. CAPA-CITY-KG/H	OPER-ATING TEMP. C	SET PRESS KG/ CM^2G	BACK PRESS KG/ CM^2G	BLOW DOWN PRESS	CLOS-ING PRESS. CM^2G	ACC-MULA-TION %	ORIFICE AREA (CALC./ SELEC.) CM^2G	BODY MATER-IAL	FLUID
61	532A	1		FULL BORE	6" ANSI300-RF	8" ANSI150-RF	18.02	33000	158	5/6	ATM	0.24		3	114.4	SCPH2	STEAM
62	532B	1		FULL BORE	(2 1/2)" ANSI150-RF	4" ANSI150-RF	18.02	33000	158	5	ATM	0.24		3	114.4	SCPH2	STEAM
63	516A/B	2		FULL BORE	(1 1/2)" ANSI300-RF	(2 1/2)" ANSI300-RF	17.06	3150/4543	28	22	FLARE	2.2	19.8	10	3.463	SCPH2	NH3 INERTS GAS
64	517	1	CLO-SED	FULL BORE	4" ANSI300-RF	6" ANSI150-RF	43.35	37200/ 44990	206/ 206	20	VENT STACK	0.07	18.6	10	28.274	SCPH2	CO2 + GAS
65	518	1	CLO-SED	FULL BORE	2" ANSI1500-RJ	6" ANSI300-RF	43.35	46000	180/ 180	165	VENT STACK	0.07		10	5.05		CO2
66	501	1		FULL BORE	(3/4)" SPECIAL LENES GASGET	1" ANSI300-RF	17.33	1600	155/ 150	165/ 2.5	FLARE	0.07		10	0.387	SCPH2	GASES
67	503	1		FULL BORE	6" ANSI150-RF	8" ANSI150-RF	23.09/ 18.02	33000/ 41930	155/ 150	165/ 2.5	FLARE	0.7	6.3	10	103.869	SCPH2	GASES
68	533	1		SEMI LIFT	(3/4)" ANSI150-RF	1" ANSI150-RF	1	3	42	7	ATM	0.7		25	0.297	SCPH2	COND.
69	513	1		FULL BORE	4" ANSI300-RF	6" ANSI150-RF	17.03	22.1	43	22	FLARE	2.2		10	18.857	SCS13	NH3 G.

SAFTEY VALVES OF AMMONIA & UREA

NO	VALVE NAME	NO. REQ	BON-NET TYPE	LIFT	INLET SIZE & RATING	OUTLET SIZE & RATING	MOL-WT/ SP-GR	REQ. CAPA-CITY-KG/H	OPER-ATING TEMP. C	SET PRESS KG/ CM^2G	BACK PRESS KG/ CM^2G	BLOW DOWN PRESS	CLOS-ING PRESS. CM^2G	ACC-MULA-TION %	ORIFICE AREA (CALC./ SELEC.) CM^2G	BODY MATER-IAL	FLU
70	508	1		FULL BORE	(1/2)" ANSI300-RF	1" ANSI150-RF	17.03	1.2	43		FLARE	2.5		10	0.785	SCPH2	NH
71	537	1		FULL BORE	2" ANSI150-RF	(2 1/2)" ANSI150-RF	18.02	1200	306	4/ 5.5	ATM	0.22		3	5.003/ 7.068	SCPH2	STEA
72	538	1		FULL BORE	(1 1/2)" ANSI150-RF	2" ANSI150-RF	18.02	571	305	4/ 5.5	ATM	0.22		3	2.38/ 4.523	SCPH2	STEA

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SAFTEY VALVES OF BOILERS

NO	VALVE NAME	NO. REQ	TYPE (MM)	NOMINAL PRESS. (PC'S)	NOMINAL DIAMETER (B)	MATERIAL (BODY/TRIM)	FLUID	OPERA-TION PRESS (KG/ CM^2G	SET PRESS KG/ CM^2G	CLOSING PRESS KG/ CM^2G	TEMP-ERAT-URE (C)	CAPACITY (KG/H)	SEAT DIAME-TER (MM)	THROAT DIAME-TER (MM)
1	801A,B C,D	4	FULL BORE 7.9	1500	2	WCB/SUS	SATURATED STEAM	79	85	79.05	299	32748	41	35
2	802A,B C,D	4	FULL BORE 7.9	1500	2	WCB/SUS	SATURATED STEAM	79	85	79.05	299	32748	41	35
3	803A,B C,D	4	FULL BORE 7.9	1500	2	WCB/SUS	SUPER HEATED STEAM	71	74	68.82	470	23015	41	35
4	805A	1	FULL BORE 10.9	150	65	SCPH2/ SUS	SUPER HEATED STEAM	3	5	4.6	250	4456	58	49

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PIPE & FITTING FOR BOILER

ITEM	SIZE	SCH	MAT	DESCRIPTION	QTY
PIPE	1 1/2"	1MM	SGP		70
PIPE	1 1/2"	SCH80	STPG38		25
PIPE	1"	SCH80	STPT38		30
PIPE	1"	SCH80	STPG38		35
PIPE	1"	SCH40	SUS304		10
PIPE	1"	SCH80	STPT42		30
PIPE	1/2"	SCH80	STPT38		40
PIPE	1/2"	SCH80	STPG38		60
PIPE	1/2"	SCH80	STPT42		70
PIPE	1/2"	SCH80	SGP		40
PIPE	12"	16MM	STPA12		20
PIPE	12"	SCH20	STPG38		25
PIPE	12"	7.9MM	SGP		20
PIPE	12"	SCH20	STPG38		25
PIPE	14"	9MM	SGP		15
PIPE	14"	7.9MM	SGP		40
PIPE	2"	1.5MM	SGP		20
PIPE	3"	SCH40	STPG38		40
PIPE	3"	SCH80	STPG38		10
PIPE	3/4"	SCH40	SUS304		35
PIPE	4"	SCH80	STPA12		80
PIPE	4"	SCH40	STPG38		75
PIPE	4"	4MM	SGP		40
PIPE	6"	SCH40	STPG38		30
PIPE	6"	SCH40	STPT38		20
PIPE	6"	SCH120	STPT38		20
PIPE	6"	4MM	SGP		20
PIPE	8"	SCH80	STPA12		30
PIPE	8"	SCH120	STPT38		15
PIPE	8"	SCH40	STPG38		20
FLANGE	1"	-	-	ANSI-900-WN-RJ-S30C	2
FLANGE	1/2"	-	-	ANSI-900-WN-RJ-S30C	3
FLANGE	12"	-	-	ANSI-900-WN-RJ-A182F1	2
FLANGE	3"	-	-	ANSI-300-SO-RF-S25C	2
FLANGE	3/4"	-	-	ANSI-150-SO-RF-SUS304	2
FLANGE	3/4"	-	-	ANSI-900-WN-RJ-S30C	2
FLANGE	4"	-	-	ANSI(125/150)-SO-FF-SS41 OR S25C	2
FLANGE	6"	-	-	ANSI-400-WN-RF-S25C	2
FLANGE	8"	-	-	ANSI-900-WN-RJ-S25C	6
FLANGE	8"	-	-	ANSI-900-WN-RJ-A182F1	1
FLANGE	8"	-	-	ANSI-400-WN-RF-S25C	2
TEE	1 1/2"	1.5MM	SGP. GALV.	-	2
TEE	1/2"*1/2"	SCH80	STPG38	-	1
TEE	12"*12"	7MM	SGP	-	2
TEE	12"*12"	16MM	STPA12	-	2
TEE	12"*12"	SCH20	STPG38	-	1
TEE	12"*8"	SCH80	STPA12	-	1
TEE	3"*3"	SCH40	STPG38	-	4
TEE	3/4"*1/2"	SCH80	STPG38	-	2
TEE	3/4"*3/4"	SCH80	SUS304	-	6
TEE	4"*2"	4MM	SGP	-	3
TEE	4"*4"	7MM	SGP	-	2

TEE	4"*4"	3MM	SGP	-	1
TEE	4"*4"	SCH80	STPA12	-	1
TEE	6"*6"	4MM	SGP	-	2
TEE	6"*6"	SCH40	STPG38	-	4
TEE	8"*4"	5MM	SGP	-	1
TEE	8"*6"	SCH120	STPT38	-	4
TEE	8"*8"	SCH40	STPT38	-	1
TEE	8"*8"	SCH80	STPA12	-	2
TEE	8"*8"	SCH20	STPG38	-	1
ELBOW	1 1/2"	SCH80	STPG38	-	4
ELBOW	1 1/2"	1.5MM	SGP.GLV.	-	6
ELBOW	1"	SCH80	STPG38	-	4
ELBOW	1"	SCH20	SGP	-	2
ELBOW	1"	SCH80	STPT42	-	4
ELBOW	1"	SCH80	STPT38	-	4
ELBOW	1/2"	SCH80	STPG38	-	6
ELBOW	1/2"	SCH20	SGP	-	2
ELBOW	1/2"	SCH80	STPT42	-	4
ELBOW	1/2"	SCH80	STPT38	-	4
REDUCER	10"*8"	SCH80	STPA12	-	1
ELBOW	12"	7MM	SGP	-	4
ELBOW	12"	16MM	STPA12	-	2
ELBOW	12"	SCH20	STPG38	-	3
REDUCER	12"*8"	6MM	STPA12	-	1
ELBOW	18"	SCH20	STPG38	-	3
ELBOW	2"	1.5MM	SGP	-	8
ELBOW	3/4"	SCH80	STPG38	-	2
ELBOW	3/4"	SCH80	SUS304	-	3
ELBOW	4"	3MM	SGP	-	1
ELBOW	4"	SCH40	STPA12	-	10
ELBOW	4"	4MM	SGP	-	2
REDUCER	4"*3"	2MM	SGP	-	2
REDUCER	4"*8"	4MM	SGP	-	1
ELBOW	6"	SCH40	STPT38	-	2
ELBOW	6"	4MM	SGP	-	4
ELBOW	6"	SCH120	STPT38	-	2
ELBOW	6"	SCH40	STPG38	-	5
REDUCER	6"*14"	4MM	SGP	-	2
REDUCER	6"*4"	SCH120	STPT38	-	2
ELBOW	8"	STPT38	SCH40	-	2
ELBOW	8"	SCH80	STPA12	-	8
ELBOW	8"	5MM	SGP	-	2

PIPING & FITTING FOR POLISHER

TYPE	SIZE	MAT	THICK (mm)	QTY	SPECIF
BALL VALVE	3/4"	PVC	-	24	150IBS
ELBOW	1 1/2	SGP	-	27	-
ELBOW	1"	STPG 38	-	40	90
ELBOW	10"	SUS304	-	12	-
ELBOW	10"	STPG38	SCH20	6	-
ELBOW	100	TV37-A	-	12	90
ELBOW	100	PVC	-	16	-
ELBOW	12	PVC	-	46	90
ELBOW	14"	STPG 38	-	6	90
ELBOW	250	TV37-A	-	4	90
ELBOW	3/4	STPG 38	-	4	90
ELBOW	32	A33	-	30	90
ELBOW	40	PVC	-	15	-
ELBOW	40	A33	-	25	90
ELBOW	50	C/S A33	-	1	90
ELBOW	50	TV37-A	-	14	90
ELBOW	50	PVC	-	12	-
ELBOW	6"	SGP WITH POLYETHLEN	-	45	90
ELBOW	65	C/S API-SL A33	-	4	ANGLE 90
ELBOW	65	C/S API-SL A33	-	12	90
ELBOW	65	TV37-A	-	3	90
ELBOW	75	POLYPROPYLEME	-	7	90
ELBOW	80	TV37-A	-	1	90
ELBOW	80	TV37-A	-	10	90
FLANGE	1"	STPG 38	-	22	150 IBS S.O
FLANGE	10"	SUS304	-	15	150IBS,S.O
FLANGE	10"	STPG38	-	6	150IBS,S.O
FLANGE	100	TV37-A	-	16	SLIPON 150IBS
FLANGE	100	TV37-A	-	14	WELD NECK150IBS
FLANGE	100	PVC	-	16	IBS15O
FLANGE	12	PVC	-	30	180IBS

FLANGE	14"	STPG-38	-	10	150 IBS S.O
FLANGE	25	TV37-A	-	30	SLIPON 150IBS
FLANGE	25	TV37-A	-	20	WELD NECK150IBS
FLANGE	250	TV37-A	-	5	SLIPON 150 IBS
FLANGE	250	TV37-A	-	1	WELD NECK150IBS
FLANGE	3/4	STPG 38	-	34	150IBS S.O
FLANGE	32	A33	-	30	SLIPON 150 IBS
FLANGE	32	A33	-	26	WELD NECK150IBS
FLANGE	40	PVC	-	20	IPS 150
FLANGE	40	A33	-	40	SLIPON 150 IBS
FLANGE	40	A33	-	20	WELD NECK150IBS
FLANGE	50	C/S A33	-	1	WELD NECK150IPS
FLANGE	50	TV37-A	-	4	SLIPON 150IBS
FLANGE	50	TV37-A	-	3	WELD NECK
FLANGE	50	PVC	-	14	IBS150
FLANGE	6"	SGP LINING WITH POLYETHLEN	-	150	WELDED LINING
FLANGE	65	C/S API-SL A33	-	11	SLIPON 150 IBS
FLANGE	65	C/S API-SL A33	-	4	WELD NECK150IPS
FLANGE	65	C/S API-SL A33	-	11	SLIPON 150 IBS
FLANGE	65	C/S API-SL A33	-	10	WELD NECK150IBS
FLANGE	65	TV37-A	-	1	SLIPON 150IBS
FLANGE	75	A42	-	4	150 IBS
FLANGE	80	TV37-A	-	1	SLIPON 150 IBS
FLANGE	80	TV37-A	-	1	WELD NECK150IBS
FLANGE	80	TV37-A	-	18	SLIPON 150 IBS
FLANGE	80	TV37-A	-	18	WELD NECK150IBS
FLNGE	1 1/2	SGP GALV	-	50	150 IBS S.O
PIPE	80	TV37-A	3.2	2m	-
PIPE	1 1/2	SGP GALV	SCH40	180m	-
PIPE	1"	STPG 38	SCH80	45m	-
PIPE	10"	SUS 304	4	40m	-
PIPE	10"	STPG38	SCH20	40M	
PIPE	100	TV37-A	3.6	40m	-
PIPE	100	PVC	8.8	80m	-
PIPE	12	PVC	2.3	120m	-
PIPE	14"	STPG-38	SCH20	20m	SCH 20

PIPE	25	TV37-A	2.3	100m	-
PIPE	250	TV37-A	6.3	40m	-
PIPE	3/4	STPG 38	SCH80	60m	
PIPE	32	A33	4.85	130m	-
PIPE	40	PVC	5	100m	-
PIPE	40	A33	5.08	120m	-
PIPE	50	C/S A33	3.91	3 m	-
PIPE	50	TV37-A	2.9	30m	-
PIPE	50	PVC	5	100m	-
PIPE	6"	SGP LINING WITH POLYETHLEN	-	1200m	-
PIPE	65	C/S API-5L A33	5.16	130 m	-
PIPE	65	C/S API-SL A33	5.16	160 m	-
PIPE	65	TV37-A	2.9	20m	-
PIPE	75	POLYPROPYLEME	6.8	180m	-
PIPE	80	TV37-A	3.2	30m	-
REDUCER	100*200	TV-37-A	-	6	-
REDUCER	125*100	TV-37-A	-	12	-
REDUCER	150*250	TV-37-A	-	12	-
REDUCER	200*100	TV-37-A	-	12	-
REDUCER	300*200	TV-37-A	-	10	
REDUCER	65*80	TV-37-A	-	14	-
REDUCER	75*100	TV-37-A	-	10	-
TEE	10"*10"*10"	TV-37-A	-	8	-
TEE	10"*10"*4"	TV-37-A	-	10	-
TEE	12"*12"*8"	TV-37-A	-	5	-
TEE	12*12"*10"	TV-37-A	-	6	-
TEE	4"*4"*2"	TV-37-A	-	14	-
TEE	6"*6"*4"	TV-37-A	-	12	-
TEE	8"*10"*10"	TV-37-A	-	9	-
TEE	8"*8"*6"	TV-37-A	-	10	-
VALVE	1 1/2"	A33	-	20	DIAPHRAME VALVE 150IBS
VALVE	1"	A33	-	25	DIAPHRAM 150IBS
VALVE	1/2"	PVC	-	30	150IBS
VALVE	1/2"	A33	-	25	HV DIAPHRAM VALVE 150IBS
VALVE	10"	TV-37-A	-	18	DIAPHRAME VALVE/150IBS
VALVE	10"	TV-37-A	-	8	BUTTER FLY VALVE/150IBS

VALVE	12"	TV-37-A	-	14	DIAPHRAME VALVE/150IBS
VALVE	12"	TV-37-A	-	10	BUTTER FLY VALVE/150IBS
VALVE	2 1/2"	TV-37-A	-	25	DIAPHRAME VALVE/150IBS
VALVE	2"	A33	-	40	DIAPHRAME VALVE/150IBS
VALVE	3"	TV-37-A	-	15	SIAPHRAME VALVE/150IBS
VALVE	3/4"	A33	-	30	DIAPHRAM 150IBS
VALVE	4"	TV-37-A	-	20	DIAPHRAME VALVE/150IBS
VALVE	6"	TV-37-A	-	23	DIAPHRAME VALVE/150IBS
VALVE	6"	TV-37-A	-	9	BUTTER FLY VALVE/150IBS
VALVE	8"	TV-37-A	-	19	DIAPHRAME VALVE/150IBS
VALVE	8"	TV-37-A	-	6	BUTTER FLY VALVE/150IBS

1) Screw end steam trap	1"	600 lb	SUS416	15
	¾"	600 lb	=	50
	½"	300 lb	=	30
	¼"	300 lb	=	30
	¾"	150 lb	SUS410	50
	1-1/2"	600 lb	C.S	12
	max. 5"	150 lb	=	5
	3"	150lb	=	8
2) Socket end steam trap	2"	300 lb	SUS416	25
	¾"	300 lb	=	20
3) Flg.& screw end steam trap	¾"	SS41	AISI-416	25
	½"	SS41	=	15
4) Flg.steam trap	½"	150 lb	SUS416	15
	4"	900 Rj	C.S	12
	1"	600 lb	=	7
	2"	300 lb	=	10
	¾"	300 lb	=	60
	1"	150 lb	=	15
5) Flg. Steam trap	2"	150 lb	C.S	8

ANNEX NO.4
PUMPS FOR AMMONIA UNIT

	TAG.NO.	SERVCE	NO. REQ.
1	P-101 AB	HIGH PRESS. B.F.W. PUMP	2
2	P-101 AT	HIGH PRESS. B.F.W. TURBINE	1
3	P-102ABC	B.C.W.PUMP	3
4	P-102ABT	B.C.W.PUMP TURBINE	2
5	P-104 AB	L.P.B.F.W.PUMPE	2
6	P-105	HYDRAZINE FEED PUMP	1
7	P-106	L.P.W.H.B. PHOSPHATE FEED PUMP	1
8	P-107 AB	TURBINE CONDENSATE RETURNE PUMP	2
9	P-108	AMMONIA FEED PUMP	1
10	P-109	HIGH PRESS. W.H.B PHOSPHATE FEED PUMP	1
11	P-110	AMMONIA & HYDRAZINE FEED SPARE PUMP	1
12	P-111	P-101 AT AUX. L.O. PUMP	1
13	P-112	P-101 B AUX. L.O. PUMP	1
14	P-201AB	SEMI – LEAN SOLUTION PUMP	1
15	P-201HT	HYDRAULIC TURBINE	1
16	P-201AT	SEMI – LEAN SOLUTION PUMP TURBINE	1
17	P-202AB	LEAN SOLUTION PUMP	1
18	P-203AB	REFLUX PUMP	1
19	P-204	SOLVENT TRANSFER	1
20	P-205	ANTIFOAM INJECTION PUMP	1
21	P-206AB	CONDENSATE INJECTION PUMP	1
22	P-207AB	STEAM CONDENSATE RECOVERY PUMP	1
23	P-208AB	P – 201A, B AUX. L.O. PUMP	1

	TAG.NO.	SERVICE	NO. REQ.
24	*P-301AB*	SYN. GAS COMP'R CONDENSATE RETURN PUMP	2
25	P-302AB	SYN. GAS COMP'R LUBE OIL PUMP	2
26	P302AT-	SYN. GAS COMP'R L.O.& L.P.S.O. PUMP TURBINE	1
27	P-303AB	SYN. GAS COMP'R L.P. SEAL OIL PUMP	2
28	P-304AB	SYN. GAS COMP'R H.P. SEAL OIL PUMP	1
29	P-304AT	SYN. GAS COMP'R H.P.S.O. PUMP TURBINE	1
30	P-311AB	SYN. GAS COMP'R CONDSATE RETURN PUMP	2
31	P-312AB	AIR COMP'R LUBE OIL PUMP	2
32	P-312AT	AIR COMP'R L.O. PUMP TURBINE	1
33	P-321AB	N.G. & REF. COMP'R CONDSATE RETURN PUMP	2
34	P-322AB	N.G. & REF. COMP'R LUBE OIL PUMP	2
35	P-322AT	N.G. & REF. COMP'R L.O. & S.O. PUMP TURBINE	1
36	P-323AB	N.G. & REF. COMP'R SEAL OIL PUMP	2
37	P-401AB	AMMONIA PRODUCT PUMP	2

PUMPS FOR UREA UNIT

	Item No,	Services	No. REQ'D	New Supply	Repair	
1-	P-501AB	Ammonia Feed Pump	2			
2-	P-502AB	H.P.Carbamate Solution Pump	2			
3-	P-503AB	M.P.Carbamate Solution Pump	2			
4-	P-504AB	Stripping Tower Feed Pump	2			
5-	P-505AB	Ammonia Booster Pump	2			
6-	P-506AB	Steam Condensate Pump	2			
7-	P-508	H.P.Washing Pump	1			
8-	P-509AB	Carbamate Booster Pump	2			
9-	P-530AB	K-501 Condensate Retur1n Pump	2			
10-	P-531AB	K-501 Lube Oil Pump	2			
11-	P-532AB	K-501 Seal Oil Pump	2			
12-	P-531AT	P-531A Turbine	1			
13-	P-532AT	P-532A Turbine	1			

PUMPS FOR UTILITIES

	Item No.	Service	No. Req'd
1	P-711ABC	Cooling Water Circulating pump	3
2	P-712EDR	Fire Water pump Diesel engine	1
3	P-713AB	Corrosion Inhibitor Feed pump	2
4	P-718AB.	PH Control Chemical Feed pump	1.
5	P-714	Biocide Inhibitor & Sodium Hypo chloride Feed pump	1
6	P-719 AB	**P-711 Turbine Aux. L.O. pump**	2
7	P-721ABC	**Aluminum Sulphate Feed pump**	3
8	P-722AB	**Lean Solution Feed pump**	2
9	P-731AbcD	Filtrated Water pump	4
10	P-732AB	Sulphuric Acid Dosing pump for Cation	2
11	P-733A	Caustic Soda Dosing pump for Anion	1
12	P-734AB	Sulphuric Acid Dosing pump for Mixed Bed	2
13	P-735AB	Caustic Soda Dosing pump for Mixed Bed	2
14	P-736AB	Deminerlized Water Transfer pump	2
15	P-737B	Caustic Soda Dissolving Circulation pump	1
16	P-738B	Neutralized Effluent pump	1
17	P-740AB	Effluent pump	2
18	P-761B	Condensate Feed pump	1
19	P-765AB	Deionized Water pump	2
20	P-801ABC	K-801 Turbine aux.l.o. Pump	3
21	P-715	Waste Water pump	1

MITSUBISHI HEAVY INDUSTRIES, LTD.

CENTRIFUGAL PUMP DATA SHEET

Rev.	
Date	
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Plant	IRAQ EXP PROJECT					Item No.	P-101 A.B				
Customer	M.O.I IRAQ										
Order	563021					Service	HIGH PRESS. B.F.W PUMP				
Location	Indoor (Outdoor)					No. Req'd	Working 1	Spare 1	Total 2		
Regulation						Code					
Process Data											
Liquid	BOILER FEED WATER										
Capacity	Nor. 378 m³/h			Max. Point 1) 422 m³/h			Max. Point 2) 480 m³/h				
Pump Temp.	125.5 °c			Disch. Press.	1) 89.7	2) 84.8	kg/cm²G	NPSH Avail	11.5	m	
Sp. Gr. at Pump T.	939 kg/m³			Suct. Press.	2.3	2.2	kg/cm²G	NPSH Req'd	8.5 (at Pint 2))	m	
Vap. Press. at Pump T.	2.4035 kg/cm²A			Diff. Head	87.4	82.6	kg/cm²G		—		
Vis. at Pump T.	— cp.			Diff. Head	930	*880	m				
Corr. or Solid	—			Max. Suct. Press.	4.5		kg/cm²G	Duty	24	h/day	
Design Data											
Type	HORIZONTAL MULTI-STAGE PUMP.					Drive Type	A-STEAM TURBINE. B-MOTOR				
No. Stage	6					Design Press.			116	kg/cm²G	
Impeller Dia.	(MAX 355) mm		Type	CLOSED		Hydro. Test Press.	174(CASING)		10.5 (JACKET)	kg/cm²G	
Axis	BETWEEN BEARING		Split	VERTICAL		Seal System	(Gland)	Mech. Seal			
R.P.M.	2970					Mech. Seal	Single	Double			
Hydraulic HP					kw		Balance	Unbalance			
Efficiency	Nor 78	1) 79	2) 79	%			Self Flush	External Flush			
B.H.P.	1215	1270	1368	kw							
Control System	FORCED OIL SYSTEM										
Lubricating Oil System											
Cooling Water	Kind: CTW 34.6 °c			5.0 kg/cm²G		1.14 m³/h	0.0006 m²h°c/kcal				
	Gland: YES		Packing Box: YES			Pedestal: NO		Flush Cooler: NO			

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	TOP	8B	ANSI 150 lb RF	Cage Ring				Hydrostatic		NO
Outlet	TOP	6B	ANSI 900 lb RJ	Throat Bush				Balancing		NO
				Wear Ring	NO			Performance	YES	YES
				Gland				Running		YES
				Mech. Seal				NPSH		YES
								Overhaul	YES	YES

Materials					
Case	13Cr. STEEL	Mech. Seal	NO		
Impeller	13Cr. STEEL.	Cage Ring	NO	Tie Bolt	SCM5
Shaft	Ni,Cr,Mo,V,STEEL	Case Gasket	ASBESTOS.	Gland Stud	SUS 420 J2
Shaft Sleeve	15Cr STEEL	Case Wearing Ring	14 Cr. STEEL	Bearing	
Gland Packing	ASBESTOS	Imp. Wearing Ring	14 Cr. STEEL		

Motor					
Type	No.560L INDUCTION MOTOR	Volt.	6600 V	Drive Type	DIRECT DRIVE
Rated Output	1510 kw	Phase	3	Speed Reducer	NO
Cycle	50 Hz	Pole	2	Rotation (from PUMP)	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	Press. Guage	YES
Anchor Bolt		Drain Value	YES	Piping for C.W.	
GEAR COUP.		Tool	YES	Lube oil System	
Coupling Cover					

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD.			Model No.	HDBS-150/6		
Weight	Pump & Base: B) 3170 kg	Motor: 11,000 kg	Total:	14,170 kg			
Painting	A) 2920 kg	Turbine+Gear 11280 kg	Total:	14,200 kg			

Remarks

1. * marked Diff. Head Shows on pump performance curve (MCEC'S req'd head is 850m).
2. Slow turning of pump rotor is available.

		Checked by	Designed by	Date

MITSUBISHI HEAVY INDUSTRIES, LTD. 2/

CENTRIFUGAL PUMP DATA SHEET

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Plant	IPAQ EXP PROJECT					Item No.	P-104 A.B				
Customer	M.O.I IRAQ					Service	Low PRESS. BFW PUMP				
Order	563021					No. Req'd	Working 1	Spare 1	Total 2		
Location	Indoor (Outdoor)					Code					
Regulation											
Process Data											
Liquid	BOILER FEED WATER										
Capacity	~~Min.~~ Nor. 23.1 m³/h		~~Nor.~~ Point 1) 30.3 m³/h			Max. Point 2) 33.3 m³/h					
Pump Temp.	125.5 °c		Disch. Press. 1) 16.0		2) 15.3 kg/cm²G		NPSH Avail	9.5 m			
Sp. Gr. at Pump T.	939 kg/m³		Suct. Press. 2.3		2.3 kg/cm²G		NPSH Req'd	4.6 m			
Vap. Press. at Pump T.	2.4035 kg/cm² A		Diff. Head 13.7		13.0 kg/cm²G						
Vis. at Pump T.	cp.		Diff. Head 146.0		138.0 m (#2)						
Corr. or Solid	NONE		Max. Suct. Press. 4.5 kg/cm²G				Duty 24 h/day				
Design Data											
Type	HORIZONTAL MULTI-STAGE PUMP.						Drive Type	MOTOR DRIVEN			
No. Stage	5						Design Press.	22.5 kg/cm²G			
Impeller Dia.	(Max 160) mm		Type CLOSED				Hydro. Test Press.	33.7 kg/cm²G			
Axis	Between Bearing		Split VERTICAL				Seal System	(Gland) Mech. Seal			
R.P.M.	2960						Mech. Seal	Single Double			
Hydraulic HP	kw							Balance Unbalance			
Efficiency	Nor 57	1) 63	2) 64 %					Self Flush External Flush			
B.H.P.	16.5	17.9	18.3 kw								
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind: CTW 34.6 °c 5.0 kg/cm²G 0.24 m³/h 0.0006 m²h°c/kcal										
	Bearing: NO Packing Box: YES ~~Pedestal~~: Gland: YES ~~Flush Cooler~~										

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	SIDE	2½B	ANSI 125 FF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	2 B	ANSI 250 RF	Throat Bush				Balancing		NO
				Wear Ring				Performance	YES	YES
				Gland				Running		YES
				Mech. Seal				NPSH		YES
								Overhaul	YES	YES

Materials					
Case	FC 20	Mech. Seal	NO	Connecting Bolt.	SCM 3
Impeller	FC 20	Cage Ring	NO	~~Case Stud~~	
Shaft	S35C	Case Gasket	ASBESTOS	Gland Stud	SUS 420 J2
Shaft Sleeve	SUS 420 J2	Case Wearing Ring	FC 20	Bearing	NU 207K + H207/C3
Gland Packing	ASBESTOS	Imp. Wearing Ring	NO		

Motor					
Type	NO.200L-INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	22 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~ PUMP	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	By-Pass Orifice (Flanged Type)	#1
Anchor Bolt		~~Air &~~ Drain ~~Cock~~ Valve	YES	Companion Flange (Discharge & Suction)	YES
Flex. Coupling		Tool			
Coupling Cover		Piping for C.W			

Spare Parts (Refer to Spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information			
Manufacturer	TORISHIMA PUMP MFG CO., LTD.	Model No.	WL - 50/5
Weight	Pump & Base: 194 kg, Motor: 275 kg, Total: 469 kg		
Painting			

Remarks
1. All pump capacities include by-pass flow of 4.5 m³/H.
2. #1 marked flanges of by-pass orifice. to be welded of ANSI 300lb RF.
3. #2 marked Diff. Head shows on pump performance curve (MCEC'S reqd head is 135.4 m)

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MITSUBISHI HEAVY INDUSTRIES, LTD. 3

CENTRIFUGAL PUMP DATA SHEET

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Plant	IRAQ EXP. PROJECT					Item No.	P-107 A.B				
Customer	M.O.I IRAQ					Service	TURB COND. RETURN PUMP (for H.P. BFW PUMP)				
Order	563021					No. Req'd	Working 1	Spare 1	Total 2		
Location	Indoor (Outdoor)					Code					
Regulation											
Process Data											
Liquid											
Capacity	Min. m³/h	Nor. 11.5 m³/h	Max. 13.34 m³/h								
Pump Temp.	60 °c	Disch. Press.	3.5 kg/cm²G	NPSH Avail	2.5 m						
Sp. Gr. at Pump T.	983 kg/m³	Suct. Press.	−0.8 kg/cm²G	NPSH Req'd	1.2 m						
Vap. Press. at Pump T.	0.203 kg/cm²A	Diff. Head	4.3 kg/cm²G								
Vis. at Pump T.	cp.	Diff. Head	43.9 m								
Corr. or Solid	NONE	Max. Suct. Press.	1.0 kg/cm²G	Duty	24 h/day						
Design Data											
Type	HORIZONTAL VOLUTE			Drive Type	MOTOR DRIVEN						
No. Stage	1			Design Press.	5.6 kg/cm²G						
Impeller Dia.	(Max 209) mm	Type	CLOSED	Hydro. Test Press.	8.4 kg/cm²G						
Axis	Overhang	Split	VERTICAL	Seal System	Gland (Mech. Seal)						
R.P.M.	2950			Mech. Seal	(Single) Double						
Hydraulic HP	kw				Balance (Unbalance)						
Efficiency	44 %				(Self Flush) External Flush						
B.H.P.	3.6 kw										
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind : °c kg/cm²G — m³/h m³h°c/kcal										
	Bearing : NO Packing Box : NO Pedestal : NO Flush Cooler : NO										

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	2½ B	ANSI 125 lb FF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	2 B	ANSI 125 lb FF	Throat Bush				Balancing		NO
				Wear Ring				Performance	YES	
				Gland				Running		YES
				Mech. Seal	YES	SELF		NPSH		
								Overhaul	YES	YES

Materials					
Case	FC 25	Mech. Seal	STELLITE XC. SUS 316		
Impeller	FC 25	Cage Ring	—	Case Stud	S45C
Shaft	S45C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS 316 · Hcr Plating	Case Wearing Ring	FC 25	Bearing	No. 6305 C3
Gland Packing	—	Imp. Wearing Ring	—		
Motor					
Type	No 132M. INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	5.5 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~ PUMP)	cw (ccw)
Accessories					
Common Base	YES	V-Pulley	NO	Companion Flange.	YES
Anchor Bolt		~~Air &~~ Drain ~~Cock~~ Valve.	YES	(Discharge & Suction)	
Flex. Coupling		Tool	YES		
Coupling Cover					

Spare Parts (Refer to Spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD.			Model No.	CPK − G 40 − 20		
Weight	Pump & Base : 124 kg	Motor : 100 kg	Total : 224 kg				
Painting							
Remarks							

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CENTRIFUGAL PUMP DATA SHEET

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Plant	IRAQ EXP. PROJECT					Item No.	P-202 A.B				
Customer	M.O.I IRAQ					Service	LEAN SOLUTION PUMP				
Order	563021					No. Req'd	Working 1	Spare 1	Total 2		
Location	Indoor (Outdoor)					Code					
Regulation											
Process Data											
Liquid											
Capacity	Min.	m³/h	Nor. 182.4	m³/h	Max. 200	m³/h					
Pump Temp.	79.4	°c	Disch. Press.	29.0	kg/cm²G	NPSH Avail	9.5	m			
Sp. Gr. at Pump T.	1237	kg/m³	Suct. Press.	0.6	kg/cm²G	NPSH Req'd	8.0	m			
Vap. Press. at Pump T.	0.402	kg/cm²A	Diff. Head	28.4	kg/cm²G						
Vis. at Pump T.		cp.	Diff. Head	230	m						
Corr. or Solid	CO_2 DISSOLVED		Max. Suct. Press.	3.0	kg/cm²G	Duty	24	h/day			
Design Data											
Type	HORIZONTAL MULTI-STAGE.					Drive Type	MOTOR DRIVEN				
No. Stage	4					Design Press.	43.3	kg/cm²G			
Impeller Dia.	(Max 245)	mm	Type	CLOSED		Hydro. Test Press.	65	kg/cm²G			
Axis	Between Bearing		Split	VERTICAL		Seal System	Gland	(Mech. Seal)			
R.P.M.	2960					Mech. Seal	Single	(Double)			
Hydraulic HP		kw					(Balance)	(Unbalance)			
Efficiency	Nor 65	Max 66	%				Self Flush	(External Flush)			
B.H.P.	228	234.3	kw								
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind : CTW	34.6 °c	5.0 kg/cm²G	1.5 m³/h	0.0006 m²h°c/kcal						
	Bearing : YES(0.3 m³/H)	Packing Box : NO	Pedestal : NO	Flush Cooler : YES(3.3 m³/H)							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	TOP	5B	ANSI 150 lb RF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	5B	ANSI 300 lb RF	Throot Bush				Balancing		
				Wear Ring				Performance	YES	
				Gland				Running		YES
				Mech. Seal	YES	B.F.W	0.36	NPSH		
								Over hayl	YES	YES

Materials					
Case	SCS 13	Mech. Seal	WC x WC - WC x C.SUS316	J. Connecting Bolt.	SCM3
Impeller	SCS 13	Cage Ring	NO	~~Case Stud~~	
Shaft	SUS 304	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS 304	Case Wearing Ring	SCS 13	Bearing	NO. 2313
Gland Packing	—	Imp. Wearing Ring	SUS304+STELLITENo1		

Motor					
Type	NO. 500L. INDUCTION MOTOR	Volt.	6600 V	Drive Type	DIRECT DRIVE
Rated Output	260 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	Piping for C.W	YES
Anchor Bolt		~~Air &~~ Drain ~~Cock~~ Valve	YES.	Piping With cooler for flushing to Mech Seal	
~~Flex. Coupling~~ GEAR COUP.		Tool			
Coupling Cover					

Spare Parts (Refer to Spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD.		Model No.	125-4KM			
Weight	Pump & Base : 2760 kg	, Motor : 3000 kg,	Total : 5760 kg				
Painting	1. BFW for external flushing is fed to the vendor from MH; at 125.5°C						
Remarks	and 10 kg/cm²G.						

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CENTRIFUGAL PUMP DATA SHEET

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Plant	IRAQ EXP. PROJECT					Item No.	P-203 A.B				
Customer	M.O.I. IRAQ					Service	REFLUX PUMP				
Order	563021					No. Req'd	Working 1	Spare 1	Total 2		
Location	Indoor (Outdoor)					Code					
Regulation											
Process Data											
Liquid	CONDENSATE										
Capacity	Min.	m³/h	Nor.	42.6	m³/h	Max.	51	m³/h			
Pump Temp.	50	°c	Disch. Press.	6.7	kg/cm²G	NPSH Avail	9.0	m			
Sp. Gr. at Pump T.	988	kg/m³	Suct. Press.	0	kg/cm²G	NPSH Req'd	2.5	m			
Vap. Press. at Pump T.	0.13	kg/cm²A	Diff. Head	6.7	kg/cm²G		—				
Vis. at Pump T.		cp.	Diff. Head	67.8	m						
Corr. or Solid	NONE		Max. Suct. Press.	2.0	kg/cm²G	Duty	24	h/day			
Design Data											
Type	HORIZONTAL VOLUTE					Drive Type	MOTOR DRIVEN				
No. Stage	1					Design Press.	9.0	kg/cm²G			
Impeller Dia.	(MAX 260) mm		Type	CLOSED		Hydro. Test Press.	13.5	kg/cm²G			
Axis	Overhang		Split	VERTICAL		Seal System	(Gland)	Mech. Seal			
R.P.M.	2960					Mech. Seal	Single	Double			
Hydraulic HP		kw					Balance	Unbalance			
Efficiency	Nor 50	MAX 55 %					Self Flush	External Flush			
B.H.P.	15.7	17 kw									
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind :	°c	kg/cm²G	—	m³/h	m²h°c/kcal					
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler: NO							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	4 B	ANSI 1b 125 FF	Cage Ring	NO			Hydrostatic	YES	NO
Outlet	TOP	2½ B	ANSI 1b 125 FF	Throat Bush				Balancing		
				Wear Ring				Performance		
				Gland	YES	SELF		Running		YES
				Mech. Seal	NO			NPSH		
Materials								Overhaul	YES	YES
Case	FC 25		Mech. Seal	NO						
Impeller	SCS 13		Cage Ring	NO				Case Stud	S45C	
Shaft	SUS304		Case Gasket	ASBESTOS				Gland Stud	SUS 304	
Shaft Sleeve	SUS316 Hcr. plating		Case Wearing Ring	FC 25				Bearing	NO. 6307 C3	
Gland Packing	ASBESTOS		Imp. Wearing Ring	NO						
Motor										
Type	NO200.L.INDUCTION MOTOR		Volt.	380 V				Drive Type	DIRECT DRIVE	
Rated Output	22 kw		Phase	3				Speed Reducer		
Cycle	50 Hz		Pole	2				Rotation (from ~~driver~~ PUMP)	cw (ccw)	
Accessories										
Common Base	YES		V-Pulley	NO —						
Anchor Bolt			~~Air &~~ Drain ~~Cock~~ Valve	YES						
Flex. Coupling			Tool							
Coupling Cover										

Spare Parts (Refer to spare parts List)

Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information

Manufacturer	TORISHIMA PUMP MFG CO., LTD			Model No.	CPK · 0 65 - 26		
Weight	Pump & Base : 292 kg	Motor : 320 kg	Total : 612 kg				
Painting							
Remarks							

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Plant	IRAQ EXP. PROJECT					Item No.	P-204					
Customer	M.O.I IRAQ											
Order	563021					Service	SOLVENT TRANSFER PUMP					
Location	Indoor (Outdoor)					No. Req'd	Working 1	Spare 0	Total 1			
Regulation						Code						
Process Data												
Liquid	CATACARB SOLUTION											
Capacity	Min. m³/h	Nor. m³/h	Max. 50 m³/h									
Pump Temp.	Nor 30 MAX 105 * °c	Disch. Press.	2.7	kg/cm²G	NPSH Avail	m						
Sp. Gr. at Pump T.	1270 kg/m³	Suct. Press.	0	kg/cm²G	NPSH Req'd	3.0 m						
Vap. Press. at Pump T.	MAX 1.0 kg/cm²A	Diff. Head	2.7	kg/cm²G								
Vis. at Pump T.	cp.	Diff. Head	21.3	m								
Corr. or Solid		Max. Suct. Press.	0.25	kg/cm²G	Duty	INTERMITENT h/day						
Design Data												
Type	VERTICAL VOLUTE				Drive Type	MOTOTOR DRIVEN						
No. Stage	1				Design Press.	3.62 kg/cm²G						
Impeller Dia.	(MAX 260) mm	Type	CLOSED		Hydro. Test Press.	5.5 kg/cm²G						
Axis		Split	HORIZONTAL		Seal System	NONE	Gland	Mech. Seal				
R.P.M.	1450				Mech. Seal		Single	Double				
Hydraulic HP	kw						Balance	Unbalance				
Efficiency	52 %						Self Flush	External Flush				
B.H.P.	7.07 kw											
Control System												
Lubricating Oil System	GREASE											
Cooling Water	Kind : °c kg/cm²G — m³/h m²h°c/kcal											
	Bearing : NO Packing Box : NO Pedestal : NO Flush Cooler: NO											

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	BOTTOM			Cage Ring				Hydrostatic		NO
Outlet	TOP	2½B	ANSI 150 lb RF	Throat Bush	NO			Balancing	YES	
				Wear Ring				Performance		
				~~Gland~~ Metal	YES		0.6	Running		YES
				Mech. Seal	NO			NPSH	NO	NO
								Overhaul	YES	YES

Materials					
Case	FC 20	Mech. Seal	NO		
Impeller	FC 20	Cage Ring	NO	Case Stud	SUS 304
Shaft	S 35 C	Case Gasket (Packing)	VITON-B	~~Gland Stud~~	
Shaft Sleeve	SUS304 STELLITE COAT.	Case Wearing Ring	2% Ni – FC	Bearing	NO. 6309
Gland Packing	NO	Imp. Wearing Ring	NO	Metal	2% Ni – FC

Motor					
Type No.	L5-160L INDCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	11 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	4	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	Flushing piping with valve,	YES
Anchor Bolt	YES	Air & Drain Cock	NO		
Flex. Coupling	YES	Tool	YES		
Coupling Cover	NO				

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

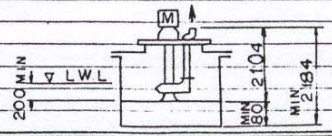
Information

Manufacturer TORISHIMA PUMP MFG CO., LTD. Model No. 65 – CVS

Weight | Pump & Base : 550 kg , Motor : 180 kg, Total : 730 kg

Painting

Remarks 1. * - marked temperature means mechanical design temperature. Max. availabe temperature for operation is 85°C.



Checked by	Designed by	Date
H. Kawtam	H. Tanaimoto	Oct. 15 '72

MITSUBISHI HEAVY INDUSTRIES, LTD.

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Plant	IRAQ EXP. PROJECT					Item No.	P – 206 A.B				
Customer	M.O.I. IRAQ										
Order	563021					Service	CONDENSATE INJECTION PUMP				
Location	Indoor (Outdoor)					No. Req'd	Working 1	Spare 1	Total 2		
Regulation						Code					
Process Data											
Liquid	CONDENSATE										
Capacity	Min.	m³/h	Nor.	12.5	m³/h	Max.	13.6	m³/h			
Pump Temp.	133.3	°c	Disch. Press.	28.9	kg/cm²G	NPSH Avail	20	m			
Sp. Gr. at Pump T.	931	kg/m³	Suct. Press.	21.1	kg/cm²G	NPSH Req'd	2.4	m			
Vap. Press. at Pump T.	3.04	kg/cm² A	Diff. Head	7.8	kg/cm²G						
Vis. at Pump T.		cp.	Diff. Head	83.8	m						
Corr. or Solid	CO_2 DISSOLUED		Max. Suct. Press.	24.5	kg/cm²G	Duty	24	h/day			
Design Data											
Type	HORIZONTAL VOLUTE.					Drive Type	MOTOR DRIVEN				
No. Stage	1					Design Press.	32.5 (for CASE)		kg/cm²G		
Impeller Dia.	(Max 260) mm		Type	CLOSED		Hydro. Test Press.	CASE 49 JACKET 10.5		kg/cm²G		
Axis	Overhang		Split	VERTICAL		Seal System	Gland	(Mech. Seal)			
R.P.M.	2960					Mech.-Seal	(Single)	Double			
Hydraulic HP		kw					(Balance)	Unbalance			
Efficiency	32	%					*1 (Self Flush)	External Flush			
B.H.P.	9.02	kw									
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind : CTW 34.6 °c	5.0 kg/cm²G	1.44 m³/h	0.0006 m²h°c/kcal							
	Bearing : NO	Packing Box : YES 0.24 m³/H	Pedestal : NO	Flush Cooler : YES 1.2 m³/H							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	2B	ANSI 300 lb RF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	1½ B	ANSI 300 lb RF	Throat Bush				Balancing		
				Wear Ring				Performance	YES	
				Gland				Running		YES
				Mech. Seal	YES	SELF		NPSH		
								Over haul	YES	YES

Materials					
Case	SCS 13	Mech. Seal	WC x C SUS 316		
Impeller	SCS 13	Cage Ring	NO.	Case Stud	SUS 304
Shaft	SUS 304	Case Gasket	TEFLON	Gland Stud	SUS 304
Shaft Sleeve	SUS 316 HCr. Plating	Case Wearing Ring	SUS316	Bearing	No. 6409C3/7309DB
Gland Packing	NO	Imp. Wearing Ring	SUS316		

Motor					
Type	NO. IBOM · INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	15 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	Mini. Flow Orifice	YES
Anchor Bolt		~~Air~~ & Drain ~~Cock~~ Valve.	YES	Self Flushing System with Cooler	YES
Flex. Coupling		Tool	YES		
Coupling Cover					

Spare Parts (Refer to Spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD			Model No.	CPK·C 40–26		
Weight	Pump & Base : 237 kg	Motor : 230 kg	Total : 467 kg				
Painting							
Remarks	1. *1. Self-flushing is done through the Cooler						
	2. All pump Capacities Include by-pass flow of 2 m³/H.						

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Plant	IRAQ EXP PROJECT						Item No.	P-207 A,B				
Customer	M·O·I IRAQ						Service	STEAM CONDENSATE RECOVERY PUMP				
Order	563021						No. Req'd	Working 1	Spare 1	Total 2		
Location	Indoor (Outdoor)						Code					
Regulation												
Process Data												
Liquid	STEAM CONDENSATE											
Capacity	Min.	m³/h	Nor.	16.7	m³/h	Max.	18.4	m³/h				
Pump Temp.	141.1	°c	Disch. Press.	5.04	kg/cm²G	NPSH Avail	2.5	m				
Sp. Gr. at Pump T.	925	kg/m³	Suct. Press.	3.04	kg/cm²G	NPSH Req'd	2.0	m				
Vap. Press. at Pump T.	3.8	kg/cm² A	Diff. Head	2.0	kg/cm²G							
Vis. at Pump T.		cp.	Diff. Head	21.6	m							
Corr. or Solid	NONE		Max. Suct. Press.	4.0	kg/cm²G	Duty	24	h/day				
Design Data												
Type	HORIZONTAL VOLUTE					Drive Type	MOTOR DRIVEN					
No. Stage	1					Design Press.	6.33	kg/cm²G				
Impeller Dia.	(Max 169)	mm	Type	CLOSED		Hydro. Test Press.	9.5	kg/cm²G				
Axis	Overhang		Split	VERTICAL		Seal System	Gland (Mech. Seal)					
R.P.M.	2950					Mech. Seal	(Single) Double					
Hydraulic HP		kw					Balance (Unbalance)					
Efficiency	Mor. 47	Max 48	%				(Self Flush) External Flush					
B.H.P.	1.96	2.1	kw									
Control System												
Lubricating Oil System	OIL BATH											
Cooling Water	Kind: CTW	34.6 °c	5.0	kg/cm²G	0.18	m³/h	0.0006	m²h°c/kcal				
	Bearing: NO	Packing Box: YES		Pedestal: NO		Flush Cooler: NO						

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	2½B	ANSI 10 125 FF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	2B	ANSI 10 125 FF	Throat Bush				Balancing	YES	
				Wear Ring				Performance		
				Gland				Running		YES
				Mech. Seal	YES	SELF		NPSH		
								Overhaul	YES	YES

Materials					
Case	FC 25	Mech. Seal	WCXC SUS 316		
Impeller	FC 25	Cage Ring	NO	Case Stud	S45C
Shaft	S45C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Mech. Sleeve	SUS 316 Hcr. Plating	Case Wearing Ring	FC 25	Bearing	NO.6305C3
Gland Packing		Imp. Wearing Ring	NO		
Motor					
Type	NO 132 S INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	3.7 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from PUMP)	cw (ccw)
Accessories					
Common Base	YES	V-Pulley	NO	Companion flange	YES
Anchor Bolt		Drain Valve	YES	(DISCHARGE & SUCTION)	
Flex. Coupling		Tool	YES		
Coupling Cover		Piping for C.W.	YES		
Spare Parts (Refer to spare parts list)					
Impeller		Case Gasket		Case Wearing Ring	
Shaft		Rubber for Cpl'g			
Bearing		Gland Packing			
Mech. Seal		Imp. Ring			

Information

Manufacturer TORISHIMA PUMP MFG CO., LTD. Model No. CPK · G 40-16

Weight | Pump & Base: 114 kg, Motor: 90 kg, Total: 204 kg

Painting

Remarks

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Plant	IRAQ EXP. PROJECT					Item No.	P-401 A.B				
Customer	M.O.I IRAQ					Service	AMMONIA PRODUCT PUMP				
Order	563021					No. Req'd	Working 1	Spare 1	Total 2		
Location	Indoor (Outdoor)					Code					
Regulation											
Process Data											
Liquid	LIQUID AMMONIA										
Capacity	Min.	m³/h	Nor.	18	m³/h	Max.	60	m³/h			
Pump Temp.	-31.9	°c	Disch. Press.	4.5	kg/cm²G	NPSH Avail	2.5	m			
Sp. Gr. at Pump T.	680	kg/m³	Suct. Press.	0.25	kg/cm²G	NPSH Req'd	2.3	m			
Vap. Press. at Pump T.	1.109	kg/cm²A	Diff. Head	4.25	kg/cm²G						
Vis. at Pump T.		cp.	Diff. Head	62.5	m						
Corr. or Solid	NONE		Max. Suct. Press.	10.5	kg/cm²G	Duty	24	h/day			
Design Data											
Type	HORIZONTAL VOLUTE					Drive Type	MOTOR DRIVE				
No. Stage	1					Design Press.	15.0	kg/cm²G			
Impeller Dia.	(Max 260)	mm	Type	CLOSED		Hydro. Test Press.	22.5	kg/cm²G			
Axis	Overhang		Split	VERTICAL		Seal System	Gland	*1 (Mech. Seal)			
R.P.M.	2960					Mech. Seal	(Single)	Double			
Hydraulic HP		kw					(Balance)	Unbalance			
Efficiency	Nor 27.5	MAX 58	%				(Self Flush)	External Flush			
B.H.P.	8.0	11.75	kw								
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind :	°c	kg/cm²G	—	m³/h	m²h°c/kcal					
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler : NO							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	4B	ANSI 1b 300 RF	Cage Ring				Hydrostatic		NO
Outlet	TOP	2½B	ANSI 1b 300 RF	Throat Bush	NO			Balancing	YES	
				Wear Ring				Performance		
				Gland				Running		YES
				Mech. Seal	YES	SELF		NPSH		
								Over haul	YES	YES

Materials					
Case	SCPL 1	Mech. Seal	WCXC. SUS 316		
Impeller	SCS 13	Cage Ring	NO	Case Stud	SUS 304
Shaft	SNC 2	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS 316 Hcr. Plating	Case Wearing Ring	FC 25	Bearing	NO. 6307 C3
Gland Packing		Imp. Wearing Ring	NO		

Motor					
Type	INDUCTION MOTOR NO 180L	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	19 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	Anti-freezing piping :	YES
Anchor Bolt		~~Air &~~ Drain ~~Cock~~ Valve.	YES		
Flex. Coupling		Tool	YES		
Coupling Cover					

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD.			Model No.	CPK·E 65 — 26		
Weight	Pump & Base : 247 kg	Motor : 250 kg	Total : 497 kg				
Painting							
Remarks	1. *1. Seal cover of Mech. seal shall be usually quenched with dry air.						

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CENTRIFUGAL PUMP DATA SHEET

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Plant	IRAQ EXP PROJECT					Item No.	P - 701 A.B				
Customer	M.O.I , IRAQ										
Order	563023					Service	RIVER WATER INTAKE PUMP				
Location	Indoor (Outdoor)					No. Req'd	Working 1	Spare 1	Total 2		
Regulation						Code					
Process Data											
Liquid	RIVER WATER										
Capacity	Min.	m³/h	Nor.		m³/h	Max.	1380	m³/h			
Pump Temp.	32	°c	Disch. Press.	3.6	kg/cm²G	NPSH Avail	8.0	m			
Sp. Gr. at Pump T.	1 000	kg/m³	Suct. Press.	0	kg/cm²G	NPSH Req'd		m			
Vap. Press. at Pump T.	0.0485	kg/cm²A	Diff. Head	3.6	kg/cm²G						
Vis. at Pump T.		cp.	Diff. Head	36	m						
Corr. or Solid	SOME SAND INTAKING		Max. Suct. Press.	0.5	kg/cm²G	Duty	24	h/day			
Design Data											
Type	VERTICAL MIXED FLOW					Drive Type	MOTOR DRIVEN				
No. Stage	1					Design Press.	5.4	kg/cm²G			
Impeller Dia.	(Max. 592) mm		Type	CLOSED		Hydro. Test Press.	8.1	kg/cm²G			
Axis			Split	HORIZONTAL		Seal System	(Gland)	Mech. Seal			
R.P.M.	970					Mech. Seal	Single	Double			
Hydraulic HP		kw					Balance	Unbalance			
Efficiency	75	%					Self Flush	External Flush			
B.H.P.	180	kw									
Control System											
Lubricating Oil System	GREASE										
Cooling Water	Kind :	°c	kg/cm²G	——	m³/h	m²h°c/kcal					
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler : NO							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	BOTTOM			Cage Ring	} NO			Hydrostatic	} YES	} NO
Outlet	SIDE	16B	JIS. 5K FF	Throat Bush				Balancing		
				Wear Ring				Performance		
				~~Gland~~ Cutless Bearing	YES	Lub. Water	1.8	Running		} YES
				Mech. Seal	NO			NPSH	NO	
								Overhaul	YES	YES

Materials					
Case	FC 20	Mech. Seal	NO		
Impeller	FC 20	Cage Ring	NO	Case Stud	S 45C
Shaft	S35C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS 304	Case Wearing Ring	FC 20	Bearing	NO. 7319 BDB
Gland Packing	ASBESTOS	Imp. Wearing Ring	NO		

Motor					
Type	NO. 4003, INDUCTION MOTOR	Volt.	6600 V	Drive Type	DIRECT DRIVE
Rated Output	200 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	6	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	NO	V-Pulley	NO	Lub. water piping	YES
~~Setting~~ ~~Anchor~~ Bolt	YES	Drain Valve	YES		
Flex. Coupling	YES	Tool	YES		
Coupling Cover	NO	Motor pedestal	YES		

Spare Parts (Refer to spare parts list)			
Impeller	Case Gasket	Case Wearing Ring	
Shaft	Rubber for Cpl'g		
Bearing	Gland Packing		
Mech. Seal	Imp. Ring		

Information					
Manufacturer	TORISHIMA PUMP MFG CO., LTD.	Model No.	400 - SPV		
Weight	Pump & Base : 2513 kg	Motor : 2500 kg	Total : 5013 kg		
Painting					
Remarks					

MITSUBISHI HEAVY INDUSTRIES, LTD.

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CENTRIFUGAL PUMP DATA SHEET

Rev. / Date / Check

Plant	1300 T/D UREA PLANT					Item No.	P-503 A.B					
Customer	M.O.I IRAQ					Service	M.P CARBAMATE SOLUTION PUMP					
Order	563022					No. Req'd	Working 1	Spare 1	Total 2			
Location	Indoor (Outdoor)					Code						
Regulation												
Process Data												
Liquid	CARBAMATE SOLUTION											
Capacity	Min. m³/h	Nor. 13.5 m³/h	Max. 16.0 m³/h									
Pump Temp.	30 ~ 50 °c	Disch. Press. 23.0 kg/cm²G	NPSH Avail 5.0 m									
Sp. Gr. at Pump T.	961 kg/m³	Suct. Press. 3.5 kg/cm²G	NPSH Req'd 2.5 m									
Vap. Pres. at Pump T.	4.0 kg/cm² A	Diff. Head 19.5 kg/cm²G										
Vis. at Pump T.	2.2 cp.	Diff. Head 203 m										
Corr. or Solid	Corr.	Max. Suct. Press. 6.1 kg/cm²G	Duty 24 h/day									
Design Data												
Type	HORIZONTAL MULTI STAGE		Drive Type	MOTOR DRIVEN								
No. Stage	5		Design Press.	26.3 kg/cm²G								
Impeller Dia.	(Max 180) mm	Type CLOSED	Hydro. Test Press.	40 kg/cm²G								
Axis	Between Bearing	Split VERTICAL	Seal System	Gland (Mech. Seal)								
R.P.M.	2960		Mech. Seal	Single (Double)								
Hydraulic HP	kw			(Balance) X (Unbalance)								
Efficiency	Nor. 36	MAX. 40 %		Self Flush (External Flush)								
B.H.P.	20.2	21.2 kw										
Control System												
Lubricating Oil System	OIL BATH											
Cooling Water	Kind : CTW	34.6 °c	5.0 kg/cm²G	0.36 m³/h	0.0006 m²h°c/kcal							
	Bearing : YES	Packing Box : NO	Pedestal : NO	Flush Cooler : NO								

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	TOP	2 1/2 B	ANSI 150 lb RF	Cage Ring	NO			Hydrostatic	YES	NO
Outlet	TOP	2 B	ANSI 300 lb RF	Throat Bush				Balancing		
				Wear Ring				Performance		
				Gland				Running		YES
				Mech. Seal	YES	BFW *1	0.24	NPSH		
Materials								Overhaul	YES	YES

Case	SCS 13	Mech. Seal	WCXWC. WCXC. SUS 316	Connecting Bolt	SCM 3
Impeller	SCS 13	Cage Ring	NO	Case Stud	
Shaft Mech.	SUS 304	Case Gasket	ASBESTOS	Gland Stud	SUS 304
~~Shaft~~ Sleeve	SUS 316	Case Wearing Ring	SCS 13	Bearing	NO. 7307DB / 5307
Gland Packing	NO	Imp. Wearing Ring	NO		
Motor					
Type	INDUCTION MOTOR NO.225-S	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	30 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~ PUMP)	cw (ccw)
Accessories					
Common Base	YES	V-Pulley	NO	Ext. Flushing Piping with Sight Grass	YES
Anchor Bolt		~~Air~~ & Drain ~~Cock~~ Valve	YES		
Flex. Coupling		Tool	YES		
Coupling Cover					

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD.	Model No.	65 x 50 – 5 KM				
Weight	Pump & Base : 1510 kg	Motor : 275 kg.	Total : 1785 kg				
Painting							
Remarks							

1. *1. Condensate of 5 ~ 10kg/cm²G, 60°C is used for external flushing.
   Pump shall be designed to endure against press of
   12 kg/cm²G at pump – stop.

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CENTRIFUGAL PUMP DATA SHEET

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Plant	1300 T/D UREA PLANT				Item No.	P-505 A.B					
Customer	M.O.I IRAQ				Service	AMMONIA BOOSTER PUMP					
Order	563022				No. Req'd	Working 1	Spare 1	Total 2			
Location	Indoor (Outdoor)				Code						
Regulation											
Process Data											
Liquid	AMMONIA										
Capacity	Min.	m³/h	Nor.	84 m³/h	Max.	96 m³/h					
Pump Temp.	28 °c		Disch. Press.	23 kg/cm²G	NPSH Avail	4.0 m					
Sp. Gr. at Pump T.	598 kg/m³		Suct. Press.	16.4 kg/cm²G	NPSH Req'd	2.7 m					
Vap. Press. at Pump T.	11.2 kg/cm²A		Diff. Head	6.6 kg/cm²G							
Vis. at Pump T.	0.204 cp.		Diff. Head	110.4 m							
Corr. or Solid	NONE		Max. Suct. Press.	23 kg/cm²G	Duty	24 h/day					
Design Data											
Type	HORIZONTAL VOLUTE				Drive Type	MOTOR DRIVEN					
No. Stage	1				Design Press.	30 kg/cm²G					
Impeller Dia.	(Max 320) mm	Type	CLOSED		Hydro. Test Press.	45 kg/cm²G					
Axis	Overhang	Split	VERTICAL		Seal System	Gland (Mech. Seal)					
R.P.M.	2960				Mech. Seal	(Single) Double					
Hydraulic HP	kw					(Balance) Unbalance					
Efficiency	Nor 51 MAX 55 %					(Self Flush) External Flush					
B.H.P.	30.2 31.5 kw										
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind :	°c	kg/cm²G	–	m³/h	m³h°c/kcal					
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler : NO							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	5 B	ANSI 150 lb RF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	3 B	ANSI 300 lb RF	Throat Bush				Balancing		
				Wear Ring				Performance	YES	
				Gland				Running		YES
				Mech. Seal	YES	SELF		NPSH		
								Overhaul	YES	YES

Materials					
Case	SC 46	Mech. Seal	WCX C. SUS 316		
Impeller	SCS 1	Cage Ring	NO	Case Stud	S45C
Shaft	S45C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS316 Hcr. Plating	Case Wearing Ring	SUS420J2	Bearing	NO. 6411 C3/7311DB
Gland Packing	NO	Imp. Wearing Ring	NO		
Motor					
Type	INDUCTION MOTOR NO. 225M	Volt.	380 V	Drive Type	DIRECT Drive
Rated Output	37 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~ PUMP)	cw (ccw)
Accessories					
Common Base	YES	V-Pulley	NO		
Anchor Bolt	YES	~~Air & Drain Cock~~ Valve	YES		
Flex. Coupling		Tool	YES		
Coupling Cover					

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA POMP MFG CO., LTD.	Model No.	CPK-E 80-32				
Weight	Pump & Base : 362 kg	Motor : 375 kg	Total : 737 kg				
Painting							
Remarks							

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CENTRIFUGAL PUMP DATA SHEET

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Plant	1300 T/D UREA PLANT			Item No.	P-506 / A.B				
Customer	M.O.I IRAQ								
Order	563022			Service	STEAM CONDENSATE PUMP				
Location	Indoor (Outdoor)			No. Req'd	Working 1	Spare 1	Total 2		
Regulation				Code					
Process Data									
Liquid	STEAM CONDENSATE								
Capacity	Min.	m³/h	Nor. 37	m³/h	Max. 46.0	m³/h			
Pump Temp.	80~100	°c	Disch. Press.	30	kg/cm²G	NPSH Avail	4.5	m	
Sp. Gr. at Pump T.	958	kg/m³	Suct. Press.	0	kg/cm²G	NPSH Req'd	3.5	m	
Vap. Press. at Pump T.	1.0	kg/cm²A	Diff. Head	30	kg/cm²G				
Vis. at Pump T.	0.285	cp.	Diff. Head	313	m				
Corr. or Solid	NO		Max. Suct. Press.	0.7	kg/cm²G	Duty	24	h/day	
Design Data									
Type	HORIZONTAL MULTI-STAGE PUMP			Drive Type	MOTOR DRIVEN				
No. Stage	8			Design Press.	37.5	kg/cm²G			
Impeller Dia.	(Max 185) mm	Type	CLOSED	Hydro. Test Press.	56.2	kg/cm²G			
Axis	Between Bearing	Split	VERTICAL	Seal System	(Gland)	Mech. Seal			
R.P.M.	2960			Mech. Seal	Single	Double			
Hydraulic HP		kw			Balance	Unbalance			
Efficiency	Nor 63	MAX 68	%		Self Flush	External Flush			
B.H.P.	51	55.1	kw						
Control System									
Lubricating Oil System	OIL BATH								

Cooling Water	Kind: CTW	34.6 °c	5.0 kg/cm²G	0.06 m³/h	0.0006 m²h°c/kcal
	~~Bearing~~: Gland : YES	Packing Box:	Pedestal:	Flush Cooler:	

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	SIDE	3B	ANSI 125 lb FF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	2½B	ANSI 150 lb RF	Throat Bush				Balancing		
				Wear Ring				Performance	YES	
				Gland				Running		YES
				Mech. Seal				NPSH		

Materials					
Case	FC 20	Mech. Seal	NO	Overhaul	YES / YES
Impeller	FC 20	Cage Ring	NO	Connecting Bolt	SCM3
Shaft	S35C	Case Gasket	ASBESTOS	~~Case Stud~~	
Shaft Sleeve	SUS 420 J2	Case Wearing Ring	FC 20	Gland Stud	SUS 420 J2
Gland Packing	ASBESTOS	Imp. Wearing Ring	NO	Bearing	NU207K + H207/C3

Motor					
Type	NO280SINDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	60 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from ~~driver~~)	cw (ccw)

Accessories				**PUMP**	
Common Base	YES	V-Pulley	NO	By-Pass Orifice (Flanged Type)	*1
Anchor Bolt		~~Air &~~ Drain ~~Cock~~ Valve	YES	Companion Flange (Discharge & Suction)	YES
Flex. Coupling		Tool	YES		
Coupling Cover		Piping for C.W	YES		

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information					
Manufacturer	TORISHIMA PUMP MFG CO., LTD.		Model No.	WL-65/8	
Weight	Pump & Base: 381 kg	Motor: 680 kg	Total: 1061 kg		
Painting					

Remarks 1. All pump capacities include by-pass flow of 6m³/H

2. *1. marked franges of by-pass orifice to be welded of ANSI 300 lb RF.

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CENTRIFUGAL PUMP DATA SHEET

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Plant	1300 T/D UREA PLANT				Item No.	P-551 A.B					
Customer	M.O.I IRAQ										
Order	563022				Service	CRYSTALLIZER FEED PUMP					
Location	Indoor (Outdoor)				No. Req'd	Working 1	Spare 1	Total 2			
Regulation					Code						
Process Data											
Liquid	UREA SOLUTION										
Capacity	Min.	m³/h	Nor.	m³/h	Max.	210 m³/h					
Pump Temp.	65~90 °c		Disch. Press.	4.0 kg/cm²G		NPSH Avail	2.5 m				
Sp. Gr. at Pump T.	1175 kg/m³		Suct. Press.	0 kg/cm²G		NPSH Req'd	2.2 m				
Vap. Press. at Pump T.	0.6 kg/cm²A		Diff. Head	4.0 kg/cm²G							
Vis. at Pump T.	2.0 cp.		Diff. Head	34 m							
Corr. or Solid	Corr.		Max. Suct. Press.	0.95 kg/cm²G		Duty	24 h/day				
Design Data											
Type	HORIZONTAL VOLUTE					Drive Type	MOTOR DRIVEN				
No. Stage	1					Design Press.	5.3 kg/cm²G				
Impeller Dia.	(Max 404) mm		Type	CLOSED		Hydro. Test Press.	8.0 kg/cm²G				
Axis	Overhang		Split	VERTICAL		Seal System	(Gland) Mech. Seal				
R.P.M.	1450					Mech. Seal	Single Double				
Hydraulic HP	kw						Balance Unbalance				
Efficiency	66 %						Self Flush *1 (External Flush)				
B.H.P.	34.4 kw										
Control System											
Lubricating Oil System	OIL BATH										
Cooling Water	Kind :	°c	kg/cm²G	–	m³/h	m³h°c/kcal					
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler : NO							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	8 B	ANSI 150 lb RF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	6 B	ANSI 150 lb RF	Throat Bush				Balancing		
				Wear Ring				Performance	YES	
				Gland Packing	YES	Condensate	0.12	Running		YES
				Mech. Seal	NO			NPSH		
				Materials				Overhaul	YES	YES

Case	SCS 13	Mech. Seal	NO		
Impeller	SCS 13	Cage Ring		Case Stud	SUS 304
Shaft	SUS 304	Case Gasket	TEFLON	Gland Stud	SUS 304
Shaft Sleeve	SUS316 Hcr. Plating	Case Wearing Ring	NO	Bearing	NO. 6411 C3
Gland Packing	ASBESTOS	Imp. Wearing Ring	NO		
Motor					
Type NO.250M	INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	45 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	4	Rotation (from ~~driver~~ PUMP)	cw (ccw)
Accessories					
Common Base	YES	V-Pulley	NO		
Anchor Bolt		~~Air~~ & Drain ~~Cock~~ Valve.	YES		
Flex. Coupling		Tool	YES		
Coupling Cover					
Spare Parts (Refer to spare Parts list)					
Impeller		Case Gasket		Case Wearing Ring	
Shaft		Rubber for Cpl'g			
Bearing		Gland Packing			
Mech. Seal		Imp. Ring			
Information					

Manufacturer TORISHIMA PUMP MFG CO., LTD. Model No. CPK · C 150 – 40

Weight | Pump & Base : 575 kg , Motor : 465 kg, Total : 1040 kg

Painting

Remarks 1. *1 100°C 6ata Condensate shall be used for EXT-Flushing.

Checked by	Designed by	Date

MITSUBISHI HEAVY INDUSTRIES, LTD.

CENTRIFUGAL PUMP DATA SHEET

Rev.	
Date	
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Plant	1300 T/D UREA PLANT			Item No.	P-557 A,B			
Customer	M.O.I. IRAQ							
Order	563022			Service	MELT UREA PUMP			
Location	(Indoor) Outdoor			No. Req'd	Working 2	Spare 0	Total 2	
Regulation				Code				
Process Data								
Liquid	MELT UREA + UREA CRYSTAL (CRYSTAL 20% ~ 40%)							
Capacity	Min. m³/h	Nor. m³/h	Max. 252 m³/h					
Pump Temp.	90 ~ 140 °c	Disch. Press.	4.0 kg/cm²G	NPSH Avail	5 m			
Sp. Gr. at Pump T.	1210 kg/m³	Suct. Press.	0 kg/cm²G	NPSH Req'd	4 m			
Vap. Press. at Pump T.	kg/cm²A	Diff. Head	4.0 kg/cm²G					
Vis. at Pump T.	2.03 cp.	Diff. Head	33.1 m					
Corr. or Solid	Corr. Solid 20%~40%	Max. Suct. Press.	0.6 kg/cm²G	Duty	24 h/day			
Design Data								
Type	HORIZONTAL VOLUTE			Drive Type	MOTOR DRIVEN			
No. Stage	1			Design Press.	12 kg/cm²G			
Impeller Dia.	(Max 330) mm	Type	OPENED	Hydro. Test Press.	CASE. 18, JACKET. 10.5 kg/cm²G			
Axis	Overhang	Split	VERTICAL	Seal System	Gland (Mech. Seal)			
R.P.M.	1470			Mech. Seal	(Single) Double			
Hydraulic HP	kw				Balance (Unbalance)			
Efficiency	52 %				Self Flush *1.(External Flush)			
B.H.P.	52.8 kw							
Control System								
Lubricating Oil System	OIL BATH							
Cooling Water	Kind : CTW 34.6 °c		5.0 kg/cm²G	0.6 m³/h	0.0006 m²h°c/kcal			
	Bearing : YES (0.6 m³/Hr)	Packing Box : NO	Pedestal : NO	Flush Cooler : NO				

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	8B	ANSI 150 RF	Cage Ring				Hydrostatic		NO
Outlet	TOP	6B	ANSI 150 RF	Throat Bush	NO			Balancing		
				Wear Ring				Performance	YES	
				Gland				Running		YES
				Mech. Seal	YES		0.18	NPSH		

Materials					
Case	SCS 13	Mech. Seal	WC x WC		
Impeller	SCS 13	Cage Ring	NO	Case Stud	SUS 304
Shaft	SUS 304	Case Gasket	TEFLON	Gland Stud	SUS 304
Shaft Sleeve	SUS 316	Case Wearing Ring	NO	Bearing	NO. 6413 C3 / 7313 DB
Gland Packing	NO	Imp. Wearing Ring	NO		

Motor					
Type	INDUCTION MOTOR NO. 280S	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	60 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	4	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	Piping for C.W	YES.
Anchor Bolt		~~Air~~ & Drain ~~Cock~~ Valve.	YES	Steam & Ext. Flush	
Flex. Coupling		Tool	YES	C.W	
Coupling Cover					

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information					
Manufacturer	TORISHIMA PUMP MFG CO., LTD.	Model No.	200 x 150 - CSH.S (K)		
Weight	Pump & Base : 651 kg	Motor : 690 kg	Total : 1341 kg		
Painting					

Remarks 1. Urea liquid of 140°C shall be injected to the part of mech. seal, and steam of 6 ata, sat. shall be also injected to the bush of mech. seal.

Checked by	Designed by	Date

MITSUBISHI HEAVY INDUSTRIES, LTD.

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CENTRIFUGAL PUMP DATA SHEET

Rev. / Date / Check

Plant	IRAQ EXP PROJECT					Item No.	P - 701 A.B				
Customer	M.O.I . IRAQ					Service	RIVER WATER INTAKE PUMP				
Order	563023					No. Req'd	Working 1	Spare 1	Total 2		
Location	Indoor (Outdoor)					Code					
Regulation											
Process Data											
Liquid	RIVER WATER										
Capacity	Min. m³/h	Nor. m³/h	Max. 1380 m³/h								
Pump Temp.	32 °c	Disch. Press.	3.6	kg/cm²G	NPSH Avail	8.0 m					
Sp. Gr. at Pump T.	1.000 kg/m³	Suct. Press.	0	kg/cm²G	NPSH Req'd	m					
Vap. Press. at Pump T.	0.0485 kg/cm² A	Diff. Head	3.6	kg/cm²G							
Vis. at Pump T.	cp.	Diff. Head	36	m							
Corr. or Solid	SOME SAND INTAKING	Max. Suct. Press.	0.5	kg/cm²G	Duty	24 h/day					
Design Data											
Type	VERTICAL MIXED FLOW				Drive Type	MOTOR DRIVEN					
No. Stage	1				Design Press.	5.4 kg/cm²G					
Impeller Dia.	(Max. 592) mm	Type	CLOSED		Hydro. Test Press.	8.1 kg/cm²G					
Axis		Split	HORIZONTAL		Seal System	(Gland) Mech. Seal					
R.P.M.	970				Mech. Seal	Single Double					
Hydraulic HP	kw					Balance Unbalance					
Efficiency	75 %					Self Flush External Flush					
B.H.P.	180 kw										
Control System											
Lubricating Oil System	GREASE										
Cooling Water	Kind :	°c	kg/cm²G	m³/h	m²h°c/kcal						
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler: NO							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	BOTTOM			Cage Ring				Hydrostatic		NO
Outlet	SIDE	16B	JIS: 5K FF	Throat Bush	NO			Balancing	YES	
				Wear Ring				Performance		
				~~Gland~~ Cutless Bearing	YES	Lub. Water	1.8	Running		YES
				Mech. Seal	NO			NPSH	NO	
								Overhaul	YES	YES

Materials					
Case	FC 20	Mech. Seal	NO		
Impeller	FC 20	Cage Ring	NO	Case Stud	S 45C
Shaft	S35C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS 304	Case Wearing Ring	FC 20	Bearing	NO. 7319 BDB
Gland Packing	ASBESTOS	Imp. Wearing Ring	NO		

Motor					
Type	NO.4003. INDUCTION MOTOR	Volt.	6600 V	Drive Type	DIRECT DRIVE
Rated Output	200 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	6	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	NO	V-Pulley	NO	Lub. water piping	YES.
~~Setting~~ ~~Anchor~~ Bolt	YES	Drain Valve	YES		
Flex. Coupling	YES	Tool	YES		
Coupling Cover	NO	Motor pedestal	YES		

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD.			Model No.	400 - SPV		
Weight	Pump & Base :	2513 kg	Motor :	2500 kg.	Total :	5013 kg	
Painting							
Remarks							

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CENTRIFUGAL PUMP DATA SHEET

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Plant	IRAQ EXP. PROJECT				Item No.	P-715 A.B					
Customer	M.O.I IRAQ				Service	WASTE WATER PUMP					
Order	563023				No. Req'd	Working 1	Spare 1	Total 2			
Location	Indoor (Outdoor)				Code						
Regulation											
Process Data											
Liquid	WASTE WATER										
Capacity	Min.	m³/h	Nor.	m³/h	Max.	570 m³/h					
Pump Temp.	AMBIENT	°c	Disch. Press.	3.0	kg/cm²G	NPSH Avail	—	m			
Sp. Gr. at Pump T.	1.000	kg/m³	Suct. Press.	0	kg/cm²G	NPSH Req'd	—	m			
Vap. Press. at Pump T.	—	kg/cm²A	Diff. Head	3.0	kg/cm²G						
Vis. at Pump T.	—	cp.	Diff. Head	3.0	m						
Corr. or Solid	NONE		Max. Suct. Press.	0.15	kg/cm²G	Duty	24	h/day			
Design Data											
Type	VERTICAL MIXED FLOW				Drive Type	MOTOR DRIVEN					
No. Stage	1				Design Press.	5 kg/cm²G					
Impeller Dia.	(Max 372) mm		Type	CLOSED	Hydro. Test Press.	7.5 kg/cm²G					
Axis			Split	HORIZONTAL	Seal System	(Gland) Mech. Seal					
R.P.M.	1470				Mech. Seal	Single Double					
Hydraulic HP		kw				Balance Unbalance					
Efficiency	72	%				Self Flush External Flush					
B.H.P.	64.5	kw									
Control System											
Lubricating Oil System	GREASE										
Cooling Water	Kind :	°c	kg/cm²G	—— m³/h	m²h°c/kcal						
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler : NO							

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	BOTTOM			Cage Ring	NO			Hydrostatic	YES	NO
Outlet	SIDE	10B	JIS10KFF	Throat Bush				Balancing		
				Wear Ring				Performance		YES
				Gland				Running		
				Mech. Seal				NPSH	NO	
								Over haul	YES	YES

Materials					
Case	FC 20	Mech. Seal	NO		
Impeller	FC 20	Cage Ring	NO	Case Stud	S 45C
Shaft	S 35C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS 304	Case Wearing Ring	Ni FC	Bearing	NO. 7315 ADB
Gland Packing	ASBESTOS	Imp. Wearing Ring	NO		

Motor					
Type	INDUCTION MOTOR NO. L5-280M	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	75 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	4	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	NO	V-Pulley	NO	Piping for grease	YES
~~Anchor~~ Setting Bolt	YES	~~Air~~ & Drain ~~Cock~~	NO		
Flex. Coupling	YES	Tool	YES		
Coupling Cover	NO				

Spare Parts (Refer to spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	Grease Seal
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD			Model No.	250 – SPV		
Weight	Pump & Base : 1422 kg	Motor : 720 kg	Total : 2142 kg				
Painting							
Remarks							

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CENTRIFUGAL PUMP DATA SHEET

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Plant	IRAQ EXP. PROJECT			Item No.	P – 717 A.B				
Customer	M.O.I IRAQ								
Order	563023			Service	TURB. COND. RETURN PUMP				
Location	Indoor (Outdoor)			No. Req'd	Working 1	Spare 1	Total 2		
Regulation				Code					
Process Data									
Liquid	CONDENSATE								
Capacity	Min. m³/h	Nor. m³/h		Max. 29.6 m³/h					
Pump Temp.	60 °c	Disch. Press.	4.0 kg/cm²G	NPSH Avail	2.5 m				
Sp. Gr. at Pump T.	983 kg/m³	Suct. Press.	– 0.8 kg/cm²G	NPSH Req'd	1.5 m				
Vap. Press. at Pump T.	0.203 kg/cm²A	Diff. Head	4.8 kg/cm²G						
Vis. at Pump T.	cp.	Diff. Head	49 m						
Corr. or Solid		Max. Suct. Press.	1.0 kg/cm²G	Duty	24 h/day				
Design Data									
Type	HORIZONTAL VOLUTE			Drive Type	MOTOR DRIVEN				
No. Stage	1			Design Press.	5.0 kg/cm²G				
Impeller Dia.	(Max 209) mm	Type	CLOSED	Hydro. Test Press.	7.5 kg/cm²G				
Axis	Overhang	Split	VERTICAL	Seal System	Gland (Mech. Seal)				
R.P.M.	2960			Mech. Seal	(Single) Double				
Hydraulic HP	kw				Balance (Unbalance)				
Efficiency	51 %				(Self Flush) External Flush				
B.H.P.	7.76 kw								
Control System									
Lubricating Oil System	OIL BATH								
Cooling Water	Kind : °c	kg/cm²G	— m³/h	m³h°c/kcal					
	Bearing : NO	Packing Box : NO	Pedestal : NO	Flush Cooler : NO					

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	3 B	ANSI 125 FF	Cage Ring	NO			Hydrostatic		NO
Outlet	TOP	2 B	ANSI 125 FF	Throat Bush				Balancing		
				Wear Ring				Performance	YES	
				Gland				Running		YES
				Mech. Seal	YES	SELF		NPSH		
								Overhaul	YES	YES

Materials					
Case	FC25	Mech. Seal	STELLITE, x C:SUS316		
Impeller	FC25	Cage Ring	NO	Case Stud	S 45C
Shaft	S45C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	SUS316 Hcr. Plating	Case Wearing Ring	FC25	Bearing	NO. 6305 C3
Gland Packing	NO	Imp. Wearing Ring	NO		

Motor					
Type	NO. 160 L INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	11 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	2	Rotation (from PUMP)	cw (ccw)

Accessories					
Common Base		V-Pulley	NO.		
Anchor Bolt	YES	~~Air~~ & Drain ~~Cock~~ Valve.	YES		
Flex. Coupling		Tool	YES		
Coupling Cover		Companion Flange.	YES		

Spare Parts (Refer to Spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information					
Manufacturer	TORISHIMA PUMP MFG CO., LTD.	Model No.	CPK . G 50 – 20		
Weight	Pump & Base : 163 kg	Motor : 130 kg	Total : 293 kg		
Painting					
Remarks					

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Plant	IRAQ. EXP. PROJECT					Item No.	P – 765 A.B.					
Customer	M.O.I IRAQ											
Order	563023					Service	DEIONIZED WATER PUMP.					
Location	Indoor (Outdoor)					No. Req'd	Working 1	Spare 1	Total 2			
Regulation						Code						
Process Data												
Liquid	DEIONIZED WATER											
Capacity	Min.	m³/h	Nor.	330	m³/h	Max.	370	m³/h				
Pump Temp.	65	°c	Disch. Press.	8.0	kg/cm²G	NPSH Avail	6.5	m				
Sp. Gr. at Pump T.	980	kg/m³	Suct. Press.	0	kg/cm²G	NPSH Req'd	3.0	m				
Vap. Press. at Pump T.	0.255	kg/cm²A	Diff. Head	8.0	kg/cm²G							
Vis. at Pump T.		cp.	Diff. Head	81.6	m							
Corr. or Solid			Max. Suct. Press.	1.0	kg/cm²G	Duty	24	h/day				
Design Data												
Type	HORIZONTAL VOLUTE					Drive Type	MOTOR DRIVEN					
No. Stage	1					Design Press.	9.3	kg/cm²G				
Impeller Dia.	(Max 505)	mm	Type	CLOSED		Hydro. Test Press.	14.0	kg/cm²G				
Axis	Overhung		Split	VERTICAL		Seal System	(Gland)	Mech. Seal				
R.P.M.	1460					Mech. Seal	Single	Double				
Hydraulic HP		kw					Balance	Unbalance				
Efficiency	Nor 62		Max 66		%		Self Flush	External Flush				
B.H.P.	115.7		122		kw							
Control System												
Lubricating Oil System	OIL BATH											
Cooling Water	Kind :		°c		kg/cm²G	—	m³/h		m³h°c/kcal			
	Bearing : NO		Packing Box : NO			Pedestal : NO		Flush Cooler : NO				

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	END	10B	ANSI 10 125 FF	Cage Ring	NO			Hydrostatic	YES	NO
Outlet	TOP	8B	ANSI 10 125 FF	Throat Bush				Balancing		
				Wear Ring				Performance		
				Gland Packing	YES	SELF		Running		YES
				Mech. Seal	NO			NPSH		
								Over haul	YES	YES

Materials					
Case	FC 20	Mech. Seal	NO		
Impeller	FC 20	Cage Ring	NO	Case Stud	S 45C
Shaft	S45C	Case Gasket	ASBESTOS	Gland Stud	SUS 304
Shaft Sleeve	FC 20	Case Wearing Ring	FC 20	Bearing	NO. 6412 C3
Gland Packing	ASBESTOS	Imp. Wearing Ring	NO		

Motor					
Type NO.315L	INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	150 kw	Phase	3	Speed Reducer	
Cycle	50 Hz	Pole	4	Rotation (from ~~driver~~ PUMP)	cw (ccw)

Accessories					
Common Base	YES	V-Pulley	NO	Companion Flange (Discharge & Suction)	YES
Anchor Bolt		~~Air & Drain Cock~~ Valve	YES		
Flex. Coupling		Tool	YES		
Coupling Cover					

Spare Parts (Refer to Spare parts list)		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO, LTD		Model No.	ETA 200 – 50			
Weight	Pump & Base : 755 kg	Motor : 1300 kg	Total : 2055 kg				
Painting							
Remarks							

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Plant	WATER TREATMENT			Item No.	P – 740 A.B						
Customer	MOI , IRAQ										
Order	563023			Service	EFFLUENT PUMP						
Location	Indoor (Outdoor)			No. Req'd	Working 1	Spare 1	Total 2				
Regulation				Code							
Process Data											
Liquid	WASTE WATER										
Capacity	Min. m³/h	Nor. 180 m³/h	Max. 190 m³/h								
Pump Temp.	40 °c	Disch. Press.	3.0 kg/cm²G	NPSH Avail	8 m						
Sp. Gr. at Pump T.	1.000 kg/m³	Suct. Press.	0 kg/cm²G	NPSH Req'd	2 m						
Vap. Press. at Pump T.	0.075 kg/cm²A	Diff. Head	3.0 kg/cm²G								
Vis. at Pump T.	cp.	Diff. Head	30 m								
Corr. or Solid	SLIGHT	Max. Suct. Press.	– kg/cm²G	Duty	24 h/day						
Design Data											
Type	VERTICAL VOLUTE			Drive Type	MOTOR DRIVEN						
No. Stage	1			Design Press.	4 kg/cm²G						
Impeller Dia.	(Max 404) mm	Type	CLOSED	Hydro. Test Press.	6 kg/cm²G						
Axis		Split	HORIZONTAL	Seal System	(Gland) Mech. Seal						
R.P.M.	1 450			Mech. Seal	Single Double						
Hydraulic HP	kw				Balance Unbalance						
Efficiency	65 %				Self Flush (External Flush)						
B.H.P.	24 kw										
Control System	—										
Lubricating Oil System	Grease packed										
Cooling Water	Kind : °c kg/cm²G m³/h m³h°c/kcal										
NO	Bearing : NO Packing Box : NO Pedestal : NO Flush Cooler: NO										

Nozzle	Orient.	Size	Rating	Flush	Req'd	Fluid	m³/h	Test	Req'd	Witness
Inlet	Bottom	6 B	ANSI 150# RF	Cage Ring	YES	WR	0.03	Hydrostatic	YES	NO
Outlet	SIDE	5 B		Throat Bush	NO			Balancing		
				Wear Ring	NO			Performance		YES
				CUTLESS ~~Gland~~ BEARING	YES	WR	0.96	Running		
				Mech. Seal				NPSH	NO	
								Over haul	YES	YES

Materials					
Case	SCS 13	Mech. Seal	NONE		
Impeller	SCS 13	Cage Ring	FC 20	Case Stud	SUS 304
Shaft	SUS 304	Case Gasket	PTFE	Gland Stud	SUS 304
Shaft Sleeve	SUS 304	Case Wearing Ring	SUS 304	Bearing (CUTLESS)	SUS304+RUBBER
Gland Packing	ASBESTOS	Imp. Wearing Ring	NONE		

Motor					
Type WALS-225S	INDUCTION MOTOR	Volt.	380 V	Drive Type	DIRECT DRIVE
Rated Output	30 kw	Phase	3	Speed Reducer	—
Cycle	50 Hz	Pole	4	Rotation (from ~~driver~~ PUMP)	(cw) ccw

Accessories					
Common Base	NO	V-Pulley	NO	Lub. water piping	YES
~~Setting~~ Anchor Bolt	YES	Air & Drain Cock	NO		
Flex. Coupling	YES	Tool	YES		
Coupling Cover	NO	Motor Stand	YES		

Spare Parts Refer to Spare parts List		
Impeller	Case Gasket	Case Wearing Ring
Shaft	Rubber for Cpl'g	
Bearing	Gland Packing	
Mech. Seal	Imp. Ring	

Information							
Manufacturer	TORISHIMA PUMP MFG CO., LTD.			Model No.	125 – CVS (K)		
Weight	Pump & Base :	650 kg	Motor :	360 kg	Total :	1010	kg
Painting							
Remarks							

Checked by	Designed by	Date

ANNEX NO. 5

1- The existing system is not functional due to the change of salinity of water in the Shat Al Arab.
Therefore completely a new system with a treated water capacity of 600 m3/hr permeate water is planned to be built. This new system is also considered to be executed by bidder.

2- The Reverse Osmosis shall be designed according to the following data:
2-1 Treated Water at plant Battery limits
2-1-1 Qualities

Analysis Results of Raw Water

S	Item Sample	Raw Water		Filtered Water	
		Limit Value	Results	Limit Value	Results
1	PH at 25 C	8.1	7.35		
2	E.C (/an)		6700		
3	Temperature (C)	32	29 C		
4	Turbidity (pip as kaolin)	150 Max.	33.3	< 1.0	
5	Total Hardness (ppm as CaCO3)	720	829		
6	Ca - Hardness (ppm as CaCO3)	374	357		
7	P- Alkalinity (ppm as CaCO3)				
8	m- Alkalinity (ppm as CaCO3)	193	144		
9	CI Ions (ppm as CaCO3)	772	1500		
10	SO4 Radicals (ppm as CaCO3)	317	600		
11	Silica (ppm as SiO2)	24 Max.	5.5	24	
12	Iron (ppm as Fe)	2	1.12	0.5	
13	C.O.D (ppm as O)	10	3.2	7	
14	Suspended solids (mg/L)	300	90	4	
15	T.D.S (mg/L)	1603	4000		
16	Na+ Ions (ppm as CaCO3)	562			
17	Oil content (ppm)		0.1		

2-1-2 Conditions

Pressure	kg/cm^2g	2 Min
Flow	m^3/hr	to be defined by bidder

2-2 Reverse Osmosis Design Data

Production water capacity	600 m3/hr
Conversion Rate	to be defined by bidder
Temperature - Design	25 C
- Minimum	15 C
Quality of produced water	to be defined by bidder

Any modification, option to give better economic and performance for the plant will be considered.

- The bidder scope of supply shall cover all materials (all equipment and material) except for the civil works.

Cooling Tower

1- The old cooling tower has been demolished a new cooling tower with eight cells is under construction now.
The new design has been adopted by SIDCCO, which is differing from the old one by their dimension.

2- Basis of Design and performance data.
- Cold water flow (Circulation Water 22648 m3/h(
- Cooling Tower Design
  - Hot water temperature 46 C
  - Cold water temperature 34.3 C
  - Wet bulb temperature 31.4 C
  - Dry bulb temperature 45 C

Type of construction: One block of 8 cells
Outlet dimension:
Height (ground level = 0.0: basin bottom - 1.5 meter
Basin curb +0.5 meter
Cells +14.2 meter
Fan stacks +16.7
Type of operation: Induced fan
Design flow: 24000 m^3/h
Normal flow: 22000 m^3/h
Thermal conditions: see point 2 above
Wind velocity: 3.0 m/sec

3- Design Criteria Notes
4-1 Process Material
The cooling water is the clean water concentrated two times with 5% side Filtration.
4-2 Main Materials of Construction
4-2-1 Cooling Tower
- Basin: Concrete
- Structure: =
- Fan stack: =
- Shell: =
- Filling: polypropylene
- Drift eliminator:
- Fan: glass reinforced polyester blades

4- The bidder shall under take the technical evaluation of the above preliminary design mentioned above in order to insure reliable design and performance

and accordingly give the recommended fans, gear box, motors, filling materials, water distribution pipe, which shall be approved by SIDDCO.

5- The bidder shall supply all the equipment and materials with the quantities and specification result in point (5) above.

6- The bidder shall guarantee the performance of the cooling tower.

Extent of Delivery Condition

The equipment and material relevant to each cooling tower unit shall be delivered with the following main parts:

- Structures, internal parts, filling.
- Electric motors
- Reduction gears
- Fans
- Local control panels

ANNEX NO. 7

Urea storage, handling, bagging and ship loading system

1- These systems have also been heavily damaged during the war. No works has started yet. It is considered relatively less important compared to the other parts of plant.

Bidder is considered to supply equipments, materials, conveyor and their relative accessories, bagging machines, reclaimer, ship loader etc as mentioned in the attached specification.

2- An option for repairing the existing reclaimer and ship loader shall be submitted.

3- Any other option will be considered.

4- All instrumentation and control system for this system to be included in the offer.

5- All electrical requirement to be included in the offer.

6-The bidder scope of supply shall cover all materials except for the civil works.

1- Urea handling equipment, like small hoppers, vibrating feeders, screens, crusher, bagging machines and loaders shall generally delivered as complete unit.

Other equipment such as belt conveyors, scraper shall be delivered as follows:

a- Scraper

- Mechanical components (drives, boogies, winches, etc.) shall be shop assembled.
- Power and control boards fully pre assembled and internally wired.
- Other electrical wiring to be carried on in field.
- Structural steel (portal frame, boom structures, heads, etc.) in pre assembled element (with respect to shipping requirements) to be connected in field by means of bolted junctions.
- Connecting chutes in pre assembled elements, site junctions shall be bolted.

b- Belt Conveyor

- Head, tail and take-up frames, partially pre assembled.
- Pulleys complete with bearings, ready to be positioned on head, tail and take-up frame.
- Drive unit (motor-coupling-speed reducer) mounted on a common basement. The connection with drive pulley to be carried on in field.
- Stringers and posts in loose elements ready to be assembled with bolted joints
- Idlers and rollers, loose to be positioned in field.
- Rubber belts in reels to be cut and vulcanized in field.
- Chutes and hood: shop pre assembled in elements to be connected by means of bolted junctions.
- Instruments: loose to be bolted in field.

	Item No.	Item Name	Qt'y	Material Type	Capacity T/Hr	Length Mm	Width mm
1-	C-552AD	Screw Conveyor	4	Urea Crystal	16.2	A&C=4.8 B&D=5.7	-
2-	C-553	Prilling Belt Conveyor	1	=			
3-	C-554	Urea Belt Conveyor	1	=	2	14.2	400
4-	C-555	Product Belt Conveyor	1	=	65	13.5	650
5-	C-557	Product Bucket Elevator	1	=	65	16	500
6-	C-558	Product Transfer Conveyor	1	=	65	19	650
7-	C-602AB	Pile up Conveyor	2	=	65	189.5	650
8-	C-603	Take out Conveyor	1	=	200	190	1000
9-	C-604	Prilled Urea Transfer Conveyor	1	=	200	100.5	1000
10-	C-605	Conveyor Hopper Feed	1		200	16	-
11-	C-606A/H	No.1 Slat Conveyor	8	Urea Bags	800 Bags	9.5	600
12-	C-607	Prilled Urea Reclaimer	1	=	200	15	1000
13-	C-608A/H	Reverse Conveyor	8	=	800 Bags	1	1100
14-	C-609A/H	No.2 Slat Conveyor	8	=	800 Bags	6.8	600
15-	C-610AB	No.2 Transfer Conveyor	2	=	3200 Bags	A=19 B=34,5	300
16-	C-611A/H	No.1 Transfer Conveyor	8	=	800 Bags	6	300
17-	C-612AB	No.3 Transfer Conveyor	2	=	3200 Bags	20.6	300

18-	C-613A/H	140.5 Slat Conveyor	8		800 Bags	2.05	800
19-	C-614A/H	Roller Conveyor	8	Urea Bags	800 Bags	1.2	800

ANNEX NO. 8

Instrument Air Package

1-General

This package shall supply instrument air to the Ammonia / Urea and utilities units at Abu-Al Khasib fertilizer plant. The main instrument air is normally supplied by the main air compressor in the ammonia unit and the emergency air system comes into operation at the failure of the main system. This package is to supply 1600 Nm3/H clean, oil free, dry instrument air.

2-Design Basis

Production rate (normal) 1600 Nm3/H

Dew point	-25 C
Supply pressure at B.L	7kg / cm2 g
Design capacity	1600 Nm3/H

3-Process Description

One set of centrifugal air compressor driven by an electric motor. With capacity of 1600 Nm3/H has been foreseen to meet the above required quantity and quality. Air shall be drawn from atmosphere through the pre-filter, which removes solid particles. The filtered air shall be compressed in centrifugal compressor to above 8-kg/cm2 g. The compressed air shall be cooled by water in the after cooler and passed through the Air K.O. Drum which shall function as a holder instrument air shall pass through a dryer to produce air with a dew point of (-25C) at 7kg/cm2 g filters shall be used to eliminate the particles of absorbent matter before the air passes to the instrument Air Drum. The Air Drum capacity shall be 10 minutes at 6-kg/cm2 g.

The air from the instrument Air Drum will be fed to the instrument air distribution system. The plant air (service air) of capacity 600 Nm3/hr shall be divided at the instrument air K.O Drum fed to service air distribution system.

4- the scope of work for this package shall cover the Engineering; supply all equipment and materials, supervision during civil works, erection and commissioning.

6- any other option will be considered

ANNEX. 9

ELECTRICAL

7. Introduction

7.1 The main principle of the present is to provide advanced and reliable electrical equipment and material to meet the operation and safety requirements of this plant. In the mean time, the existing electrical equipment and facilities are to be fully used, and the original design to be applied as far as possible. The sole purpose of all these is to reduce the investment.

According to and the above principle and the actual condition, it i our suggestion that the high tension part of the main substation and also the ammonia substation shall remain as they are, i.e. the 11 kv and 6.6 kv switchgears are not going to be added, We can use the existing high tension equipment to meet the power requirement.

According to the plot plan arrangement and the new facilities, the scope of power supply of each substation is shown below.

1- The main and ammonia substations: the ammonia unit, the boiler, the emergency instrument air facility, the condensate polishing facility, the 110 VDC control power for this substation, and the instruments.
2- The urea substation: the urea unit, the N2 generating facility, the reliquifcation compressor, the ammonia storage unit, the air conditioning equipment for the prilled urea store.
3- Cooling tower substation: the cooling water facility.
4- R.O. Substation: the R.O. facility and new water treatment facility.
5- Water treatment substation: the water treatment facility and the bagging facility.
6- Front-end substation (new): maintenance workshop, administration building and others.

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Specification

- SF6 or vacuum SWG, indoor type
- Rating voltage 7.2 kv
- Short circuit level for 1 second 350 MVA
- Short circuit current 31.5 KA
- Control voltage 110 VDC
- 3-phase,50HZ, 3wire
- IP 31 Min.
- Design temp. 40 C

UREA SUBSTATION SWG.

The SWG. Shall be comprise the following cubicles:

- 1 off incoming 1250 A having the following protection and metering:
  - Over current relay.
  - Grounding over current relay.
  - Wattmeter.
  - Watt hour meter.
  - Ampere meter with selector switch.
  - Voltmeter with selector switch.
  - Under voltage relay.

- 10 off outgoing 630A as shown bellow

-3 transformers 1000 KVA feeder, complete with O/C & grounding O/C protection, ampere meter with selector switch.

-1 TRANSFORMER 500 KVA feeder, complete with O/C & grounding O/C protection, ampere meter with selector switch.

-2 Motor 230 KW feeder complete with the following protection:
Thermal O/L, S/C & earth fault protection with remote and local facilities, ampere meter with selector switch.

-2 Motor 770 KW feeder complete with the following protection:
Thermal O/L, S/C & earth fault protection, ampere meter with selector switch, local & remote facilities.

-1 spare cubicle for 1000 KVA transformers, complete as mentioned above.

- 1 spare cubicle for 770 KW motor complete, as mentioned above.

COOLING TOWER SUBSTATION SWG.

- The SWG shall be comprise the following cubicles:

- "1" off incoming 1250 A, having the following protection and metering.

- Over current relay.
- Grounding O/C relay.
- Under voltage relay.
- Wattmeter.
- Watt hour meter.
- Ampere meter with selector switch.
- Voltmeter with selector switch.

- 13 off outgoing 630 A as shown below.

- 1Transformer 500 KVA feeder, compete with O/C & grounding O/C protection, ampere meter with selector switch.

- 3 motor 800 KW feeder complete with the following protection:
Thermal O/L, S/C & earth fault protection, ampere meter with selector switch, local and remote facilities.

-8 motor 220 KW feeders complete with the following thermal O/L, S/C & earth fault protection, ampere meter with selector switch, local and remote facilities.

- 1 spare cubicle for 220 KW motor complete, as mentioned above.

Emergency Diesel Generator (EDG)

-Diesel generator 1400 KW 3-phase 4-pole 6.6KV 50 Hz p.f=0.8

-Switchgear panel containing all protection relays and measuring instruments and synchronizing system.

-Design temp. 50 C.

-IP 31 Min.

Also another option:

To inspect and repair the EDG existing at the site

DESK BOARD

The desk board containing anunciator, which have all alarm, and tripping signals for main substation (150 signal) and also containing the following measuring instruments:

1- Three frequency meter 45-55 HZ
2- Three power factor meter
3- Three phase sequence volt meter
4- Three watt meter
5- Three watt meter

NOTE:

- CT ratio 600/5
- PT ratio 11 KV/110 V
- Annuncitor must have buzzer alarm

PROTECTION RELAY

1-Differential protection relay "87 T" 3
2- CT 500/5 9
3- CT 1000/5 9
4- under voltage relay 110 v " 27 " 3

NOTE:

- All meters shall be digital type.
- All protection relays shall be electronic type.

THE COMPNENTS OF MCC'S OF AMMONIA AND UREA UNIT

S. NO	SPECIFICATION	QTY	REMARK
1	3-pole NFB 800A	12	
2	3-pole NFB 400A	13	
3	3-pole NFB 225A	23	
4	3-pole NFB 125A	15	
5	3-pole NFB 100A	52	
6	3-pole NFB 75A	14	
7	3-pole NFB 50A	30	
8	3-pole NFB 30A	9	
9	3-pole NFB 15A	47	
10	Thermal O/C relay TH 300	9	
11	Thermal O/C relay TH 150	15	**Rating 80~330A**
12	Thermal O/C relay TH 100	20	Rating 80~190A
13	Thermal O/C relay TH 50	22	Rating 41~130A
14	Thermal O/C relay TH 35	19	Rating 15~67A
15	Thermal O/C relay TH 18	46	Rating 7.5~34A
16	Magnetic Contactor AC3 200hp	9	Rating 0.32~18A
17	Magnetic Contactor AC3 120hp	15	
18	Magnetic Contactor 100hp	20	
19	Magnetic Contactor 70hp	12	
20	Magnetic Contactor 50hp	11	
21	Magnetic Contactor 30hp	18	
22	Magnetic Contactor 15hp	20	
23	Magnetic Contactor 7.5hp	46	
24	Current Transformer 300/1	12	
25	Current Transformer 200/1	6	
26	Current Transformer 150/1	4	
27	Current Transformer 75/1	7	
28	Current Transformer 50/1	4	
29	Current Transformer 30/1	4	
30	Current Transformer 10/1	6	
31	Current Transformer 750/5	24	
32	Potential Transformer 15VA 440/110V	12	
33	Transformer 1.5KVA 380/110V	1	
34	Transformer 20 KVA 380/110V	1	
35	Aux. Relay 220V 50HZ ‘ 2NO+2NC	234	
36	Aux. Relay 220V 50HZ ‘4NO	6	

S. NO.	SPECIFICATION	QTY	REMARK
37	Contactor 110VDC	2	
		21	
38	**Timer 6min `220V 50 HZ**	3	
39	Earth leakage relay 51G 220V 50HZ	125	
40	Push button (red)	125	
41	Push button (black)	125	
42	Signaling lamp (red)	125	
43	Signaling lamp (green)	125	
44	Signaling lamp (orange)	8	
45	Fuse 5A (with base) 500V	134	
46	Fuse 10A (with base) 500V	36	
47	Fuse 1A (with base) 500V	36	
48	Fuse 1A (with base) 110V	36	
49	Single pole MCB 1A	1	
50	Double pole MCB 15A	21	
51	Single pole MCB 15A	12	
52	Ampere meter selector	12	
53	Volt meter selector	12	
54	Ampere meter (0~750) 750/1	12	
55	Volt meter (0~500V) 110V	3	
56	Series Terminal 400mm2	9	
57	Series Terminal 200mm2	21	
58	Series Terminal 150mm2	9	
59	Series Terminal 120mm2	36	
60	Series Terminal 100mm2	36	
61	Series Terminal 80mm2	3	
62	Series Terminal 60mm2	12	
63	Series Terminal 50mm2	163	
64	Series Terminal 38mm2	39	
65	Series Terminal 30mm2	21	
66	Series Terminal 22mm2	63	
67	Series Terminal 14mm2	54	
68	Series Terminal 8mm2	18	
69	Series Terminal 5.5mm2	162	
70	Series Terminal 3.5mm2	5000	
71	Series Terminal 2.5mm2		

Remark: NO of MCC are 259
122 for Ammonia
137 for urea

THE SPECIFICATION

6.6kv cross-linked polyethylene insulated p.v.c sheathed cable '6.6kv ' armored cable

S.	CABLE SIZE (MM^2)	QTY (M)
1	3^C*50	1600
2	3^C *60	100

POWER CABLE

THE SPECIFICATION

600v special heat resistance pvc insulation 'kh-100', THESE CABLES estimated by jis THEREFORE ANY equivalent size of cables in any standard that will be USED.

se r.	**cable size (mm^2)**	**QTY (m)**
1	**6^c *3.5**	**500**
2	**2^c *3.5**	**5000**
3	**5^c *3.5**	**500**
4	**4^c *3.5**	**3000**
5	**3^c *3.5**	**11000**
6	**1^c*3.5**	**1350**
7	**3^c*1.6**	**500**
8	**3^c *2**	**500**
9	**3^c *2.6**	**500**
10	**2^c *5.5**	**2000**
11	**3^c *5.5**	**2000**
12	**4^c *5.5**	**2900**
13	**5^c *5.5**	**500**
14	**2^c *8**	**1000**

15	**3 c *8**	**2500**
16	**4 c *8**	**2500**
17	**2 c *14**	**1000**
18	**3 c *14**	**2500**
19	**2 c *30**	**500**
20	**3 c *30**	**2000**
21	**3 c *38**	**2000**
22	**4 c *38**	**6000**
23	**3 c *80**	**3250**
24	**1 c *100**	**500**
25	**2 c *100**	**1000**
26	**1 c *200**	**750**
27	**3 c *300**	**150**
28	**1 c *400**	**1250**
29	**3c * 120/70**	**500**

Control cables

THE SPECIFICATION

600V SHIELDED POLYVINY CHLORIDE INSULATED & SHEATHED (CVV-S). THESE CABLES ESTIMATED BY JIS, THEREFORE ANY EQUIVALENT SIZE OF CABLE IN ANY STANDARD THAT WILL BE USED.

Ser	CABLES SIZE (MM^2)	QTY (M)
1	12^C*2	1000
2	10^C *2	4000
3	8^C *2	11000
4	6^C *2	2500
5	4^C *2	3200
6	2^C *2	2250

TERMINAL SHOES OF CABLES ‘COPPER MADE’

Ser	TERMINAL SHOE SIZE (MM^2)	QTY (PCS)
1	400	60
2	300	12
3	200	60
4	100	72
5	80	145
6	38	400
7	36	156
8	14	112
9	8	200
10	5.5	140
11	3.5	575
12	50	46
13	60	53
14	22	92

HIGE TENSION CABLE TERMINATIONS & JOINTS

SER.	SPECIFICATION	SIZE (MM^2)	UNIT	QTY
1	HIGH TENSION CABLE TERMINATION 12 KV	300	KIT	16
2	HIGH TENSION CABLE JOINT 12 KV	300	=	3
3	HIGH TENSION CABLE TERMINATION 7.2 KV	300	=	45
4	HIGH TENSION CABLE JOINT 7.2 KV	300	=	5
5	HIGH TENSION CABLE TERMINATION 7.2 KV	95	=	30
6	HIGH TENSION CABLE JOINT 7.2 KV	95	=	3
7	HIGH TENSION CABLE TERMINATION 7.2 KV	70	=	20
8	HIGH TENSION CABLE JOINT 7.2 KV	70	=	2
9	HIGH TENSION CABLE TERMINATION 7.2 KV	50	=	33
10	HIGH TENSION CABLE JOINT 7.2 KV	50	=	3

GAS IGNITOR FOR BOILERS

CONTAINING (IGNITOR, CONTROL CABINET, ACCESSORIES) WITH SPECIFICATIONS AS BELLOW: -

- FUEL / NATURAL GAS
- FUEL TEMP. / NORMAL TEMP. & HIGH TEMP. 32C
- FUEL CAP. / 16 NM^3 /hr
- FUEL PRESS. / 0.6 K g/cm^2
- PRIMARY AIR PRESS. / 25~60 MM H2O
- SECONDARY AIR PRESS. / P 25~60 MM H2O
- SECONDARY TEMP. / MAX. 284C
- POWER SOURCE / 220V, 50 HZ
- IGNITOR TRANSFORMER / 6000V, 150VA
- IGNITOR LENGTH / APPROX. 1680MM
- CONTROL CABINET / EXPLOSION PROOF TYPE

QUNTITY TO BE DELIVERED IS FOUR SETS & SPARE PARTS FOR ONE SET.

SPECIFICATION OF PUSH BUTTON STATION

S.	EQUIP.	TYPE	DEVICE EQUIPED				CONTROL VOLTAGE	QT
			P.B.S	S.L	CT	C.O.S		
1	PUSH BUTTON STATION	OD-W-D2G4	ON-OFF	R-G	-	OFF-EM	220 VAC	8
2	PUSH BUTTON STATION	OD-S.S.CR2	=	R-G	-	MAN-AUTO	=	4
3	PUSH BUTTON STATION	OD-S.S-D2G2	=	R-G	-	=	=	14
4	PUSH BUTTON STATION	OD-S.S.CR2	=	R-G	-	MAN-AUTO/ OFF-EM	=	6
5	PUSH BUTTON STATION	OD-W-CR2	=	R-G	-	OFF-INT	=	2
6	PUSH BUTTON STATION	OD-S.S-CR2	=	R-G	300/1	MAN-AUTO/ OFF-EM	=	2
7	PUSH BUTTON STATION	OD-S.S-D2G4	=	R-G	-	MAN-AUTO/ OFF-EM	=	10
8	PUSH BUTTON STATION	OD-S.S-CR2	=	R-G	50/1	-	=	4
9	PUSH BUTTON STATION	OD-S.S-CR2	=	R-G	300/1	-	=	4
10	PUSH BUTTON STATION	OD-S.S-CR2	=	R-G	75/1	-	=	4
11	PUSH BUTTON STATION	OD-S.S-CR2	=	R-G	200/1	OFF-INT	=	4
12	PUSH BUTTON STATION	OD-S.S-D2G4	ON-OFF	R-G	-	OFF-EM	=	3
13	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	-	-	=	22
14	PUSH BUTTON	OD-S.S-CR2	=	R-G	-	MAN-AUTO	=	1

	STATION							
15	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	150/1	-	=	2
16	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	-	OFF-EM	=	4
17	PUSH BUTTON STATION	OD-S.S-CR2	=	R-G	-	OFF-INT	=	10
18	PUSH BUTTON STATION	OD-S.S-D2G4	=	R-G	-	-	=	12
19	PUSH BUTTON STATION	OD-S.S-D2G4	=	R-G	-	OFF-EM	=	2
20	PUSH BUTTON STATION	OD-S.S-CR2	=	R-G	-	OFF-EM	=	2
S.	EQUIP.	TYPE	DEVICE EQUIPPED				CONTROL VOLTAGE	QTY
			P.B.S	S.L	CT	C.O.S		
21	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	-	OFF-INT	=	2
22	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	300/1	AUTO-MAN/ OFF-EM	=	2
23	PUSH BUTTON STATION	OD-S.S-D2G4	=	R-G	-	AUTO-MAN/ OFF-EM	=	10
24	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	30/1	-	=	1
25	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	75/1	-	=	1
26	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	10/1	OFF-INT	=	6
27	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	150/1	-	=	2
28	PUSH	OD-S.S-	ON-	R-G	40/5	-	110V	7

	BUTTON STATION	CR2	OFF					
29	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	300/1	-	220V AC	3
30	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	200/1	-	=	2
31	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	300/1	MAN-AUTO	=	1
32	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	40/5	OFF-EM	110V	1
33	PUSH BUTTON STATION	OD-S.S-D2G4	ON-OFF	R-G	40/5	R-L	=	3
34	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	150/5	R-L	=	5
35	PUSH BUTTON STATION	OD-S.S-D2G4	ON-OFF	R-G	150/5	MAN-AUTO	=	1
36	PUSH BUTTON STATION	OD-S.S-D2G4	ON-OFF	R-G	40/5	MAN-AUTO	=	2
37	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	300/1	-	220V AC	4
38	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	50/1	-	=	4
39	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	75/1	-	=	5
40	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	200/1	OFF-INT	=	4
41	PUSH BUTTON STATION	OD-S.S-CR2	ON-OFF	R-G	30/1	-	=	1

OD= OUT DOOR R=RED LAMP S.L =SIGNAL LAMP

G=GREEN LAMP W = WALL

C.O.S=CHANGE OVER SWITCH

P.B.S=PUSH BUTTON SWITCH S.S=SELF STANDING

NOTE

ALL PUSH BUTTON STATIONS SHALL HAVE TWO CABLE ENTRIES SUITABLE FOR CONDUIT SIZE.
ALL PUSH BUTTON STATIONS SHOULD BE WEATHER PROOF PROTECTED (IP 54 MIN)

LIGHTING FIXTURE & LAMPS

S.	SPECIFICATION OF LIGHTING FIXTURE	QTY
1	MERCURY TYPE 400W-220VAC-STAND TYPE –OUTDOOR EXPLOSION PROOF (5M) HEIGHT OF STAND LAMPS FOR ABOVE	25 38
2	MERCURY TYPE 400W-220VAC-BRACKET TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	36 54

3	MERCURY TYPE 200W-220VAC-CEILING TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	22 33
4	MERCURY TYPE 150W-220VAC-BRACKET TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	100 150
5	INCANDESCENT TYPE 150W-220VAC-CEILING TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	220 330
6	INCANDESCENT TYPE 150W-220VAC-STAND TYPE –OUTDOOR EXPLOSION PROOF (1.8M) HEIGHT OF STAND LAMPS FOR ABOVE	350 525
7	INCANDESCENT TYPE 100W-110VDC-CEILING TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	8 12
8	INCANDESCENT TYPE 100W-110VDC-CEILING TYPE –INDOOR LAMPS FOR ABOVE	8 12
9	MERCURY TYPE 200W-220VAC-CEILING TYPE –INDOOR LAMPS FOR ABOVE	6 9
10	INCANDESCENT TYPE 150W-220VAC-BRACKET TYPE –INDOOR LAMPS FOR ABOVE	6 9
11	MERCURY TYPE 400W-220VAC-CEILING TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	50 75
12	INCANDESCENT TYPE 100W-110VDC-BRACKET TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	4 6
13	FLOURESCENT TYPE 1*40W- 220VAC-INDOOR TUBES FOR ABOVE	18 27
14	FLOURESCENT TYPE 2*40W- 220VAC-INDOOR TUBES FOR ABOVE	350 1000
15	FLOURESCENT TYPE 2*60W- 110VDC-INDOOR TUBES FOR ABOVE	15 23
S.	SPECIFICATION OF LIGHTING FIXTURE	QTY
16	MERCURA TYPE 200W-220VAC-BRACKET TYPE –OUTDOOR EXPLOSION PROOF LAMPS FOR ABOVE	4 6
17	INCANDESCENT TYPE 100W-110VDC-STAND TYPE-OUTDOOR EXPLOSION PROOF (1.8M) LAMPS FOR ABOVE	5 8
18	MERCURY TYPE 200W-220VAC-STAND TYPE-OUTDOOR EXPLOSION PROOF (1.8M) LAMPS FOR ABOVE	4 6
19	MERCURY TYPE 400W-220VAC-YARD TYPE (5M)-OUTDOOR EXPLOSION PROOF	48

	LAMPS FOR ABOVE	72
20	FLOOD LIGHTING 1000W-220VAC-OUTDOOR LAMPS FOR ABOVE	15 23
21	STREET LIGHTING (8M) –400W-220VAC LAMPS FOR ABOVE	40 60
22	OBSTRUCTION LIGHT (COMPLETE WITH ALL CONTROL CIRCUIT) LAMPS FOR ABOVE	8 12

ALL OUTDOOR LIGHTING FIXTURES SHALL BE SUITABLE FOR HAZARD AREA, (EXD, GAS GROUP IIA, AND TEMP. CLASS T1). ENCLOSURE PROTECTION TO BE IP 54 MIN. FOR OUTDOOR & IP 31 MIN. FOR INDOOR.
ALL OUTDOOR LIGHTING FIXTURES SUPPLIED WITH SUITABLE GLAND FOR TWO HUBS.

CONDUIT PIPE

ER	SPECIFICATION	QTY
1	CONDUIT PIPE 82MM	200M
2	CONDUIT PIPE 70MM	90M
3	CONDUIT PIPE 54MM	30M
4	CONDUIT PIPE 42MM	690M
5	CONDUIT PIPE 36MM	480M
6	CONDUIT PIPE 28MM	2700M
7	CONDUIT PIPE 22MM	8400M
8	CONDUIT PIPE 16MM	1860M
9	BENDING PIPE 82MM 90	50PC’S
10	BENDING PIPE 70MM =	38PC’S
11	BENDING PIPE 54MM =	50PC’S
12	BENDING PIPE 42MM =	100PC’S
13	BENDING PIPE 36MM =	100PC’S

14	BENDING PIPE 28MM =	150PC'S
15	BENDING PIPE 22MM =	360PC'S
16	BENDING PIPE 16MM =	50PC'S
17	SOCKET PIPE 82MM	150PC'S
18	SOCKET PIPE 70MM	100PC'S
19	SOCKET PIPE 54MM	100PC'S
20	SOCKET PIPE 42MM	150PC'S
21	SOCKET PIPE 36MM	200PC'S
22	SOCKET PIPE 28MM	500PC'S
23	SOCKET PIPE 22MM	1400PC'S
24	SOCKET PIPE 16MM	500PC'S
25	BUSHING 82MM	100PC'S
26	BUSHING 70MM	100PC'S
27	BUSHING 54MM	100PC'S
28	BUSHING 42MM	170PC'S
29	BUSHING 36MM	200PC'S
30	BUSHING 28MM	800PC'S
31	BUSHING 22MM	750PC'S
32	BUSHING 16 MM	500PC'S
33	CABLE GLAND 82MM,EXD. IIA, T1	20PC'S
34	CABLE GLAND 70MM,EXD. IIA, T1	25PC'S
35	CABLE GLAND 54MM,EXD. IIA, T1	50PC'S
36	CABLE GLAND 42MM,EXD. IIA, T1	120PC'S
37	CABLE GLAND 36MM,EXD. IIA, T1	150PC'S
38	CABLE GLAND 28MM,EXD. IIA, T1	200PC'S
39	CABLE GLAND 22MM,EXD. IIA, T1	*250PC'S*

ER	SPECIFICATION	QTY
40	CABLE GLAND 16MM,EXD. IIA, T1	200
41	HANGER SADDLE 42MM	50PC’S
42	HANGER SADDLE 36MM	70PC’S
43	HANGER SADDLE 28MM	400PC’S
44	HANGER SADDLE 22MM	1700PC’S
45	HANGER SADDLE 16MM	750PC’S
46	HANGER CHANNEL 100*50*5	350PC’S
47	UNION 82MM	20PC’S
48	UNION 70MM	20PC’S
49	UNION 54MM	20 PC’S
50	UNION 42MM	150 PC’S
51	UNION 36MM	250PC’S
52	UNION 28MM	300PC’S
53	UNION 22MM	250 PC’S
54	ELBOW 42MM	75PC’S
55	ELBOW 36MM	35PC’S
56	ELBOW 28MM 90	250PC’S
57	ELBOW 22MM	600PC’S
58	ELBOW 16MM	250PC’S
59	TEE 28MM	250PC’S
60	TEE 22MM	300PC’S
61	TEE 16MM	75PC’S
62	UNION 16MM	50PC’S
63	NIPPLE 28MM	125PC’S
64	NIPPLE 22MM	150PC’S
65	HUB-ADAPTOR 28 MM – 22 MM	100
66	HUB-ADAPTOR 22 MM – 16 MM	100
67	SOCKET REDUCER 28 – 22 MM	100
68	SOCKET REDUCER 22 – 16 MM	100
69	VINYIL TUBE 70MM	800M
70	VINYIL TUBE 22MM	750M
71	VINYIL TUBE 16MM	700M
72	U-BOLT WITH NUT 16MM	300PC’S
73	U-BOLT WITH NUT 22MM	500PC’S
74	U-BOLT WITH NUT 28MM	400PC’S
75	U-BOLT WITH NUT 36MM	100PC’S
76	U-BPLT WITH NUT 42MM	350PC’S
77	TEE ELBOW 28MM	50PC’S
78	TEE ELBOW 22MM	75PC’S
79	PIPE CLIP 42MM	50PC’S
ER	SPECIFICATION	QTY
80	PIPE CLIP 36MM	50 PC’S
81	PIPE CLIP 28MM	75PC’S

82	PIPE CLIP 22MM	200PC'S
83	HUNGER BOLT M75	50PC'S

JUNCTION BOX

SER	JUNCTION BOX TYPE " EXD, II A, T1 "	QTY (PC'S)
1	FLAME PROOF JUNCTION BOX WITH FLAT COVER ADAPTABLE CONDUIT (HUB SIZE 16MM) AS BELLOW HUB STYLE: - - ONE –HUB - TWO –HUB IN LINE - TWO –HUB IN RIGHT ANGLE - THREE –HUB - FOUR –HUB	 75 75 75 100 100
2	FLAME PROOF JUNCTION BOX WITH FLAT COVER ADAPTABLE CONDUIT (HUB SIZE 22MM) AS BELLOW HUB STYLE: - - ONE –HUB - TWO –HUB IN LINE - TWO –HUB IN RIGHT ANGLE - THREE –HUB - FOUR –HUB	 250 250 250 300 300
3	FLAME PROOF JUNCTION BOX WITH FLAT COVER ADAPTABLE CONDUIT (HUB SIZE 28MM) AS BELLOW HUB STYLE: - - ONE –HUB - TWO –HUB IN LINE - TWO –HUB IN RIGHT ANGLE - THREE –HUB - FOUR –HUB	 125 125 125 150 150

ALL JUNCTION BOXES SUPPLIED WITH SUITABLE GLAND.

IGHTING DISTRIBUTION PANELS & WELDING DISTRIBUTION PANELS

SER	NAME OF EQUIPMENT	QTY (SET)	CONTAIN
1	LIGHTING DISTRIBUTION PANEL FLAME PROOF, OUTDOOR	5	1-NFB 100AF/100AT, 8-NFB 30AF/30AT
2	LIGHTING DISTRIBUTION PANEL FLAME PROOF, OUTDOOR	2	1-NFB 100AF/100AT, 10-NFB 30AF/30AT
3	LIGHTING DISTRIBUTION PANEL WALL HANGING, INDOOR	1	1-NFB 100AF/100AT, 10-NFB 30AF/30AT
4	LIGHTING DISTRIBUTION PANEL WALL HANGING, INDOOR	1	1-NFB 100AF/100AT, 8-NFB 30AF/30AT
5	LIGHTING DISTRIBUTION PANEL WALL HANGING, INDOOR	1	1-NFB 100AF/100AT, 9-NFB 30AF/30AT 1-NFB 50AF/30AT
6	LIGHTING DISTRIBUTION PANEL WALL HANGING, INDOOR	1	1-NFB 100AF/100AT
7	LIGHTING DISTRIBUTION PANEL WALL HANGING, OUTDOOR	4	1-NFB 100AF/100AT, 7-NFB 30AF/30AT, 2-NFB 50AF/30AT
8	LIGHTING DISTRIBUTION PANEL WALL HANGING, OUTDOOR	2	2-NFB 50AF/30AT, 6-NFB 30AF/30AT
9	LIGHTING DISTRIBUTION PANEL WALL HANGING, OUTDOOR	1	1-NFB 100AF/100AT, 2-NFB 50AF/30AT, 6-NFB 30AF/30AT
10	LIGHTING DISTRIBUTION PANEL WALL HANGING, INDOOR	1	1-NFB 100AF/100AT, 6-NFB 50AF/30AT, 4-NFB 30AF/30AT
11	DISTRIBUTION PANEL FOR WELDING & MAINTENANCE WALL HANGING OUTDOOR	11	3-NFB 100AF/100AT
12	LIGHTING REMOTE CONTROL PANEL, WALL HANGING, INDOOR	1	**4-CONTROL SWITCH FOR STREET LIGHTING,** 1-EMERGENCY OFF SWITCH FOR ALL LIGHTING

Note

1) All outdoor lighting panels shall be controlled by photocell.All lighting distribution panels and welding panels supplied with suitable gland

ANNEX. 10

Instrumentation Control Works

1. Introduction

The instrumentation and control system of the plant to be replaced by DCS.

Approximately fifteen percent (15%) of the required field instruments have already been obtained from plants. Bidder is considered to supply the

remaining (85%) of the field instruments as per the documents attached here within.

The requirement includes two parts, namely: the rehabilitation / reconstruction part and the upgrading plant. For the instrument and control unit, the reconstruction is to be the basis of the present quotation, which includes all the instruments, and DCS covered in the following sections and specific control items.

1- Any modification or option to give better solution and performance for the plants will be considered.
   - The bidder scope of supply shall cover all materials except for the civil works.
   - The B.O.Q is attached here within

2- Extent of Delivery Condition

2.1 Local instruments, transmitters, control valves, shall be supplied as a complete unit.

2.2 DCS system and control board shall be supplied as complete unit (Receiver instrument and removable internals shall be delivered separately)

2.3 Bulk materials shall be delivered in loose pieces. Cable and wires shall be delivered as per standards.

Cable racks, ducts and accessories shall be supplied in the state of commercial raw material.

INSTRUMENT FOR WATER TREATMENT

1-ALL INSTRUMENT TO BE WEATHER PROOF IP-54.
2-INSTRUMENT FOR RAW WATER & DEMI. WATER .

- **PANEL INSTRUMENT**

  - PLC PROGRAMABLE LOGIC CONTROLLER WITH 2 CPU PENTIUM 133 OR HIGH

    2 MONITOR
    2 HARDDISK
    2 FLOPPY DISK DRIVE
    INKJET OR LAZER PRINTER

  AND ALL OTHER ACCESSORIER LIKE POWER SUPPLY & COMMUNICATION INTERFACE CARD.

  FOR RAW WATER & LINK CABLES

    -DIGITAL INPUT 224 POINTS
    -DIGITAL OUTPUT 96 POINTS
    -ANALOG INPUT 8 POINTS

  FOR DEMI. WATER

    - DIGITAL INPUT 160 POINTS
    - DIGITAL OUTPUT 128 POINTS
    -ANALOG OUTPUT 8 POINTS

  - FOR RAW WATER

    1 RECORDER INPUT 4~20MA WITH ALARM 2SPDT CONTACT
    2 INDICATOR INPUT 4~20MA
    1 COUNTER 0~1500 M^3/H INPUT 4~20MA
    1 SET OF ALARM ANNUCIATOR 60 POINTS FOR RAW WATER

  - FOR DEMI. WATER

    - FLOW RECORDER INPUT 4~20MA (3 CHANNEL)WITH ALARM
    -CONDUCTIVITY RECORDER (6 CHANNEL)INDICATOR & ALARM -
    SILICA RECORDER (6 CHANNEL) INDICATOR & ALARM
    -PH INDICATOR WITH ALARM
    -SET OF ALARM ANNUNCIATOR 60 POINTS

1

- **CONTROL PANAL MISCELLANEOUS EQUIPMENT.**

-RAW WATER

1 EMERGENCY SHUTDOWN SYSTEM CONTENTS THE FOLLOWING ITEMS:

PUSH BUTTON SWITCH - RED 59
PUSH BUTTON SWITCH – GREEN 59
LAMP FOR STATUS RUN/STOP WHITE 44
LAMP FOR STATUS RUN/STOP RED 35
LAMP FOR STSTUS COMMON ALARM –GREEN 35
CHANGEOVER SWITCHS 2 POSITION 18
CHANGEOVER SWITCHS 3 POSITION 3
RELAY 4 SPDT CONTACTS 260
SET OF POINTS TERMINAL
1 SET POWER SUPPLY

-DEMI. WATER

1 EMERGENCY SHUTDOWN SYSTEM CONTENTS THE FOLLOEING ITEMS

PUSH BUTTON SWITCH RED 88
PUSH BUTTON SWITCH GREEN 88
LAMPS FOR STSTUS RUN/STOP WHITE 88
LAMPS FOR STATUS RUN/STOP RED 20
LAMPS FOR STATUS COMMON ALARM – GREEN 20
CHANGEOVER SWITCH 2 POSITION 27
RELAY 4 SPDT CONTACTS 280
1 SET OF POINTS TERMINAL
1 SET OF POWER SUPPLY

- **LOCAL INSTRUMENT**

-FOR RAW WATER

DESCRIPTION	QTY
SMART TRANSMITTER DEFFERINTIAL PRESSURE WITH 3 VALVE-MANIFOLD CONNECTION 1/2" PT -OUTPUT 4~20MA -INTERNAL SUPPLY 24VDC –BODY C.STEEL –DIAGPHRAM SUS316	2
PRESSURE GAUGE CONNECTION 1/2"-BOURDUN TUBE SUS316	8
VACUMM GAUGE PANEL MOUNTING WITH CONTACT	6
LEVEL SWITCH	15
LOCAL PANEL MOUNTING SOLENOID VALVE 3 WAY -1/4 NPT CONNECTION FOR IBSTRUMMENT AIR	21
SOLENOID VALVE -1/4NPT -4WAY	1
SOLENOID VALVE 1/2 NPT-3 WAY	4
OPEN/CLOSE/AUTO SELECTOR SWITCH FOR S.V. LOCAL PANEL MOUNTING	30
CABLE $3C*2^{SQ}$	1300M
CABLE 2C*1.5SQ	300M
CABLE 4C*2SQ	300M
CABLE 16C*2SQ	300M
COMPLET SET OF CABLES & WIRE ,ROUND TERMINAL,SCREW FOR TERMINAL	
PNEUMATIC VALVE	20
TWO AIR FILTER REGULATOR FOR EACH LOCAL PANEL	4
COMPLET SET OF CHLORINATOR SYSTEM	
LIMITE SWITCH	40
CABLE 24C*2SQ	300M
CABLE 10C*2SQ	300M
CANLE 3*8SQ	500M

-FOR DEMI. WATER

DESCRIPTION	QTY
D/P CELL SMART TRANSMITTER WITH 3 VALVE MANIFOLD-PROCESS CONNECTION 1/2"-OUTPUT 4~20MA-SUPPLY 24VDC –WITH ORIFICE	5
PH METER OUTPUT 4~20MA WITH SAMPLING UNIT	1 SET
CONDUCTIVITY METER WITH SAMPLING UNIT –OUTPUT 4~20MA	5 SET
SILICA METER WITH SAMPLING UNIT – OUTPUT 4~20MA	5 SET
PRESSURE GAUGE	25 SET
FLOW SWITCH WITH INDICATOR	2
LEVEL SWITCH	13
ROTAMETER (AREA FLOW METER)	3
ROTAMETER WITH INTEGRATED ORIFICE	3
TEMPRETURE SWITCH WITH SENSER	2
CABLE 24C*2SQ	500M
CABLE 2C*2SQ	1050M
PNEUMATIC VALVE	72
ROTAMETER (AREA FLOW METER) WITH ALARM	4
SOLENOID VALVE 1/4"- AIR PRESSURE 7KG/CM^2 –4WAY	80
AUTO/CLOSE/OPEN CHANGEOVER SWITCH	72
TWO AIR FILTER REGULATOR FOR EACH LOCAL PANAL	4
COMPLET SET FOR DEMI. WATER WITH CABLES,TERMINAL,ACCESSORIES N.F.B. POWER SUPPLY ETC..	
CABLE 3*2SQ	4000M
CABLE 4*2SQ	120M
CABLE 5*2SQ	1850M
CABLE 2*1.5SQ	130M
CABLE 3*1.5SQ	220M

R.O. UNIT (PAKAGE)

INSTRUMENT PANAL PLC OR DCS BASE CONTROLLER ELECTRONIC WITH CPU SMART ELECTRONIC TRANSMITTER

CONDENSATE POLISHER

DESCRIPTION	QTY
PRESSURE GAUGE	6
DIFFRENTIAL PRESSURE GAUGE WITH ALARM	2
AREA FLOWMETER	3
LEVEL SWITCH	4
TEMPRETURE SWITCH	1
PH METER WITH SAMPLING UNIT	1SET
INDICATOR WITH ALARM PANAL INDICATOR WITH CABLE,TERMINAL,CONDUIT PIPE & FITTING	1 SET
CONDUCTIVITY DOUBLE ELEMENT WITH SAMPLING UNIT	1 SET

COOING WATER

DESCRIPTION	QTY
PRESSURE GAUGE	2
DIFFRENTIAL PRESSURE GAUGE WITH ALARM	1
AREA FLOW METER	5
LEVEL SWITCH	2
LOCAL PANAL FOR FILTERS 1,2,3,4,5 CONSIST FROM MASTER TIMER & OTHER TIMER (FOR SERVICE & BACKWASH),NECCERAY RELAIES & TWO FILTER REQULATOR IN THE PANAL	
SELONIED VALVE	20
PNEUMATIC VALVE 8" (200MM)	24
D/P CELL SMART TRANSMITTER 4~20MA WITH 3 VALVE MANIFOLD, INDICATION WITH ALARMCONTACT IN DCS AMMONIA & UREA CCR OR IN SEPARATE INDICATOR IN CCR	3
D/P CELL PNEUMATIC TRANSMITTER WITH 3 VALVE MANIFOLD WITH LOCAL INDICATOR (WITH ANNUBAR TUBE)	3
AREA FLOW METER	2
D/P CELL PNEUMATIC TRANSMITTER WITH 3 VALVE MANIFOLD WITH LOCAL INDICATOR WITH ORIFICE	2
ROTAMETER WITH TRANSMITTER OUTPUT 4~20MA (INDICATOR & ALARM IN DCS OR IN SEPARATE INDICATOR IN CCR)	1
LEVEL ELECTRONIC TRANSMITTER BUBBLE TYPE (OUTPUT 4~20MA) (CONTROLLER & ALARM UNIT IN DCS OR IN SEPARATE CONTROLLER IN CCR)	1
CONTROL VALVE BUTTERFLY 10" WITH ACCESSORIES	1
DISPLACER ELECTRONIC TRANSMITTER OUTPUT 4~20MA CONTROLLER & ALARM SETTER IN DCS & DIGITAL OUTPUT TO INTERLOCK SYSTEM	1
CONTROL VALVE 2"	1
D/P CELL ELECTRONIC TRANSMITTER LEVEL MEASURMENT WITH INDICATOR & ALARM IN DCS	2
PITOT TUBE	2
LEVEL PROBE WITH LEVEL SWITCH FOR AUTO START P-740AB,P-715AB,EFFLUENT PIT AND WASTE PANAL	3
D/P CELL ELECTRONIC TRANSMITTER WITH 3 VALVE MANIFOLD INDICATOR IN DCS WITH OUTPUT CONTACTS FOR INTERLOCK SYSTEM	1
PRESSURE ELECTRONIC TRANSMITTER (CONTROLLER & ALARM SYSTEM IN DCS)	1
CONTROL VALVE BUTTERFLY 18"	1
PRESSURE ELECTRONIC TRANSMITTER INDICATOR & ALARM IN DCS	1
PRESSURE GAUGE	20
THERMOCOUPLE WITH THERMOWELL (INDICATOR IN DCS)	2
TEMPRETURE GAUGE WITH THERMOWELL	10
PH TRANSMITTER WITH SAMPLING SYSTEM 0~14PH-4~20MA OUTPUT(RECORDER & ALARM IN DCS ONE OUTPUT DIGITAL FOR INTERLOCK SYSTEM)	4SET
CONDUCTIVITY TRANSMITTER WITH SAMPLING SYSTEM 0~200 ,4~20MADC O/P (RECORDER AND ALARM IN DCS)	1
COMPLETE SET WITH CABLE ,CONDUCT,MATERIAL FOR ERACTION	

5

INSTRUMENT AIR COMPRESSOR

OIL FREE DRY AIR DEW POINT –25C -PRESSURE 7KG/CM^2

DESCRIPTION	QTY
ELECTRONIC PRESSURE TRANSMITTER (INDICATOR,CONTROLLER AND ALARM IN DCS/OUTPUT DIGITAL TO INTERLOCK SYSTEM	2
CONTROL VALVE	4
SOLEMOID VALVE	2
PRESSURE GAUGE	6
PRESSURE GAUGE WITH ALARM	2
MANUAL LOADER IN DCS TO VALVE	

INSTRUMENT FOR BOILER

AS WE ARE LOOKING FORWARD TO IMPROVE THE EFFECIENCT OF THE BOILERS BY ADDING TO THE CONTROL SYSTEM THE CONDUCTIVITY CONTROLLER TO BLOW OFF CONTROL & CONNECTING THE O2 ANALYIZER FOR AUTO ADJUSTING THE AIR /FUEL RATIO, WE WOULD LIKE YOU TO PROVIDE US WITH THE NECESSORY INFORMATION CONCERING THE A/M SUBJECT

-NO. OF BOILERS 4 SETS
-INSTRUMENT IN PANAL WEATHER PROOF
-INSTRUMENT IN LOCAL FLAME PROOF
-SEPARATE PANAL FOR EACH BOILER
-PROGRAMABLE DIGITAL CONTROLLER ,SELF TUNING
HAVING AN ABANDANCE OF CONTROL &
COMPUTATION FUNCTION IN ADDITION TO P/D
CONTROLLER WITH COMMUNICATION INTERFACE
CARD TO COMPUTER FOR FLOW MEASURMENT
,TEMPERATURE AND PRESSURE COMBPENSATION AND
SQURE ROOT TO BE USED
-INPUT &OUTPUT SIGNAL 4~20MA DC
-COMPACT POWER SUPPLY (LOOP VOLTAGE 24VDC)
-STAND BY MANUAL UNIT
-TWO SPDT CONTACT OUTPUT

FOR 4 BOILERS

OR TO BE CONNECTED TO DCS SYSTEM OF UTILITY

- SET OF COMPUTER
- HARDDISK / 1SET
- PRINTER /1 SET

FOR EACH (ONE) BOILER

-ONE SET OF ALARM SYSTEM	60 POINTS
-EMERGENCY LIGHT OFF,S/D SYSTEM,SAFTY SYSTEM RELAY & TIMERS	
DIGITAL INPUT	30 POINTS
DIGITAL OUTPUT TO LOCAL	32 POINTS
DIGITAL OUTPUT TO ALARM	46 POINTS
BUSH BUTTON & MAINTANCE SWITCH	10
-CONTROLLER 4~20MADC OUTPUT	16
-CONTROLLER THERMOCOUPLE INPUT TYPE K	2
-LEVEL,FLOW,PRESSURE RECORDING	10 POINTS
ANALYIZERRECORDING (CONDUCTIVITY,PH,O2)	6 POINTS
TEMPERATURE RECORDING	6 POINTS
INDICATION	12 POINTS
INTEGRATOR	4 POINTS
-COMPLETE SET WITH CABLES ,WIRES,TERMINALS,CALCULATION INSTRUMENT SAFTY BARRIER ,ISOLATOR ETC....	

LOCAL PANEL (4 SET FLAME PROOF)

THE FOLLOWING EQUIPMENT FOR 1 SET

ELECTRONIC INDICATOR	6
DRAFT GAUGE	5
ULTRAVIOLET AMPLIFIER WITH 2 OUTPUT	3
STATUS LAMP & PUSH BUTTON FOR INGLTION , PURGING, SHUTDOWN VALVES,STC...	1 SET

LOCAL INSTRUMENT (FOR 1 BOILER FLAME PROOF)

ULTRAVIOLET DETECTOR ELECTRONIC TRANSMITTER SMART OUTPUT 4~20MADC POWER SUPPLY INTERNAL 24VDC	3
LEVEL AND FLOW TRANSMITTER WITH 3 VALVE MAINFOLD	10
PRESSURE TRANSMITTER	6
LOCAL CONTROLLER PNEUMATIC 0.2~1.0KG/CM^2 OUTPUT	2
PRESSURE GAUGE	24
REGULATING VALVE	1
U TYPE DRAFT GAUGE (DOUBLE)	1
CONTROL VALVE & SHUTDOWN VALVE (WITH POSITIONERS & CONVERTORS)	14
CONDENSATE POT	3
ORIFICE ASSY.	2
SOLENOID VALVE	8
THERMOCOUPLE & THERMOWELL	7
TEMPURATURE GAUGE AND THERMOWELL	15
DRIVE UNIT OF FORCED DRAFT FAN QXYGEN ANALYZER WITH SAMPLING SYSTEM (OUTPUT 4~20MADC , RANGE 0~10%)	2 FOR BOILER A&D 1 FOR BOILER C&B 1SET
PH ANALYZER WITH SAMPLING SYSTEM (OUTPUT 4~20MADC , RANGE 0~14PH)	2 SET
CONDUCTIVITY ANALYZER WITH SAMPLING SYSTEM(OUTPUT 4~20MADC, RANGE 0~10)	1SET
CONDUCTIVITY ANALYZER WITH SAMPLING SYSTEM(OUTPUT 4~20MADC, RANGE 0~200)	1SET
SPEED TACHOMETER FOR FDF TURBINE	1 SET
LEVEL SWITCH FOR CHEMICAL TANK	1
LEVEL SWITCH FOR STEAM DRUM	1
LEVEL GAUGE FOR CHEMICAL TANK	1
LEVEL GAUGE FOR STEAM DRUM	2
SET OF SHEILDED CABLE & THERMOCOUPLE CABLE AND POWER CABLE (DIFFERENCE SIZE)	ABOUT 16000M
SET OF GASKET ,BOLT & NUT, TERMINAL,CONDUIT,PROCESS CONNECTION MATERIAL,PNEUMATIC CONNECTION FOR INSTRUMENT AND CONTROL VALVE,INSULATION MATERIALS	
IGINTION TRANSFORMER (COMPLET PANEL)WITH IGINITOR ELECTRODE AND OTHER ACCESSORIES	1SET
SUITABLE POWER SUPPLY WITH ALKALINE BATTERIES	

INSTRUMENT IN AMMONIA & UREA PLANT

WE ARE LOOKING TO USE MODERN INSTRUMENT IN AMMONIA ,UREA AND UTILITY PLANTS BY USING DISTRIBUTED CONTROL SYSTEM (DCS) OR PROGRAMABLE DIGITAL CONTROLLERS WITH COMMUNICATION INTERFACE CARDS TO COMPLUTER. BOTH SYSTEM FOR CONTROLLING,RECORDING ,INDICATING AND ALARM INDICATION .

DCS CONSIST	AMMONIA	UREA	UTILITY
OPERATING STATION WITH FLOPPY DISK	3SET	3SET	3SET
HARD DISK DRIVE	1	1	1
VIDEO COPER AND LOGGING PRINTER	1	1	1
ENGINEERING STATION	1	1	1

WITH SUITABLE UPS SYSTEM AND ALKALINE BATTERIES
FANICTION OF OPERATING STATION : TREND RECORDER
TAG LIST (SUMMARY LIST)
CONTROL PANEL
ALARM PANEL
SEQUENC
CONTROLLING IN DCS OR PROGRAMABLE DIGIT CONTROLLER TO BE , SELF TUNING PID & COMPUTATION FUNCTION.
FOR FLOW MEASURMENT TEMPERATURE & PRESSURE COMPENSATION & SQUARE ROOTING (LINEARIZATION) TO BE USED TO CORRECT THE FLOW MEASURMENT VALUES .
PANEL INSTRUMENT WEATHER PROOF IP54
LOCAL INSTRUMENT & PANEL EXPLOSION PROOF INTRINSIC SAFETY IN AMMONIA PLANT WEATHER PROOF SUITABLE FOR UREA GRADE IN UREA PLANT .

NUMBER OF ANALOGE & DIGITAL INPUT & OUTPUT

FUNCTION / NO.	AMMONIA & NH3 TANK	UREA	COOLING WATER 1-A, OFFSITE (UTILITY)
CONTROLLING A1/A0 4~20MADC	110	90	16
ANALOGE OUTPUT (A0)	16	30	-
CONTROLLING A1/A0 (THERMOCUPLE TYPE K)	30	25	8
RECORDING 4~20MADC	90	70	16
RECORDING THERMOCUPLE INPUT TYPE K	60	50	16
COUNTONG	10	4	-
ANALOGE INPUT FOR ALARM 4~20MA	225	150	50
ANALOGE INPUT THERMOCUPLE	100	50	20
COMPUTING FUNCTION	32	16	8
INDICATING (4~20MA) INPUT	40	40	20
INDICATING THERMOCUPLE TYPE K INPUT	160	100	20
DIGITAL INPUT	50	20	8
DIGITAL OUTPUT	30	20	10

INSTRUMENT IN AMMONIA & UREA PLANT

WE ARE LOOKING TO USE MODERN INSTRUMENT IN AMMONIA ,UREA AND UTILITY PLANTS BY USING DISTRIBUTED CONTROL SYSTEM (DCS) OR PROGRAMABLE DIGITAL CONTROLLERS WITH COMMUNICATION INTERFACE CARDS TO COMPLUTER. BOTH SYSTEM FOR CONTROLLING,RECORDING ,INDICATING AND ALARM INDICATION .

DCS CONSIST	AMMONIA	UREA	UTILITY
OPERATING STATION WITH FLOPPY DISK	3SET	3SET	3SET
HARD DISK DRIVE	1	1	1
VIDEO COPER AND LOGGING PRINTER	1	1	1
ENGINEERING STATION	1	1	1

WITH SUITABLE UPS SYSTEM AND ALKALINE BATTERIES
FANICTION OF OPERATING STATION : TREND RECORDER
TAG LIST (SUMMARY LIST)
CONTROL PANEL
ALARM PANEL
SEQUENC
CONTROLLING IN DCS OR PROGRAMABLE DIGIT CONTROLLER TO BE , SELF TUNING PID & COMPUTATION FUNCTION.
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ANALOGE OUTPUT (A0)	16	30	-
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RECORDING 4~20MADC	90	70	16
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COUNTONG	10	4	-
ANALOGE INPUT FOR ALARM 4~20MA	225	150	50
ANALOGE INPUT THERMOCUPLE	100	50	20
COMPUTING FUNCTION	32	16	8
INDICATING (4~20MA) INPUT	40	40	20
INDICATING THERMOCUPLE TYPE K INPUT	160	100	20
DIGITAL INPUT	50	20	8
DIGITAL OUTPUT	30	20	10

THE OTHER SEPARATE SYSTEMS IN CONTROL ROOM

- EMERGENCY SHUTDOWN & SAFETY SYSTEM:
  COMPLETE SET RELAY TYPE WITH MAINTANCE (BY BASS SWITCH) STATUS LAMP , CHANGE OVER SWITCH & PUSH BOTTON WITH SUITABLE POWER SUPPLY AND BELL

CAPACITY OF EMERGENCY SYSTEM:

FUNCTION	AMMONIA & NH3 TANK	UREA	UTILITY
DIGITAL INPUT	125	60	30
DIGITAL OUTPUT TO ALARM	130	70	25
DIGITAL OUTPUT TO LOCAL INST. & ELECTRIC SYSTEM	110	40	40
DIGITAL OUTPUT TO SWITCHES LAMP & PUSH BOTTON	50	30	15
RELAIES ,OFF DELAY & TIMERS	280	75	45
CHANGE OVER SWITCH	26	15	5

- FOR IMPORTANT DATA FOLLOWING INSTRUMENT TO BE USED

FUNCTION	AMMONIA	UREA	UTILITY
RECORDER	5	3	1
INDICATOR	2	1	-

- ALARM SYSTEM

FUNCTION	AMMONIA	UREA	UTILITY
ALARM SYSTEM	100 POINTS	50 POINTS	20 POINTS

- COMPLETE SET OF CABLES, WIRES, TERMINALS ..ETC FOR ERECTION OF INSTRUMENT IN CONTROL ROOM
- SET OF SAFETY BARRIERS FOR ANALOGE INPUT & OUTPUT & DIGITAL INPUT & OUTPUT TO HAZARDES AREA .

LOCAL INSTRUMENT FOR AMMONIA PLANT

THE ELECTRONIC TRANSMITTER SMART TRANSMITTER INTERNAL VOLTAGE 24VDC OUTPUT 4~20MADC (2-WIRES) WITH OUTPUT LOCAL INDICATOR

- LOCAL INSTRUMENT EXPLOSION PROOF (INTRINSIC SAFETY)
  DETAIL SPECIFICATION WILL BE GIVEN LATER .

QUANTITY OF LOCAL INSTRUMENT AS FOLLOW

FLOW TRANSMITTER WITH 3 VALVE MANIFOLD	90
ELECTRONIC FLANGE TYPE CONNECTION LEVEL TRANSMITTER	18
ELECTRONIC PRESSURE TRANSMITTER	46
ORIFICE & ORIFICE FLANGE	30
PNEUMATIC TRANSMITTER (OUTPUT 0.2~1KG/CM^2)	12
PNEUMATIC LOCAL CONTROLLER	6
CONDENSATE POT	40
CONTROL VALVE WITH ELECTRONIC POSITIONER	115
CONTROL VALVE WITH PNEUMATIC POSITIONER	6
ROTAMETERS & PURGE SETS	20
ROTAMETER WITH ELECTRONIC TRANSMITTER	5
LEVEL SWITCH	18
LOCAL PRESSURE SWITCH	50
PRESSURE GAUGE	350
TEMPERATURE GAUGE	140
THERMOCUPLE TYPE K	155
THERMOWELL FOR TEMP. GAUGE AND THERMOCUPLE	268
DISPLACER TYPE ELECTRONIC TRANSMITTER	14
DESUPER HEATER	2
ANNUBAR TUBE	1
TURBINE FLOW METER	2
TACHOMETER (SPEED INDICATOR FOR STEAM TURBINE)	10
THERMOSTAT	5
LEVEL GAUGE	60
LIMIT SWITCH	5
PRESSURE REGULATOR	10
MECHANICAL LEVEL GAUGE	2 AMMONIA TANK BREATHING TANK
SOLEIOND VALVE	40
CONVERTER I/P & P/I	25
DIFFERINAL PRESS. LOCAL INDICATOR	10
TEMPARETURE SWITCH	4

GAS CHROMATOGRAPH ANALYZER TWO STREAM COMPLETE ONE SET FOR ANALYZE H2(HYDROGEN),Ar ,CH4 WITH SAMPLING UNIT & PROCESSOR

GAS	STREAM1	STREAM2
H2	0~100%	0~100%
Ar	0~1%	0~5%
CH4	0~2%	0`10%

OXYGEN NALYZER COMPLETE ONE SET WITH SAMPLING UNIT
RANGE 0~5% FOR PRIMARY REFORMER FLUE

GAS ANALYZER FOR CH4 WITH SAMPLING UNIT TWO SETS
FIRST RANGE 0~1%
SECOND RANGE 0~10%

GAS ANALYZER CO WITH SAMPLING UNIT ONE UNIT
RANGE 0~1%

GAS ANALYZER CO2 WITH SAMPLING UNIT TWO SET
FIRST RANGE 0~50PPM
SECOND RANGE 0~0.5%

GAS ANALYSER H2 WITH SAMPLING UNIT ONE SET
RANGE 55~85%

PH ANALYZER WITH SAMPLING UNIT 2 SETS
RANGE 0~14PH

CONDUCTIVITY METER WITH SAMPLING UNIT 3 SETS
RANGE 0~200 /CM TWO SETS
RANGE 0~20 /CM ONE SET

DEARATOR DISOLVED OXYGEN IN DEARATED WATER WITH SAMPLING UNIT
RANGE 0~10PPM

COMPLETE SET FOR ERECTION ,GASKETS,BOLTS & NUTS,CONDUITS,PIPING & CONDUIT FITTING ,PROCESS CONNECTION PIPING & FITTINGS & CABLES (POWER, SHEIDED CABLE,COMPENSATING CABLES),GAUGE UNION & SYPHON ,INSULATION MATERIALS...ETC
.

EQUIPMENT & INSTRUMENTS FOR TEST & CALBRATION OF PRESSURE ,FLOW ,LEVEL & TEMPURATURE INSTRUMENT LIKE

-AVO,MEGER 100V & 500V
-LOOP CALIBRATOR
-TEMP. BATH CALIBRATOR
-FREQUENCY GENERATOR
-SPECIAL TOOL
-SPECIAL INSTRUMENT & EQUIPMENT FOR PLC, DCS ,PROGRAMABLE , CONTROLLER TURBINE FLOW METER ...
-DEAD WEIGHT TESTER FOR PRESSURE INSTRUMENT
-POWER SUPPLY AND VOLTAGE REGULATOR
-STANDARD AMPERE AND VOLTMETER
-AMPERE AND VOLTAGE GENERATOR

LOCAL INSTRUMENT FOR UREA & CO2 COMP.

LOCAL INSTRUMENT FOR UREA TO BE WEATHER PROOF, CORRISIVE PROOF SUITABLE FOR UREA PLANT (UREA GADE)

ALL ELECTRONIC TRANSMITT TO BE SMART TRANSMITTER OUTPUT 4~20MA, INTERNAL POWER SUPPLY 24VDC (2-WIRE TRANSMITTER) WITH OUTPUT LOCAL INDICATOR ACCERSSORRIES

FLOW TRANSMITTER WITH 3 VALVE MANIFOLD (ELECTRONIC)	36
ELECTRONIC FLANGE TYPE LEVEL TRANSMITTER	12
ELECTRONIC PRESSURE TRANSMITTER	36
PNEUMATIC TRANSMITTER (OUTPUT 0.2~1KG/CM2)	6
LOCAL CONTROLLER PNEUMATIC	6
ORIFICE & ORIFICE FLANGE	20
CONDENSATE POT	20
CONTROL VALVE WITH ELECTRONIC POSITIONER & OTHER ACCESSORIES	89
CONTROL VALVE WITH PNEUMATIC POSITIONER & OTHER ACCESSORIES	6
ROTAMETER AND PURGE SETS	66
ROTAMETER WITH ELECTRONIC TRANSMITTER	4
LEVEL SWITCH	5
LOCAL PRESSURE SWITCH	20
PRESSURE GAUGE	150
TEMPERATURE GAUGE	70
THERMOCUPLE TYPE K	80
THERMOWELL FOR TEMP. GAUGE & THERMOCUPLE	195
DISPLACER TYPE ELECTRONIC TRANSMITTER	10
TURBINE FLOW METER	1
LEVEL GAUGE	20
FLOW NOZZLE	2
SOLENOID VALVE	20
AMMONIA FEED TO REACTOR (EJECTOR)	1
SELF REGULATOR VALVE	3
DIFFERENTIAL PRESSURE LOCAL INDICATOR	10
I/P & P/I CONVERTER	15
TEMP. SWITCH	8

CONDUCTIVITY METER WITH SAMPLING UNIT ONE SET
RANGE 0~200 /CM

OXYGEN ANALYZER COMPLETE SET WITH SAMPLING UNIT
RANGE 0~1% (FOR CO2 COMP.)

CONVEYER WEIGHT MACHINE (GAMA RAY) DETECTOR ,AMPLIFIER & INDICATOR FOR UREA RANGE 0~80 T/Hr WITH TEMPERATURE COMPENSATOR.

COMPLETE SET FOR ERECTION : GASKETS. BOLT & NUTS, CONDUIT PIPING AND CONDUIT FITTINGS, PROCESS CONNECTION PIPING AND FITTINGS ,POWER & SHEILD CABLE ,COMPENSATING CABLE ,GAUGE UNION & SYPHON ,INSULATION MATERIALS ..ETC

FOUR SETS OF LOCAL PANELS FOR TURBINE AND COMP.

1-K-301 SYN. COMPRESSOR
2-K-302 AIR COMPRESSOR
3-K-303 NG COMPRESSOR
K-401 REFREGURATION COMPRESSOR
4-K-501 CO2 COMPRESSOR

THE PANELS & LOCAL INSTRUMENTS TO BE EXPLOSION PROOF INTENISIC SAFETY .
LOCAL PANEL CONTENT THE FOLLOWING

-ALARM SYSTEM ELECTRONIC TYPE WITH POWER SUPPLY AND PUSH BOTTON AND LAMPS :-

K-301 30POINTS
K-302 16POINTS
K-303 & K-401 40 POINTS
K-501 25POINTS

-INTERLOCK (SAFETY DEVICE SYSTEM) WITH CHANGE OVER MAINTENANCE SWITCH PUSH BOTTON ,POWER SUPPLY, RELAY, TIMERS 4SETS

-VIBRATION & AXIAL SYSTEM PROBES , POWER SUPPLY ,DOUL INDICATION FOR VIBRATION AND SINGLE INDICATION FOR AXIAL ,PROXIMATERS, EXTENSION CABLE , RACK AND MATERIAL FOR INSTALLATION

K-301	4 PROBES FOR AXIAL 16 PROBES FOR VIBRATION 12 INDICATOR
K-302	5 PROBES FOR AXIAL 20 PROBES FOR VIBRATION 15 INDICATOR
K-303	2 PROBES FOR AXIAL 8 PROBES FOR AXIAL 6 INDICATOR
K-401	3 PROBES FOR AXIAL 12 PROBES FOR VIBRATION 9 INDICATOR
K-501	4 PROBES FOR AXIAL 20 PROBES FOR VIBRATION 15 INDICATOR

SPEED DETECTOR ,PICK UP COIL ,AMMPLIFIER AND LOCAL PANEL INDICATOR

K-301	RANGE 0~14000RPM
K-302	RANGE 0~8000 RPM
K-303	RANGE 0~15000RPM
K-401	RANGE 0~14000RPM
K-501	RANGE 0~10000RPM

	K-301	K-302	K-303	K-401	K-501
TEMPERATURE RECORDER WITH ALARM 6 POINTS	2	3	1	1	2
ELECTRONIC INDICATOR WITH 2 CONTROL	6	2	2	1	2
MANNAL LOADER ELECTRONIC WITH LOCAL REMOTE SWITCH	1	1	1	1	1
DIGITAL CONTROLER WITH 3 CONTACT OUTPUT	3	1	1	1	2
STATUS LAMP FOR PUMPS AND MOTORS	8	7	6	6	7
LOCAL MOUNTING & PRESSURE GAUGE	10	11	8	7	10
LOCAL PANEL MOUNTING PRESSURE SWITCH	2	2	2	2	3

LOCAL INSTURMENT FOR COMPRESSORS

	K-301	K-302	K-303	K-401	K-501
SMART ELECTRONIC TRANSMITTER DIFF. PRESSURE WITH 3 VALVE MANIFOLD	12	2	4	2	6
PNEUMATIC TRANSMITTER WITH 3 VALVE MANIFOLD	7	2	3	2	8
PNEUMATIC LOCAL CONTROLLER	4	3	3	3	5
CONTROL VALVE WITH POSITIONER	11	3	5	3	8
REDUCING VALVE	1	1	1	1	2
REGULATOR FOR GOVERNOR	3	3	3	3	3
LEVEL SWITCH	2	2	2	2	2
PRESSURE SWITCH	7	6	7	5	6
THERMOCUPLE WITH THERMOWELL	5	11			
THERMOCUPLE	13	13	4	7	11
TEMP. GAUGE WITH THERMOWELL	8	8	8	3	8
DIFF. PRESSURE GAUGE	2	-	-	-	3
PRESSURE GAUGE WITH UNION	20	18	18	6	20
SOLENIOD VALVE	2	2	2	2	2

SET OF GASKET, BOLT & NUTS,TERMINALS, CONDUIT PIPINGS AND FITTINGS,PROCESS CONNECTION PIPING AND FITTINGS, POWER AND SIGNAL CABLES & WIRES, PNEUMATIC CONNECTION FOR INSTRUMENT AND CONTROL VALVE ,INSULLATION MATERIALS....ETC

NO.	Substanse	B-1	B-2	B-3	B-4
1-	Colour	-	-	-	-
2-	Temperature	Less than 35 ^{o}c	45^{o} c		
3-	Suspended soilds	60	750		
4-	**PH**	6-9.5	6-9.5		
5-	**Dissolved oxygen**	-	-	-	
6-	B.O.D$_5$	**Less than 40**	1000		
7-	CO.D.(Cr$_2$ O$_7$)	**Less than 100**	-		
8-	Cyanide CN$^-$	0.05	0.5		
9-	Fluoride F$^-$	5.0	10		
10-	Free Chlorine	Trace	100		
11-	**Chlorides**	a) If the ratio of disposed water to the sourc water 1:1000 or less it is acceptable to increase the conc.by 1%of the natuoral conc. In the source before disposing. b) If the ratio of disposed water to the source water more than 1:1000, choroids conc .in the disposed water should be less than 600 mg/L c) If fluorides conc.in the source water less than 200 mg/l,each case should be studied separately by the ress ponsible about the system.			
12-	Phenol	0.01-0.05	5-10		
13-	Sulphates SO$_4^=$	a)If the ratio of disposed water to the souree water 1:1000 or less it is allowable to dispose the water to the source at a conc. and quantity creating an increment in the sulphate conc. of the source by 1%of natural source conc. before disposing. b) If the ratio of disposed water to source water more than 1:1000 , Sulphates conc.in disposed water should not be more than 400 mg/l c)If sulphate conc. in the source water less than 200mg/l,each case should be studied separately by the responsible about the system.			
NO.	**Substanse**	**B-1**	**B-2**	**B-3**	**B-4**
14-	Nitrate NO3$^-$	50	-		
15-	Phosphate PO$_4^{-3}$	3.0	-		
16-	Ammonium NH$_4^+$	-	-		
17-	DDTAntiseptic	0.0	-		
18-	Lead Pb	0.1	0.1		
19-	Arsenic As	0.05	0.05		
20-	Copper Cu	0.2	-		

Appendix No. (4)

Inviromental Requirements and Standard

Concentrations below calculated as (mg/l) except what is mentioned accortdingly

NOTE:

B-1 to B-4 mean what is mentioned in the item of water classification which include also the restriction that should be followed by the responsible about disposal.

- **It is possible to increase the allowable conic. At alimited ratio indicated in certain cases depending upon the influence of the required disposdal on the water source.**

Appendix No. (5)

Investment Law No. (13) of 2006

Unofficial translation

In the name of people

Presidency Counsel

Pursuant to what was approved by the Council of Representatives in accordance with provisions of Para (first) of Article (61) of the constitution and elapse of the legal period given in Para 5/A of Article 138 of the constitution ,the following law is promulgated

No. (13) of 2006
The Investment Law

Chapter One

Definitions

Article (1)

The following terms, wherever mentioned in this Law, shall have the following specific meanings unless the context indicates otherwise:

A: The Council :the Council of Ministers

B: National Commission for Investment: the commission established in accordance with this law responsible for drawing up the national policy and laying out its guidelines and monitoring the implementation of these guidelines and instructions in investment. It shall specialize in investment projects of a federal nature exclusively.

C: Region's Commission: The investment commission of the region responsible for investment planning and granting investment licenses in the region.

D: Governorate Commission : The investment commission of the governorate not organized in a region responsible for investment planning and granting investment licenses in the governorate.

E: The commission: The National commission for Investment or the Region's commission or the Governorate Commission as the case.

F: Chairman of the Commission: the Chairman of the National Commission for Investment.

G: The Project: the economic activity subject to the provision of this law.

H: The Assets: the tools, apparatuses, equipments, machineries, transportation means and office furnishings and appliances to be used for the project exclusively and the furniture and appliances of the hotels, tourist cities, hospitals, schools and colleges.

I: The foreign investor: is the investor who does not hold the Iraqi nationality in the case of real person, and is registered in a foreign country in the case of a juridical or legal person.

J: The Iraqi investor: is the investor who holds Iraqi Nationality in case of real person, and registered in Iraq in case of a juridical or legal person.

K: Taxes and duties: all kinds of taxes and duties imposed according to applicable laws.

L: The designed production capacity: is the production capacity designed within a specific unit of the time (hour, day…..etc) in accordance to what is fixed in the documents incoming with the machine of the supplier and the feasibility study of the project.

M: Investment Portfolio: A collection of investments in shares and bonds.

N: Investment: is the investment of capital in any economic activity or project that results in a legitimate benefit for the country.

Goals and Means

Article(2)

This law aims at the following:-

First: To promote investment and transfer modern technologies in order to contribute to the process of the developing and enhancing Iraq, and expanding and diversifying its production and service base.

Second: To encourage the Iraqi and foreign private sector to invest in Iraq by providing the required facilities for establishing investment projects and enhancing its competitive capacities in the local and foreign markets for projects covered by this law.

Third: To develop human resources based on market demands and provide work opportunities for the Iraqis.

Fourth: To protect the rights and properties of investors.

Fifth: To expand exports and improve the balance of payments and balance of trade of Iraq.

Article 3

The following means shall be adopted to realize the objectives of this law:

First: To grant projects covered by provision of this law the necessary privileges and guarantees for its continuation and development by providing support in a way that enhances the competitive capacities of these projects in the local and foreign markets.

Second: To grant projects that obtained an investment license from the Commission, additional facilities and exemptions from taxes and duties in accordance with the stipulations of this law.

Chapter Two

The National Commission for Investment and the Investment Commission in the Regions and Governorates

Article 4

First: **A Commission shall be established and called the "The National Commission for Investment".it shall enjoy a juridical personality and shall be represented by the Chairman of the Commission or the person authorized by him. It shall be responsible for drawing up the national policies for investment and drawing up it's Plans, regulations as well as monitoring the implementation of these guidelines and instructions in investment. It shall specialize in strategic investment projects of a federal nature exclusively.**

Second: **The National Commission for Investment shall be managed by Board of Director comprised of nine member who must be competent, specialized, and hold a college degree that suits the specialty of the Commission. They must not have been sentenced for a felony or misdemeanor of moral turpitude or have declared their bankruptcy.**

Third:

A. **Upon a request by the prime Minister, the Council of Ministers shall nominate a Chairman of the Commission at a grade of Minister and a Deputy Chairman at a grade of Deputy – Ministry for a period of five years and present them to the Council of Representative for approval.**
B. **The prime Minister shall appoint four member for a period of five years at a Grade of Director General.**
C. **The Prime Minister shall select three members from the private sector for five years after their nomination by Chairman of the Commission and specifying their compensations according to the bylaws.**
D. **At the conclusion of the membership of any member of the Commission referred to in Paragraph (A and B) of this Article in cases not involving dismissal and resignation, the Prime Minister shall assign them to any governmental entity at the same grade. Those mentioned in (A) of this article shall be retired on pension when not assigned to a government position equivalent to their grade.**
E. **The Council of Representatives may directly dismiss the Chairman of the National Commission for Investment and his Deputy, or upon a request by the Prime Minister for compelling reasons.**
F. **The Council of Ministers may dismiss or replace any member of the Commission or replace him with others in case he does not adhere to the standards and regulations of the Commission.**
G. **The Board of Directors of the National Commission for Investment shall meet at the invitation of its Chairman. The quorum of convening and adopting resolutions**

work shall be organized by by- laws issued by the commission.

H. The National commission for Investment shall be connected to the prime Minister.

I. The salary scale and entitlements of the Commissions employees shall be determined by a decision of the Prime Minister based on a proposal from the Chairman of the National Commission for Investment.

Fourth:

The Commissions headquarters shall be in Baghdad and it may appoint representatives in the regions and governorates.

Fifth:

The National Commission for investment shall draw up an overall national strategic policy for investment identifying the more important sectors and shall prepare a map of investment projects in Iraq in the light of the information it receives from the regions and governorates. It shall also prepare lists of investment opportunities in strategic and federal investment projects with initial information about these projects and making it available to those wishing to invest.

Article 5

First: The regions and governorates not organized in a region may form investment commissions in their areas. The latter shall enjoy the powers of granting the investment licenses, investment planning ,promoting investment and opening branches in their areas within the provisions of this law in consultation with National Commission for Investment to guarantee the availability of the legal conditions.

Second: The Investment Commission of the regions and governorate shall be composed of at least seven members including the chairman and the vice chairman of at least seven years of experience and competence and with a university degree appropriate to the specialization of the commission and not convicted in a felony or a misdemeanor involving turpitude or has declared his bankruptcy.

Third: The regions and governorates not organized in a region shall establish a mechanism of forming the investment commission of the region and the governorate and dismissing the Commission member in case of not adherence to the Commission regulations and standards.

Fourth: The Investment Commissions of the regions and governorate shall coordinate their work with the National Commission for Investment, and shall coordinate and consult with local governments regarding investment plans and facilities.

Fifth: The regions and governorates Commissions shall draw up their investment plan in a way that dose not contradict with the federal investment policy and shall prepare list of the investment opportunities in the areas that are subject thereto, with initial data about these projects and offer it to those wishing to invest.

Sixth: The regions Commissions shall be connected to the prime Minister of the region and is subject to the scrutiny of the regions Council. The governorate commission shall be connected to the Governor and is subject to the scrutiny of the governorate council in a way that does not contradict with the provisions of this law.

Seventh: Regions and Governorates Commissions board of directors shall convene upon an invitation from their chairman . The quorum of convening and adopting resolutions and recommendations shall be determined by absolute majority. The conduct of work shall be organized by by – laws issued by the Commission.

Article 6 :

In addition to ordinary correspondence, the Commission may adopt electronic mail with the official entities connected with the work and activity of the Commission through local networks or the Internet according to guidelines set by the Commission.

Article 7 :

A- The Commission shall accept investment license requests for projects whose capital is not less than the minimum amount determined by the Council of Ministers or the Council of Ministers of region as the case, by a regulation issued based on a proposal by the Commission.

B- The Commission must obtain the approval of the Council of Ministers before granting the license if the value of the investment project is more than two hundred and fifty million dollars.

C- The Commission shall make its final decision concerning the requests of investment license within a period not exceeding (45) forty five days from the date of filing a request.

D- The decisions of the Commission regarding the approved investments projects shall be obligatory for the purposes of this law.

Article 8 :

The Commission shall have an independent annual budget whose revenues shall be made up of its allocated amount in the State General Budget.

Article 9 :

The Commission shall promote investment through the following:-

First: Building confidence in the investment environment, identifying investment opportunities, and promoting and stimulating investment in them.

Second: Simplifying the procedures for registration, issuing of investment projects licenses, and following up existing projects and giving them priority in processing with the official entities. Completing the procedures of answering investor requests and obtaining the required approvals for the investor and the project.

Third: Establishing one window at the National Commission for investment and the Regions and Governorates Commissions, which includes authorized representatives from the ministries, and members nominated by the Councils of the regions and governorates as the case and the concerned authorities to undertake issuing licenses and obtain the approvals of other authorities in accordance with the law.

Fourth: Providing advice, information, and data to investors and issuing special manuals in this regard.

Fifth: Setting forth and implementing programs to promote investment in different areas of Iraq in order to attract investors.

Sixth: Facilitating the allocation of the needed lands and renting them out for establishing projects for a sum to be determined by the Commission in coordination with the concerned authorities.

Seventh: Establishing secure and free investment areas with the agreement of the Council of Ministers.

Eighth: Encouraging Iraqi investors through providing them with easy loans and financial facilities in coordination with the Ministry of Finance and with the assistance of Banking Institutions, provided that the investor obtaining the loan shall employ a number of unemployed Iraqis proportional with the volume of the loan.

Ninth: Any other tasks related to its work and assigned by the Council of Ministers.

Chapter Three

Privileges and guarantees

Article 10:

The Investor irrespective of his /her nationality shall enjoy all privileges, facilitations and guarantees and shall be subject to the obligations stated in this law. The Iraqi and foreign investor shall have the right for the purposes of housing projects, the use of the land for a sum to be determined between him and the land owner without land speculation according to conditions set forth by the National Commission of investment and the approval of the Council of Ministers. The Commission shall facilitate the allocation of the required lands for the housing projects. The housing units shall be allocated for ownership by the Iraqis after the completion of the project.

Article 11:

The investor shall enjoy the following benefits:-

First: the investor shall have the right to take out the capital he brought into Iraq and its proceeds in accordance with the provision of this law and pursuant to the instructions of the Central Bank of Iraq in an exchangeable currency after paying all his taxes and debts to the Iraqi Government and all other authorities.

Second: The foreign investor shall have the right to :

A. Exchange shares and bonds listed in the Iraqi Stock Exchange
B. Form investment portfolios in shares and bonds

Third: Renting or leasing land needed for the project for the term of the investment project, provided that it dose not exceed 50 years renewable with the agreement of the Commission, and provided that the nature of the project and its benefit for the national economy is taken into consideration when determining the period.

Fourth: Insuring the investment project with any foreign or national insurance company it deems suitable.

Fifth: Opening accounts in Iraqi or foreign currency or both at a bank inside or outside Iraq for the licensed project.

Article 12:

This law shall guarantee the following for the investor:-

First: The right to employ and use non- Iraqi workers in case it is not possible to employ an Iraqi with the required qualifications and capable of performing the same task in accordance with guidelines issued by the Commission.

Second: Granting the foreign investor and non –Iraqis working in the investment projects the right for residence in Iraq and facilitate inter and departure from Iraq.

Third: Non- seizure or nationalization of the investment project covered by the provisions of this law in whole or in part, except for projects on which a final judicial judgment was issued.

Fourth: Non Iraq technicians and administration employees working in any project shall have the right to transfer their salaries and compensations outside Iraq in accordance with the law after paying their dues and debts to the Iraqi government and all other entities.

Article 13:

Any amendment to this Law shall not have any retroactive affect regarding the guarantees, exemptions, and rights recognized by this Law.

Chapter four

Investor Obligations

Article 14:

The Investor shall observe the following:-

First: To notify the National Commission for Investment , the Region or Governorate Commission in writing immediately after the installation and equipping of the fixed assets for the purposes of the project and the date of the beginning of commercial activity.

Second: To keep proper records audited by a certified accountant in Iraq in accordance with the law.

Third: To provide an economic and technical feasibility study for the project and any information, data or documents required by the Commission or other competent authorities regarding the budget of the project and the progress made in its execution.

Fourth: To keep records of the projects duty- free imported materials in accordance with the provisions of this Law and specifying the depreciation periods of these materials.

Fifth: To protect the safety of the environment and to adhere to the valid quality control norms in Iraq and International regulations in this field also adhere to laws connected to security and health and to public order and Iraqi social ethics.

Sixth: **To adhere to the valid Iraqi laws regarding salaries, vacations, work hours, work conditions and others as a minimum.**

Seventh: **Commitment to the correspondence of the work progress schedule submitted by the investor with reality provided that the time difference shall not exceed six months, the National Commission for Investment shall set forth punitive conditions in case of exceeding the six –month period and the Commission shall have the right to withdraw the license.**

Eighth: **To train and rehabilitate its Iraqi employees as well as raising their efficiency, skill and capabilities. Priority in employment and recruitment shall be given to the Iraqis.**

Chapter Five

Exemptions

Article 15:

First: **The project that has obtained an investment license from the Commission shall enjoy exemption from taxes and duties for a period of (10) ten years as of the date of commencing commercial operations in accordance with the areas of development defined by the Council of Ministers at the suggestion of the National Commission for Investment based on the degree of economic development and the nature of the investment project.**

Second: **To Council of Ministers shall have the right to propose draft laws to extend or grant exemptions in addition to the exemptions stipulated in paragraph (First) of this Article, or provide incentives, guarantees or other benefits to any project or sector or region and for the periods and percentages it deems appropriate in accordance with the nature of the activity, its geographical location and its contribution to manpower employment and its effect on driving the economic development, for considerations of national interest.**

Third: **The National Commission for Investment has the right to increase the years of tax and duties exemption in a way directly proportional to the increase in the Iraqi Investor share in the project to reach fifteen years if the Iraqi Investor share in the project was more than 50% .**

Article 16:

In case the project is moved from one development area to another during the exemption period, the project – for the purpose of exemption stipulated in(First) of Article 15- shall be treated during the remaining term the treatment of the project in the development areas it is moving to, provided that the Commission is informed of such move.

Article 17:

The project that obtains an investment license shall also enjoy the following:-

First: **Assets imported for the purposes of the investment project shall be exempted from duties provided that their entry to Iraq is made within(3) three years from the date of granting the investment license.**

Second: **The imported assets required for the expansion, development or modernization of the project shall be exempted from duties in case they led to an increase in the designed**

capacity, provided they are brought in within three years from the date of notifying the Commission of the expansion or development. Expansion, for the purposes of this law, shall mean adding fixed capital assets aimed at increasing the designed capacity of the project in commodities or services or materials by a percentage exceeding (15%)fifteen percent. Development, for the purposes of this law, shall mean replacing project machines with more developed ones, totally or partially or making a development on the standing devices and equipments of the project by adding new machines and devices or parts thereof with the aim of raising the productive efficiency or improving and developing the quality of the products and services.

Third: Spare parts imported for the purposes of the project shall be exempted from duties if the value of these parts does not exceeded(20%) twenty percent of the fixed assets value, provided that they are not be used for any other purpose.

Fourth: Hotels, tourist institutions, hospitals, health institutions, rehabilitation centers and educational and scientific organizations project shall be granted additional exemptions from duties and taxes on their imports of furniture, furnishings and requisites for renewing and updating purposes at least once every four years, provided that these items are brought into Iraq or used in the project within (3) three years from the date of the approval decision of the Commission on the import lists and their quantities, and provided that these items are not used for purposes other than the imported purposes.

Article 18:

In case it is found that the project assets totally or partially exempted from customs and duties, are sold, in contrary to the provisions at this law or used not for the project, or used not for the declared purpose then the investor must pay the taxes and fines incurred pursuant to the law.

Chapter Six

Procedures for Granting investment and project Establishment License

Article 19:

First: The investor shall obtain the license in addition to obtaining the rest of the licenses for the purpose of enjoying the privileges and exemptions provided by the Commission.

Second: To Commission shall grant the license for investment or project establishment based on a request submitted by the investor according to conditions facilitated and prepared by the Commission. The request submitted by the investor shall include the following:-

- **A- Filling a request form prepared by the Commission.**
- **B- Financial competency from an accredited bank.**

C- Projects prohibited by the Investment Law of Outside Iraq.

D- Details of the project intended to invest in and its economic feasibility.

E- A timetable for completing the project.

Article 20:

First: The Commission must issue the establishing license through establishing one window in the region or the governorate not organized in a region that includes authorized representatives of the ministries and relevant bodies. The Commission shall grant project establishment license and obtain approvals from the entities in accordance with the law.

Second: To Commission must help the investor to obtain licenses by approaching the competent authorities and exploring the opinions of the entities concerning the issuance of the establishment license. These entities must issue the decision to reject, approve or request amendment within 15 days from the date of being notified. The failure to reply from the entity from which the opinion is solicited shall be deemed as an approval and in case of a rejection there must be cause for it.

Third: In case of disagreement between the National Commission for Investment decision and the other entity related to granting establishment license other than the region commission the dispute shall be raised to prime Minister for settlement.

Fourth: In case the request for registration in rejected, the applicant may file a complaint to the Chairman of the region or the governorate Commission concerned within(15) fifteen days after receiving notification of the rejection decision. The Chairman of the Commission concerned shall take a decision concerning the complaint in question within a period of seven days. The petitioner may appeal the decision of the Chairman of the Commission concerned rejecting his complaint to the authority to which the Commission concerned is connected to within 15 days from the date the complaints rejection and its decision is deemed final.

Chapter Seven

General Provisions

Article 21:

The project capital subject to the provisions of this law shall be made up of the following:-

First: Cash transferred to Iraq through banks and financial companies or any other legal means with the aim of investing it for the purposes of this law.

Second: The in – kind assets and incorporeal rights imported to Iraq or purchased from the local markets by the cash transferred into Iraq:-

1- Lands and objects related to the project.

B- The machinery, tools, equipment, building , construction, transportation means, furniture and offices appliances required for establishing the project.

C- The incorporeal rights that include patents, registered trade marks, technical know- how, engineering services, administrative and marketing services and the similar.

Third: Profits, proceeds and reserves resulting from the capital invested in Iraq in the project if the capital of such a project was increased or was invested in another project covered by the provisions of this law.

Article 22:

The foreign investor shall enjoy additional privileges in accordance with international agreements signed between Iraq and his country or multilateral international agreements which Iraq has joined.

Article 23:

In case the property of the project during the exemption term is transferred to another investor the project shall continue to enjoy granted exemption facilities and guarantees until the end of that period provided that the new investor continue to work on the project in the same specialization or in another, with the approval of the Commission. The new investor must take the place of the former investor in the rights and obligations consequent to the provisions of this law.

Article 24:

First: The investor, with the approval of the Commission, may sell exempted fixed assets or relinquish it to another investor benefiting from the provisions of this law, provided that he uses them in his project.

Second: The investor, after informing the Commission, may sell the exempted fixed assets to any person or other project not subject to the provisions of this law after paying the outstanding duties and taxes.

Third: The investor, with the approval of the Committee, may re-export the exempted fixed assets.

Article 25:

In the event two or more companies or enterprises merge, the new company or entity resulting from the merger must set up separate accounts for each project before the merger in order to register and apply exemptions and facilitations stipulated in this law during the remaining period of the exemption.

Article 26:

Any project approved in accordance with the provisions of the previous applicable laws shall continue to benefit from all exemptions granted to it pursuant to that law and until the expiration of the exemption period and under the same terms.

Article 27:

Disputes arising between parties who are subject to the provisions of this law shall be subject to the Iraqi law unless otherwise agreed, save to the cases that are subject to the provisions of the Iraq law exclusively or the jurisdiction of Iraqi courts.

1- Disputes arising from the labor contract shall exclusively be subject to the provisions of the Iraqi law and the jurisdiction of the Iraq courts. Non –Iraqi labor shall be exempted if the work contract stipulated otherwise.
2- If parties to a dispute are non – Iraqis and in disputes not arising from a crime, the opponents may agree on the law to be applied, the competent court or any other agreement to resolve their dispute.
3- In case of dispute between partners or between the owner of a project subjected to the provisions of this law, and others that result stoppage of work for a period of more than three months, the Commission may withdraw the license and ask the owners of the project to settle the dispute within a period not exceeding three months. If such period elapsed without settling the dispute between the partners or between the owner of the project and others, the Commission may take legal measures to liquidate the project and notify the owner of the project or one of the partners of such action. The liquidation money shall be deposited in one of the banks after paying the dues of the State or any other dues after final judgment of their entitlement is rendered.
4- If the parties to a dispute are subject to the provisions of this law, they may, at the time of signing the agreement, agree on a mechanism to resolve disputes including arbitration pursuant to the Iraqi law or any other internationally recognized entity.
5- Disputes arising between the Commission or any governmental entity and any of those subject to the provisions of this law on matters not related to violations of one of the provisions of this law shall be subject to Iraqi law and courts on civil matters. As for commercial disputes, parties may resort to arbitration provided that such an arrangement is stipulated in the contract organizing the relationship between parties.

Article 28:

In case the investor violates any of the provisions of this law, the Commission shall have the right to warn the investor in writing to remove the violation within a specific period.

In case the investor dose not remove the violation within the specified period, the Commission shall summon the investor or who represent him to state his position and grant him other respite to settle the issue. Upon repeating or not removing the violation, the Commission shall have the right to withdraw the investors license it issued and order stoppage of work on the project and retain the state's right to deny the investor the granted exemptions and privileges from the date of the violation and allow other to retain their rights to demand compensation for the damage caused by this violation, without breaching any punishments or other compensations stipulated in the applicable laws.

Article 29:

All fields of investments shall be subject to the provisions of this law except:-

First: Investment in Oil and Gas extraction and production.

Second: Investment in banks and insurance companies sectors.

Article 30:

The council of Ministers may.

First: Issue regulations to facilitate the implementation of the provisions of this law.

Second: Issue bylaws defining the Commissions formations, divisions tasks, process of its work, its authorities, financial affairs, employee affairs and any others matters.

Article 31:

The Committee may issue instructions to facilitate the implementation of regulations issued by the Council of Ministers pursuant to the provisions of this law.

Article 32:

The Provisions of this law shall be applied to the existing and operating projects of the mixed and private sectors which have commenced before the issuance of this law and upon a request from its management and the approval of the Commission with no retroactive effect.

Article 33:

No text shall be valid which contradicts the provisions of this law.

Article 34:

The (dissolved) CPA Order No. 39 of 2003 shall be revoked.

Article 35:

The Arab Investment law No(62) of 2002 issued by the dissolved Revolution Command Council shall be annulled.

Article 36:

This law shall enter into force from the date of its publication in the Official Gazette.

Justifying Reasons

For the purpose of driving the process of economic and social development and bringing technical and scientific experience and developing human resources, and for creating work opportunities for the Iraqis by encouraging investments and supporting the process of establishing investment projects in Iraq and their expansion and

these projects, this law is legislated.