

**ANNEXURE-II**

Process Specification of Charge Gas Dryers, Ethylene Dryers and Propylene Dryers

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**BRAHMAPUTRA CRACKER & POLYMER LTD.  
BRAHMAPUTRA PETROCHEMICAL COMPLEX PROJECT  
LEPETKATA, ASSAM, INDIA**

**220,000 TPA ETHYLENE PLANT**

**PROCESS SPECIFICATIONS**

**FOR**

|                          |          |                       |
|--------------------------|----------|-----------------------|
| <b>CHARGE GAS DRYERS</b> | <b>-</b> | <b>113-VV-301 A/B</b> |
| <b>ETHYLENE DRYERS</b>   | <b>-</b> | <b>113-VV-403 A/B</b> |
| <b>PROPYLENE DRYERS</b>  | <b>-</b> | <b>113-VV-430 A/B</b> |

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## 1.0 INTRODUCTION

M/s Brahmaputra Cracker and Polymer Ltd. (BCPL) is setting up a grass root petrochemical complex at Lepetkata, Dibrugarh district in Assam, India. Lummus Technology is selected as licensor and is providing the Basic Engineering Design Package (BEDP) for the Ethylene Cracker Unit.

This process specification indicates the requirements for Charge Gas Dryer, Ethylene Dryer and Propylene Dryer.

## 2.0 CHARGE GAS DRYER

### 2.1 Feed

For compositions and conditions, see attached Table I.

### 2.2 Effluent Requirement

Effluent shall have a water dew point below  $-101^{\circ}\text{C}$ .

### 2.3 Dryer System

A vapor phase two dryer systems is required, one dryer in operation while the other is on standby or being regenerated. Each dryer has a main bed followed by a guard bed. A moisture probe is located at the outlet of the main bed.

### 2.4 Cycle Time

The main bed shall be operated on a 30-hours cycle. An additional 6-hours guard bed section shall be provided below the moisture probe. Cycle times to be maintained during the full guarantee life of the desiccant.

### 2.5 Overdesign

The dryer shall be designed for 10% overdesign on flow. The dryer shall also be designed for a turndown of 50%.

### 2.6 Pressure Drop

The maximum allowable pressure drop across the dryer bed shall be  $0.21 \text{ kg/cm}^2$  including the overdesign margin.



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## 2.7 Desiccant Life

Desiccant life shall be 5 years minimum.

## 3.0 ETHYLENE DRYER

### 3.1 Feed

For compositions and conditions, see attached Table II.

### 3.2 Effluent Requirement

No more than 1 weight ppm of water in the dryer effluent.

### 3.3 Dryer System and Cycle Time

A vapor phase two dryer systems is required, one dryer in operation while the other is on standby or being regenerated. Each dryer has one bed. The cycle time for the dryer will be 168 hours. Cycle time to be maintained during the full guaranteed life of the desiccant.

### 3.4 Overdesign

The dryer shall be designed for 11% overdesign on flow. The dryer shall also be designed for a turndown of 50%.

### 3.5 Pressure Drop

The maximum allowable pressure drop across the dryer bed shall be 0.24 kg/cm<sup>2</sup> including the overdesign margin.

### 3.6 Desiccant Life

Desiccant life shall be 5 years minimum.

## 4.0 PROPYLENE DRYERS

### 4.1 Feed

For compositions and conditions, see attached Table III.

### 4.2 Effluent Requirement

No more than 1 weight ppm of water in the dryer effluent.



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#### 4.3 Dryer System and Cycle Time

A liquid phase two-dryer system is required, one dryer operating while the other is on standby or being regenerated. Each dryer has one bed. A moisture analyzer is located in the bed as well as at the outlet of each bed. The cycle time for each dryer will be 168 hours. Cycle time to be maintained during the full guaranteed life of the desiccant.

#### 4.4 Overdesign

The dryer shall be designed for 12% overdesign on flow. The dryer shall also be designed for a turndown of 50%.

#### 4.5 Pressure Drop

The maximum allowable pressure drop across the dryer bed shall be 0.35 kg/cm<sup>2</sup> including the overdesign margin.

#### 4.6 Desiccant Life

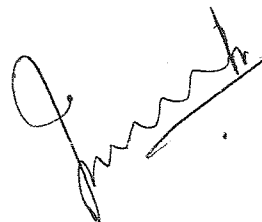
Desiccant life shall be 5 years minimum.

#### 5.0 REGENERATION GAS

For compositions and conditions, see attached Table IV.

#### 6.0 REQUESTED INFORMATION

- 1) Type and size of recommended desiccant.
- 2) Estimated and guaranteed desiccant quantity at rated capacity.
- 3) Estimated and guaranteed desiccant life at rated capacity.
- 4) Estimated and guaranteed shelf life of desiccant.
- 5) Estimated and guaranteed ultimate life of desiccant.
- 6) Physical properties of desiccant.
- 7) Operating cycle for regeneration including time required for each step (i.e. Depressuring, purging, heating, cooling and pressurizing).
- 8) Regeneration conditions and quantity of regeneration gas.
- 9) Desiccant bed dimensions – must fit within existing vessel – process data sheet is attached for each dryer. Recommended internals for supports and hold-down of the beds, etc.
- 10) Pressure drops across desiccant bed during drying and regeneration.
- 11) Recommended flow directions during normal operation and regeneration.
- 12) Expected and guaranteed cycle time between regenerations.



**ANNEXURE-II****Process Specification of Charge Gas Dryers, Ethylene Dryers and Propylene Dryers**

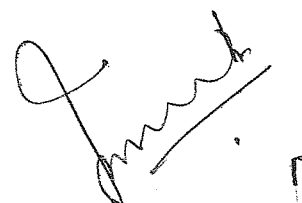
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**TABLE I : FEED TO CHARGE GAS DRYER**

| Composition, mol%                   | Design Case |
|-------------------------------------|-------------|
| Hydrogen                            | 23.07       |
| Carbon Monoxide                     | 0.13        |
| Methane                             | 18.85       |
| Acetylene                           | 0.51        |
| Ethylene                            | 30.95       |
| Ethane                              | 14.08       |
| Propadiene/Methylacetylene          | 0.45        |
| Propylene                           | 7.51        |
| Propane                             | 1.34        |
| Butadiene/C <sub>4</sub> Acetylenes | 1.06        |
| Butenes                             | 1.10        |
| Butanes                             | 0.46        |
| Pentene                             | 0.28        |
| Hexene                              | 0.02        |
| Benzene                             | 0.07        |
| Nitrogen                            | 0.05        |
| Water, mol ppm (Note 1)             | 700.00      |
| Total                               | 100.00      |
| Flowrate, kg mol/h (Note 2)         | 3177.5      |
| Molecular Weight                    | 22.26       |
| Temperature, °C                     | 15.8        |
| Pressure, kg/cm <sup>2</sup> g      | 34.73       |
| State                               | Vapor       |

**Notes:**

1. Estimated water content at 100% saturation.
2. Flowrates given represent 100% capacity. Unit shall be designed for 110% capacity.



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**TABLE II : FEED TO ETHYLENE DRYER**

| Composition, mol%              | Design Case |
|--------------------------------|-------------|
| Hydrogen                       | 0.02        |
| Methane                        | 0.02        |
| Acetylene , mol ppm            | <2          |
| Ethylene                       | 64.31       |
| Ethane                         | 35.62       |
| Propylene                      | 0.03        |
| Water, mol ppm                 | 15          |
| Total                          | 100.00      |
| Flowrate, kg mol/h (Note 1)    | 1618.8      |
| Molecular Weight               | 28.77       |
| Temperature, °C                | -23.31      |
| Pressure, kg/cm <sup>2</sup> g | 17.7        |
| State                          | Vapor       |

**Notes:**

1. Flowrates given represent 100% capacity. Unit shall be designed for 111% capacity.

**TABLE III : FEED TO PROPYLENE DRYER**

| Composition, mol%                   | Design Case |
|-------------------------------------|-------------|
| Hydrogen                            | 0.00        |
| Propadiene                          | 2.22        |
| Methylacetylene                     | 2.67        |
| Propylene                           | 80.59       |
| Propane                             | 14.47       |
| Butadiene/C <sub>4</sub> Acetylenes | 0.02        |
| Butenes                             | 0.01        |
| Water, mol ppm                      | 200         |
| Total                               | 100.00      |
| Flowrate, kg mol/h (Note 1)         | 295.1       |
| Molecular Weight                    | 42.28       |
| Temperature, °C                     | 42.21       |
| Pressure, kg/cm <sup>2</sup> g      | 28.38       |
| State                               | Liquid      |



## ANNEXURE-II

### Process Specification of Charge Gas Dryers, Ethylene Dryers and Propylene Dryers

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#### Notes:

1. Flowrates given represent 100% capacity. Unit shall be designed for 112% capacity.

**Table IV : Regeneration Gas**

#### HP Methane offgas

| Composition, mol%              |                           |
|--------------------------------|---------------------------|
| Hydrogen                       | 40.42                     |
| Carbon Monoxide                | 0.31                      |
| Methane                        | 59.06                     |
| Ethylene                       | 0.21                      |
| Total                          | 100.00                    |
| Molecular Weight               | 10.46                     |
| Pressure, kg/cm <sup>2</sup> g | 5.85                      |
| Temperature, °C                | As required (35.0 °C min) |

#### Steam

|                          | Pressure, kg/cm <sup>2</sup> g | Temperature, °C |
|--------------------------|--------------------------------|-----------------|
|                          | Normal/Design                  | Normal/Design   |
| Very High Pressure (VHP) | 103 / 116                      | 500 / 513       |
| High Pressure (HP)       | 39 / 46                        | 357 / 390       |
| Low Pressure(LP)         | 3.1 / 6.5                      | 175 / 220       |

#### Plant Air

|                                       | Normal            | Design |
|---------------------------------------|-------------------|--------|
| Pressure, kg/cm <sup>2</sup> g        | 6.5               | 10.5   |
| Temperature, C                        | 40                | 65     |
| Quality                               | Oil and Dust Free |        |
| Dew Point at Atmospheric Pressure, °C | Saturated         |        |



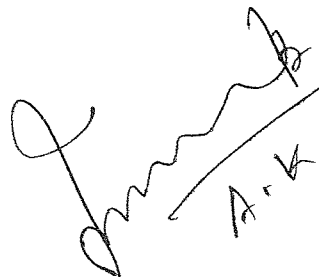
ANNEXURE-II

Process Specification of Charge Gas Dryers, Ethylene Dryers and Propylene Dryers

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Nitrogen

|                                       | Normal    | Design |
|---------------------------------------|-----------|--------|
| Pressure, kg/cm <sup>2</sup> g        | 6.0       | 10.5   |
| Temperature, C                        | 40        | 65     |
| Dew Point at Atmospheric Pressure, °C | -100      |        |
| Quality:                              |           |        |
| Nitrogen, vol%                        | 99.99 min |        |
| Oxygen, vol ppm                       | 3.0 max   |        |
| Carbon dioxide, vol ppm               | < 3.0     |        |
| Oil Content                           | Nil       |        |

  
A.K. Bora

**ANNEXURE-II**

Process Specification for Ammonia Guard Bed and Chlorine Guard Bed

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**BRAHMAPUTRA CRACKER & POLYMER LTD.  
BRAHMAPUTRA PETROCHEMICAL COMPLEX PROJECT  
LEPETKATA, ASSAM, INDIA**

**220,000 TPA ETHYLENE PLANT**

**PROCESS SPECIFICATIONS**

**FOR**

**AMMONIA GUARD BED      –      113-VV-380  
CHLORINE GURAD BED    –      113-VV-381**

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## ANNEXURE-II

### Process Specification for Ammonia Guard Bed and Chlorine Guard Bed

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#### 1.0 INTRODUCTION

M/s Brahmaputra Cracker and Polymer Ltd. (BCPL) is setting up a grass root petrochemical complex at Lepetkata, Dibrugarh district in Assam, India. Lummus Technology is selected as licensor and is providing the Basic Engineering Design Package (BEDP) for the Ethylene Cracker Unit.

This process specification indicates the requirements for Ammonia Guard Bed and Chlorine Guard Bed.

#### 2.0 AMMONIA GUARD BED

##### 2.1 Feed

For the feed composition and conditions, see Table I. The flow rates provided are at 100% of the normal operating capacity.

##### 2.2 Ammonia Guard Bed System

The Ammonia Guard Bed system consists of a single bed adsorber using non-regenerative type adsorbent.

The feed stream is the ethylene product from the ethylene fractionator after being heated in offgas exchanger, which is treated in the guard bed before being sent to OSBL storage.

##### 2.3 Overdesign

The Ammonia Guard Bed shall be designed for 20% overdesign on flow. This overdesign includes 15% overdesign for Case 1A operation plus 5% overdesign to cover high LLDPE vent gas flow. The dryer shall also be designed for a turndown of 50%.

##### 2.4 Pressure Drop

The maximum allowable pressure drop across the guard bed is 0.14 kg/cm<sup>2</sup>.

##### 2.5 Adsorbant Life

Adsorbant life shall be 3 years minimum.

##### 2.6 Ammonia Leakage in Guard Bed Effluent

The Ammonia content in the reactor effluent is to less than 0.1 ppm vol.



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### 3.0 CHLORINE GUARD BED

#### 3.1 Feed

For the feed composition and conditions, see Table I. The flow rates provided are at 100% of the normal operating capacity.

#### 3.2 Chlorine Guard Bed System

The Chlorine Guard Bed system consists of a single bed reactor using non regenerative type adsorbent.

The feed stream is the ethylene product from the ethylene fractionator after being heated in offgas exchanger, which is treated in ammonia guard bed first followed by treatment in Chlorine Guard Bed before being sent to OSBL storage.

#### 3.3 Overdesign

The Chlorine Guard Bed shall be designed for 20% overdesign on flow. This overdesign includes 15% overdesign for Case 1A operation plus 5% overdesign to cover high LLDPE vent gas flow. The dryer shall also be designed for a turndown of 50%.

#### 3.4 Pressure Drop

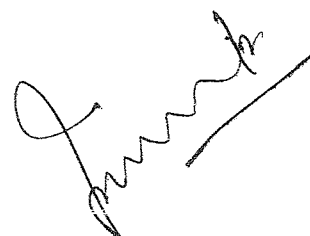
The maximum allowable pressure drop across the guard bed is 0.20 kg/cm<sup>2</sup>.

#### 3.5 Adsorbant Life

Adsorbant life shall be 3 years minimum.

#### 3.6 Chlorine Leakage in Guard Bed Effluent

The Chlorine content in the reactor effluent is to be less than 0.1 ppm vol.



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#### 4.0 REQUESTED INFORMATION

- 1) Type and size of recommended adsorbent.
- 2) Estimated and guaranteed adsorbent quantity at rated capacity.
- 3) Estimated and guaranteed adsorbent life at rated capacity.
- 4) Estimated and guaranteed shelf life of adsorbent.
- 5) Estimated and guaranteed ultimate life of adsorbent.
- 6) Physical properties of adsorbent.
- 7) Adsorbent bed dimensions, recommended internals for supports and hold-down of the beds, etc.
- 8) Pressure drops across adsorbent bed.
- 9) Recommended flow direction (upflow or downflow).
- 10) Classification (toxicity level) and disposal method of spent adsorbent.
- 11) MSDS for the adsorbent product and operation bulletin and loading/unloading procedures for the recommended adsorbent.

**TABLE I : FEED TO AMMONIA AND CHLORINE GUARD BED**

| Compositions, mol%             | Ammonia Guard Bed | Chlorine Guard Bed |
|--------------------------------|-------------------|--------------------|
| Methane                        | 0.002             | 0.002              |
| Ethylene                       | 99.97             | 99.97              |
| Ethane                         | 0.028             | 0.028              |
| Ammonia                        | 1 mol ppm         | <0.1 mol ppm       |
| Chlorine                       | 2 mol ppm         | 2 mol ppm          |
| Total                          | 100               | 100                |
| Flowrate, kgmol/h (Note 1)     | 986.9             | 986.9              |
| Molecular Weight               | 28.05             | 28.05              |
| Temperature, °C                | 34.9              | 34.7               |
| Pressure, kg/cm <sup>2</sup> g | 36.6              | 36.4               |

**Notes:**

1. Flowrate given represents 100% capacity. Unit shall be designed 120% capacity.

*Ammonia*  
AK Bora

ANNEXURE-II  
PROCESS DATA FOR VESSELS

ITEM NUMBER: 113-VV-301A/B

ITEM NAME: CHARGE GAS DRYERS

NOTES

1. All dimensions are in mm, unless otherwise specified. All nozzle sizes are in inches.
2. All pressures are in kg/cm<sup>2</sup> gauge, unless otherwise indicated.
3. Design basis is Case 1A with 10% overdisein.
4. Dry-out at 80°C and 7.5 kg/cm<sup>2</sup>g.
5. Molecular Sieve: UOP Type 3A-EPG-2 1/8 inch pellets or equivalent. Final molecular sieve properties to be determined by the vendor.
6. Molecular Sieve: UOP Type 3A-EPG 1/16 inch pellets or equivalent. Final molecular sieve properties to be determined by the vendor.
7. Inert ceramic balls per vendor recommendations.
8. Support grid to be designed to carry:
  - 5070 mm bed of molecular sieve at 750 kg/m<sup>3</sup> maximum density.
  - 300 mm bed of inert balls at 1500 kg/m<sup>3</sup> maximum density.
  - 0.18 kg/cm<sup>2</sup> pressure drop across bed.
  - Hold down grating and SS screen.
9. Support grid to be designed to carry:
  - Up to 770 mm bed of molecular sieve at 720 kg/m<sup>3</sup> maximum density (Bed height corresponds with recommendation from another vendor).
  - 300 mm bed of inert balls at 1500 kg/m<sup>3</sup> maximum density.
  - 0.03 kg/cm<sup>2</sup> pressure drop across bed
  - Hold down grating and SS screen.
10. Manways #1B and #1D are to be flush with bottom of molecular sieve bed.
11. Operating and design conditions:

|           | Drying      |                                  | Regeneration |                                  |
|-----------|-------------|----------------------------------|--------------|----------------------------------|
|           | Temp.<br>°C | Pressure<br>kg/cm <sup>2</sup> g | Temp.<br>°C  | Pressure<br>kg/cm <sup>2</sup> g |
| Operating | 16          | 34.7                             | 232          | 4.4                              |
| Design    | 65          | 39.4                             | 250          | 8.6                              |

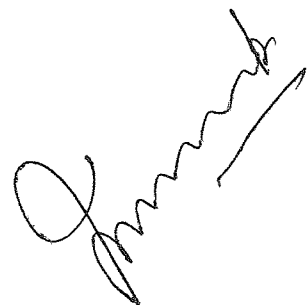
12. Tyler 12 mesh SS screen to be provided above and below molecular sieve bed. Holes in screen to be small enough to withhold molecular sieve pellets. Final mesh size to be determined by molecular sieve vendor.
13. Each dryer is designed to be operated on a 30 hour cycle, with an additional six hour guard bed provided below the moisture probe.

ANNEXURE-II  
PROCESS DATA FOR VESSELS

ITEM NUMBER: 113-VV-301A/B

ITEM NAME: CHARGE GAS DRYERS

14. Size of Manway #1A to be increased as required to allow passage of flanged internal pipe.
15. Hold down grating to have minimum 80% open area. Select grating openings such that ceramic balls cannot pass through either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grating.
16. Flow direction is downward during normal operation and upward during regeneration.
17. Support grid to have minimum 80% open area. Select grid openings such that ceramic balls cannot pass either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grid.
18. Two dryers provided; one in operation and one in regeneration or standby.
19. Requirements of paragraph UCS-66 of ASME Section VIII, Division I shall apply for all carbon steel materials.
20. 1½ inch IPS moisture probe to be inserted through and flanged to Nozzle #49. Probe to extend about ¾ of vessel diameter and to have 7 mm holes every 75mm on all sides.
21. 180mm extra height above hold down grating is required for alternate vendor requirement.
22. Vapor density at operating conditions is 38.0 kg/m<sup>3</sup>.



ANNEXURE-II  
PROCESS DATA FOR VESSELS

ITEM NUMBER: 113-VV-403A/B

ITEM NAME: ETHYLENE DRYERS

NOTES

1. All dimensions are in mm, unless otherwise specified. All nozzle sizes are in inches.
2. All pressures are in kg/cm<sup>2</sup> gauge, unless otherwise indicated.
3. Design basis is Case 1A with 11% overdiseign  
Overdesign includes the following factors:
  - 5% overdiseign for Case 1A operation.
  - 5% overdiseign to cover higher LLDPE recycle rate.
  - 1% overdiseign for feed flexibility.
4. Dry-out at 80°C and 7.5 kg/cm<sup>2</sup>g.
5. Molecular Sieve: UOP Type 3A-EPG 1/16 inch pellets or equivalent. Final sieve properties to be determined by the vendor.
6. Inert ceramic balls of 10 to 15 mm diameter. Final size to be determined by selected molecular sieve vendor.
7. Support grid to be designed to carry:
  - Upto 2710 mm bed of molecular sieve at 720 kg/m<sup>3</sup> maximum density (Bed height corresponds with recommendation from alternate vendor).
  - 300 mm bed of inert balls at 1500 kg/m<sup>3</sup> maximum density.
  - 0.24 kg/cm<sup>2</sup> pressure drop across bed.
  - Hold down grating and SS screen.
8. Dump Nozzle #3 is to be flush with bottom of molecular sieve bed.
9. Operating and design conditions:

|           | Drying      |                                  | Regeneration |                                  |
|-----------|-------------|----------------------------------|--------------|----------------------------------|
|           | Temp.<br>°C | Pressure<br>kg/cm <sup>2</sup> g | Temp.<br>°C  | Pressure<br>kg/cm <sup>2</sup> g |
| Operating | -23         | 17.7                             | 232          | 4.4                              |
| Design    | -25/65      | 25.5                             | 250          | 8.6                              |

10. Tyler 12 mesh SS screen to be provided above and below molecular sieve bed. Holes in screen to be small enough to withhold molecular sieve pellets. Final mesh size to be determined by molecular sieve vendor.
11. Each dryer is designed to be operated on a 7 day (168 hour) cycle.
12. Size of Nozzle #1A to be increased as required to allow passage of flanged internal pipe.

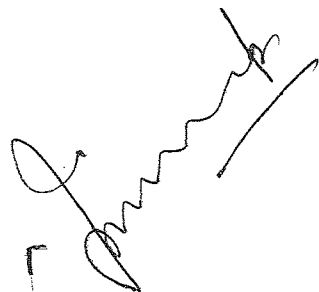
ANNEXURE-II  
PROCESS DATA FOR VESSELS

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ITEM NUMBER: 113-VV-403A/B  
ITEM NAME: ETHYLENE DRYERS

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13. Hold down grating to have minimum 80% open area. Select grating openings such that ceramic balls cannot pass either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grating.
14. Flow direction is downward during normal operation and upward during regeneration.
15. Support grid to have minimum 80% open area. Select grid openings such that ceramic balls cannot pass either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grid.
16. Two dryers provided; one in operation and one in regeneration or standby.
17. Requirements of paragraph UCS-66 of ASME Section VIII, Division I shall apply for all carbon steel materials.
18. 1700mm extra height above hold down grating is required for alternate vendor requirement.
19. If bed heights are different than those specified on Sheet 1 based on recommendations from alternate desiccant supplier, distance between top of bed and hold down grating to be maintained at 150mm. Inert ceramic balls to occupy space between top of bed and hold down grating.
20. 1½ inch IPS moisture probe to be inserted through and flanged to Nozzle #49, probe to extend about ¾ of vessel diameter and to have 7mm holes, located 90 degrees apart in sets of four(4), every 75mm.
21. Vapor density at operating conditions is 34.2 kg/m3.



ANNEXURE-II  
PROCESS DATA FOR VESSELS

ITEM NUMBER: 113-VV-430A/B  
ITEM NAME: PROPYLENE DRYERS

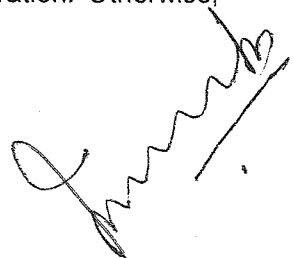
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NOTES

1. All dimensions are in mm, unless otherwise specified. All nozzle sizes are in inches.
2. All pressures are in gauge, unless otherwise indicated.
3. Design basis is Case 1A with 12% overdesign.  
Overdesign includes the following factors:
  - 10% overdesign for Case 1A operation.
  - 2% overdesign for feed flexibility.
4. Dry-out at 80°C and 7.5 kg/cm<sup>2</sup>g.
5. Inert ceramic balls of 10 to 15 mm diameter. Final size to be determined by selected molecular sieve vendor.
6. Support grid to be designed to carry:
  - Upto 7600 mm bed of molecular sieve at 720 kg/m<sup>3</sup> maximum density (Bed height corresponds with recommendation from alternate vendor).
  - 300 mm bed of inert balls at 1500 kg/m<sup>3</sup> maximum density.
  - 0.35 kg/cm<sup>2</sup> pressure drop across bed
  - Hold down grating and SS screen.
7. Dump Nozzle #3 to be flush with bottom of molecular sieve bed.
8. Molecular Sieve: UOP Type 3A-EPG 1/16 inch pellets or equivalent. Final molecular sieve properties to be determined by the vendor.
9. Operating and design conditions:

|           | Drying      |                                  | Regeneration |                                  |
|-----------|-------------|----------------------------------|--------------|----------------------------------|
|           | Temp.<br>°C | Pressure<br>kg/cm <sup>2</sup> g | Temp.<br>°C  | Pressure<br>kg/cm <sup>2</sup> g |
| Operating | 42          | 27.3                             | 232          | 4.4                              |
| Design    | 65          | 39.5 (NOTE 15)                   | 250          | 8.6                              |

10. Tyler 12 mesh SS screen to be provided above and below molecular sieve bed. Holes in Screen to be small enough to withhold molecular sieve pellets. Final mesh size to be determined by molecular sieve vendor.
11. Dryer is designed to be operated on a 7 days (168 hours) cycle.
12. Size of Nozzle #1A to be increased as required to allow passage of flanged internal pipe.
13. Hold down grating to have minimum 80% open area. Select grating openings such that ceramic balls cannot pass either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grating.



ANNEXURE-II  
PROCESS DATA FOR VESSELS

ITEM NUMBER: 113-VV-430A/B

ITEM NAME: PROPYLENE DRYERS

14. Flow direction is upward during normal operation and downward during regeneration.
15. Design pressure to be checked by the Detailed Engineering Contractor against shut off pressure of Depropanizer No.1. Reflux Pump (113-PA-410 A/B).
16. Vessel normally liquid filled.
17. Support grid to have minimum 80% open area. Select grid openings such that ceramic balls cannot pass either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grid.
18. Two dryers provided; one in operation and one in regeneration or standby.
19. Requirements of paragraph UCS-66 of ASME Section VIII, Division I shall apply for all carbon steel materials.
20. 1½ inch moisture probe to be inserted through and flanged to Nozzle #49, probe to extend about ¾ of vessel diameter and to have 7mm holes, located 90 degrees apart in sets of four(4), every 75mm.
21. 1030 mm extra height above hold down grating is required for alternate vendor requirement.
22. If bed heights are different than those specified on Sheet 1 based on recommendations from alternate desiccant supplier, distance between top of bed and hold down grating to be maintained at 150mm. Inert ceramic balls to occupy space between top of bed and hold down grating.
23. Nozzle size is preliminary based on 113-PSV-8201/8202 inlet line size requirement and to be confirmed by Detailed Engineering Contractor based upon final PSV sizing.

ANNEXURE-II  
PROCESS DATA FOR VESSELS

ITEM NUMBER: 113-VV-380

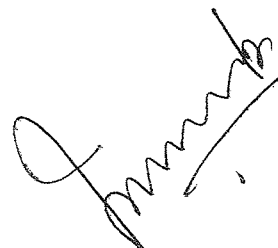
ITEM NAME: AMMONIA GUARD BED

NOTES

1. All dimensions are in mm, unless otherwise specified. All nozzle sizes are in inches.
2. All pressures are in kg/cm<sup>2</sup> gauge, unless otherwise indicated.
3. Design basis is Case 1A with 20% overdiseign.  
Overdesign includes the following factors:
  - 15% overdiseign for Case 1A operation.
  - 5% overdiseign to cover higher LLDPE recycle rate.
4. Dry out at 80°C and 7.5kg/cm<sup>2</sup> g.
5. Molecular Sieve: UOP Type 13X-HP 8 X 12 mesh in a single bed adsorber or equivalent.
6. Inert ceramic balls of 10 to 15 mm diameter. Final size to be determined by selected molecular sieve vendor.
7. Support grid to be designed to carry:
  - 9380 mm bed of molecular sieve at 750 kg/m<sup>3</sup> maximum density.
  - 600 mm bed of inert balls at 1500 kg/m<sup>3</sup> maximum density.
  - 0.14 kg/cm<sup>2</sup>g pressure drop across bed.
  - Hold down grating and SS screen.
8. Dump Nozzle #3 to be flushed with bottom of adsorbent bed and angled downward at 30° from the vertical. Provide flush cover inside nozzle.
9. Operating and design conditions:

|           | Temp.<br>°C | Pressure<br>kg/cm <sup>2</sup> g |
|-----------|-------------|----------------------------------|
| Operating | 35          | 36.6                             |
| Design    | 65          | 56.0                             |

10. Tyler 12 mesh SS screen to be provided above and below molecular sieve bed. Holes in screen to be small enough to withhold molecular sieve pellets. Final mesh size to be determined by molecular sieve vendor.
11. Locate nozzles 7 and 11 at minimum distance from tangent line.
12. Size of Nozzle #1A to be increased as required to allow passage of flanged internal pipe.
13. Nozzle size to be determined by Detailed Engineering Contractor based on PSV requirements.
14. Flow direction is downward.



ANNEXURE-II  
PROCESS DATA FOR VESSELS

ITEM NUMBER: 113-VV-380

ITEM NAME: AMMONIA GUARD BED

15. Support grid to have minimum 80% open area. Select grid openings such that ceramic balls cannot pass either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grid.
16. Requirements of paragraph UCS-66 of ASME Section VIII, Division I shall apply for all carbon steel materials.
17. Vapor density at operating conditions is  $51.7 \text{ kg/m}^3$ .



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ANNEXURE-II  
PROCESS DATA FOR VESSELS

319

ITEM NUMBER: 113-VV-381

ITEM NAME: CHLORINE GUARD BED

NOTES

1. All dimensions are in mm, unless otherwise specified. All nozzle sizes are in inches.
2. All pressures are in kg/cm<sup>2</sup> gauge, unless otherwise indicated.
3. Design basis is Case 1A with 20% overdiseign.  
Overdesign includes the following factors:
  - 15% overdiseign for Case 1A operation.
  - 5% overdiseign to cover higher LLDPE recycle rate.
4. Dry out at 80°C and 7.5kg/cm<sup>2</sup> g.
5. Molecular Sieve: UOP Type 9139A 5 X 8 mesh in a single bed adsorber or equivalent.
6. Inert ceramic balls of 10 to 15 mm diameter. Final size to be determined by selected molecular sieve vendor.
7. Support grid to be designed to carry:
  - 9630 mm bed of molecular sieve at 750 kg/m<sup>3</sup> maximum density.
  - 600 mm bed of inert balls at 1500 kg/m<sup>3</sup> maximum density.
  - 0.14 kg/cm<sup>2</sup>g pressure drop across bed.
  - Hold down grating and SS screen.
8. Dump Nozzle #3 to be flushed with bottom of adsorbent bed and angled downward at 30° from the vertical. Provide flush cover inside nozzle.
9. Operating and design conditions:

|           | Temp.<br>°C | Pressure<br>kg/cm <sup>2</sup> g |
|-----------|-------------|----------------------------------|
| Operating | 35          | 36.4                             |
| Design    | 65          | 56.0                             |

10. Tyler 12 mesh SS screen to be provided above and below molecular sieve bed. Holes in screen to be small enough to withhold molecular sieve pellets. Final mesh size to be determined by molecular sieve vendor.
11. Locate nozzles 7 and 11 at minimum distance from tangent line.
12. Size of Nozzle #1A to be increased as required to allow passage of flanged internal pipe.
13. Nozzle size to be determined by Detailed Engineering Contractor based on PSV requirements.
14. Flow direction is downward.



ANNEXURE-II  
PROCESS DATA FOR VESSELS

318

ITEM NUMBER: 113-VV-381

ITEM NAME: CHLORINE GUARD BED

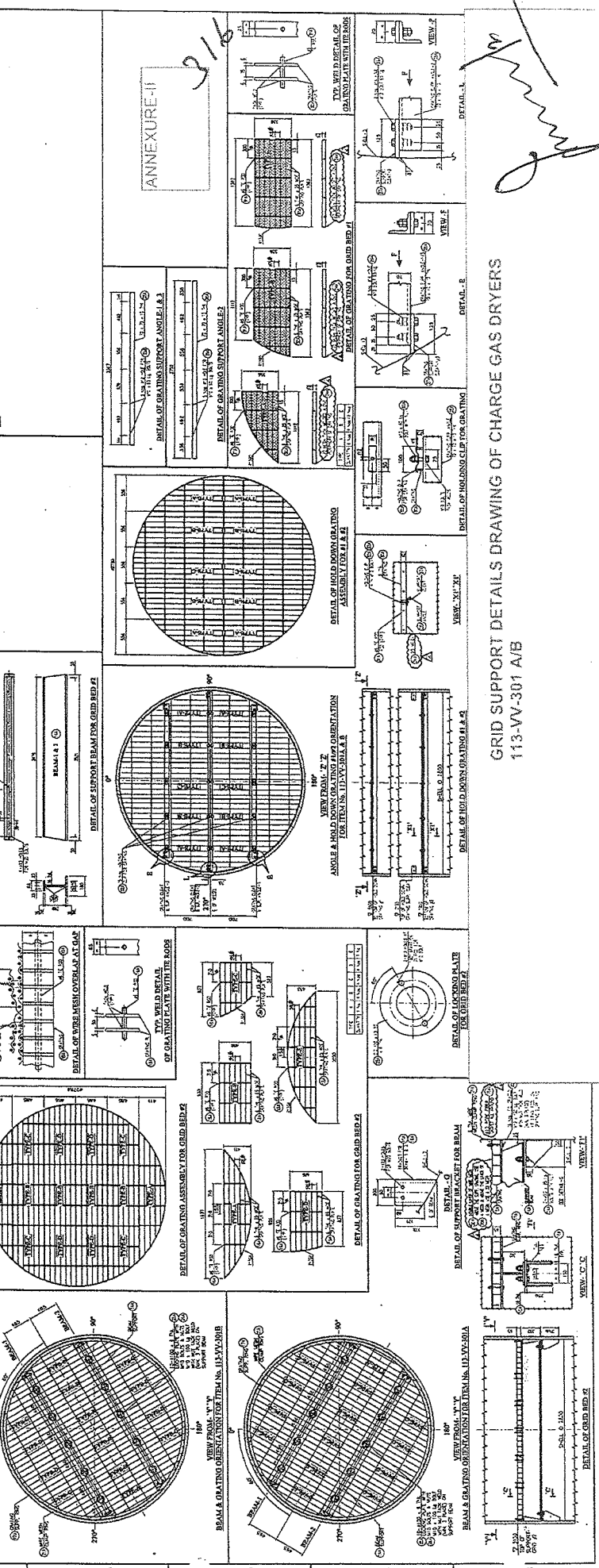
15. Support grid to have minimum 80% open area. Select grid openings such that ceramic balls cannot pass either during normal operation or regeneration. Otherwise, provide an additional SS screen between ceramic balls and grid.
16. Requirements of paragraph UCS-66 of ASME Section VIII, Division I shall apply for all carbon steel materials.
17. Vapor density at operating conditions is  $51.4 \text{ kg/m}^3$ .



*[Handwritten Signature]*  
AK Bork

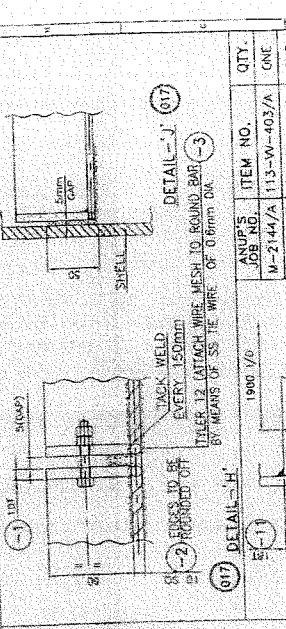
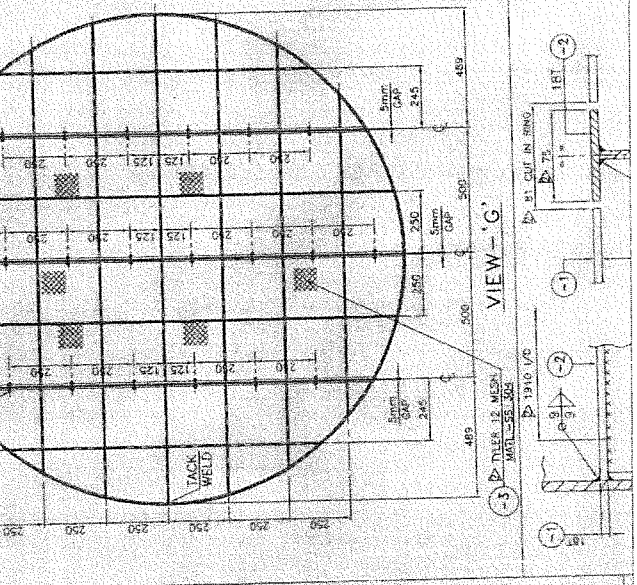
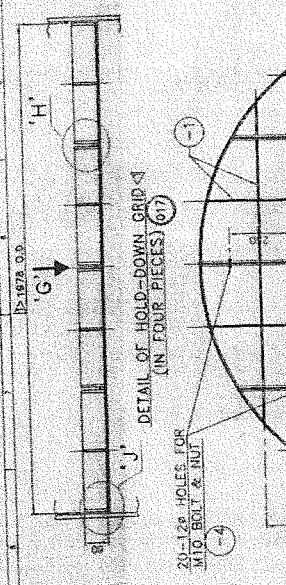
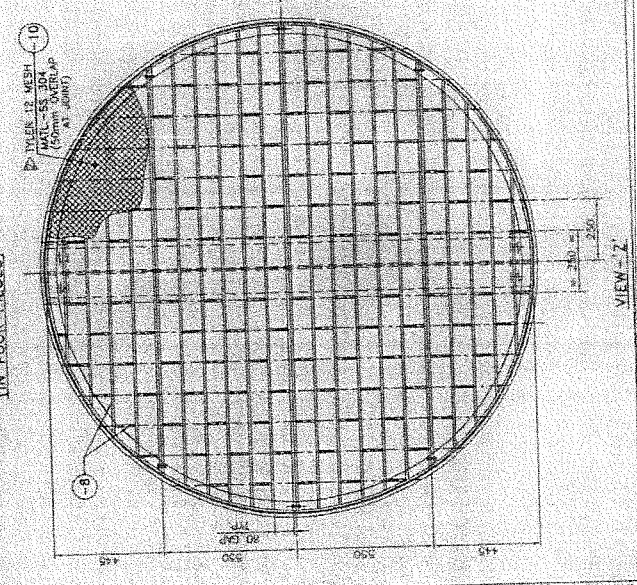
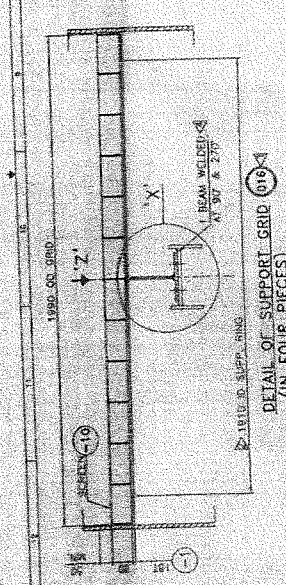


| BILL OF MATERIAL (PER EQUIP.) |      |                              |              | REMARKS                     |             |
|-------------------------------|------|------------------------------|--------------|-----------------------------|-------------|
| P. No.                        | QTY. | DESCRIPTION                  | MATERIAL     | SIZE                        | WEIGHT (KG) |
| 011                           | 2    | BEAM (FROSTED)               | SA 516 G. 70 | 12 TH. (SEE EXHA.)          | 26.10       |
| 021                           | 6    | SUPPORT BRACKET FOR BEAM     | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 031                           | 12   | GRATING PL. FOR BRACKET      | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 041                           | 1    | GRATING SUPPORT RING         | SA 516 G. 70 | 6.00 X 1.00 X 2.00 X 12 TH. | 20.00       |
| 051                           | 1    | PLATE FOR GRATING            | SA 516 G. 70 | 6 TH. X 15.00 X 6.00        | 12.00       |
| 061                           | 1    | W. ROD FOR GRATING PLATE     | CS           | 4 R00                       | 12.00       |
| 071                           | 1    | STANDARD WEL. W/ST           | SA 516 G. 70 | 2.00 X 1.00 X 1.00 X 12 TH. | 1.00        |
| 081                           | 1    | WEL. W/ST CLAMP RING (ROUND) | SA 516 G. 70 | 6.00 X 1.00 X 2.00 X 12 TH. | 1.00        |
| 091                           | 25   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 101                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 111                           | 12   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 121                           | 10   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 131                           | 10   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 141                           | 2    | BEAM (FROSTED)               | SA 516 G. 70 | 12 TH. (SEE EXHA.)          | 26.10       |
| 151                           | 6    | SUPPORT BRACKET FOR BEAM     | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 161                           | 12   | GRATING PL. FOR BRACKET      | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 171                           | 1    | GRATING SUPPORT RING         | SA 516 G. 70 | 6.00 X 1.00 X 2.00 X 12 TH. | 20.00       |
| 181                           | 1    | PLATE FOR GRATING            | SA 516 G. 70 | 6 TH. X 15.00 X 6.00        | 12.00       |
| 191                           | 1    | W. ROD FOR GRATING PLATE     | CS           | 4 R00                       | 12.00       |
| 201                           | 1    | STANDARD WEL. W/ST           | SA 516 G. 70 | 2.00 X 1.00 X 1.00 X 12 TH. | 1.00        |
| 211                           | 1    | WEL. W/ST CLAMP RING (ROUND) | SA 516 G. 70 | 6.00 X 1.00 X 2.00 X 12 TH. | 1.00        |
| 221                           | 25   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 231                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 241                           | 12   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 251                           | 10   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 261                           | 10   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 271                           | 10   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 281                           | 24   | BEAM WITH DOOR. NUT          | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 291                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 301                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 311                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 321                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 331                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 341                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 351                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 361                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 371                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 381                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 391                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 401                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 411                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 421                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 431                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 441                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 451                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 461                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 471                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 481                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 491                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 501                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 511                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 521                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 531                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 541                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 551                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 561                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 571                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 581                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 591                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 601                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 611                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 621                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 631                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 641                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 651                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 661                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 671                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 681                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 691                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 701                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 711                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 721                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 731                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 741                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 751                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 761                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 771                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 781                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 791                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 801                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 811                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 821                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 831                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 841                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 851                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 861                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 871                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 881                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 891                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 901                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 911                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 921                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 931                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 941                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 951                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 961                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 971                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 981                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 991                           | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |
| 1001                          | 1    | WEL. W/ST                    | SA 516 G. 70 | 18 TH.                      | 18.00       |



GRID SUPPORT DETAILS DRAWING OF CHARGE GAS DRYERS  
113-VV-301 A/B





DETAIL OF SUPPORT RING (17)

| NO. | DESCRIPTION             | QTY | MATERIAL     | SIZE                      | WT. (kg) | REMARK      |
|-----|-------------------------|-----|--------------|---------------------------|----------|-------------|
| 1   | TE WIRE                 | 1   | SS 304       | 0.60 x 2000 L             | 745      |             |
| 2   | BOLT WITH NUT           | 20  | SA 193 CR 80 | M10 x 50 L                |          |             |
| 3   | SCREEN                  | 1   | SS 304 CR 80 | 45 PER DRG                |          |             |
| 4   | SOL BAR                 | 1   | SA 516 CR 80 | 10 SQ. x 40 MTR L         | 25       |             |
| 5   | FLAT FOR GRID           | 1   | SA 516 CR 80 | 101 x 60W x 40 MTR L      | 189      |             |
| 6   | HOLD-DOWN GRID ASSEMBLY | 1   | SA 516 CR 80 | 181 x 1900 L/D x 1997 O/D | 42       | REF SH-1    |
| 7   | SUPPORT RING            | 1   | SA 20 SS     | 181 x 60W x 80 L          |          |             |
| 8   | SCREEN                  | 1   | SS 304       | 45 PER DRG                |          |             |
| 9   | BOLT WITH NUT           | 6   | SA 193 CR 80 | M10 x 80 L                |          |             |
| 10  | FLAT FOR GRID           | 1   | SA 516 CR 80 | 101 x 60W x 56 MTR L      | 352      | CUT TO SHIT |
| 11  | BOLT WITH NUT           | 4   | SA 193 CR 80 | M10 x 75 L                |          |             |
| 12  | SUPPORT PLATE           | 2   | SA 20 SS     | 181 x 73W x 100 L         | 5        |             |
| 13  | BASE PLATE              | 2   | SA 20 SS     | 181 x 75W x 125 L         | 3        |             |
| 14  | BEAM PLATE (RIB)        | 1   | SA 516 CR 80 | 181 x 50W x 1980 L        | 42       |             |
| 15  | BEAM PLATE (RIB)        | 1   | SA 516 CR 80 | 181 x 50W x 1980 L        | 28       |             |
| 16  | BEAM PLATE (RIB)        | 1   | SA 516 CR 80 | 181 x 75W x 1980 L        | 21       |             |
| 17  | SUPPORT RING            | 1   | SA 20 SS     | 181 x 1900 L/D x 1910 O/D | 38       | AL 2 SEC.   |
| 18  | SUPPORT GRID ASSEMBLY   | 1   | SA 516 CR 80 | 181 x 60W x 80 L          |          |             |
| 19  | SUPPORT GRID ASSEMBLY   | 1   | SA 516 CR 80 | 181 x 60W x 80 L          |          |             |

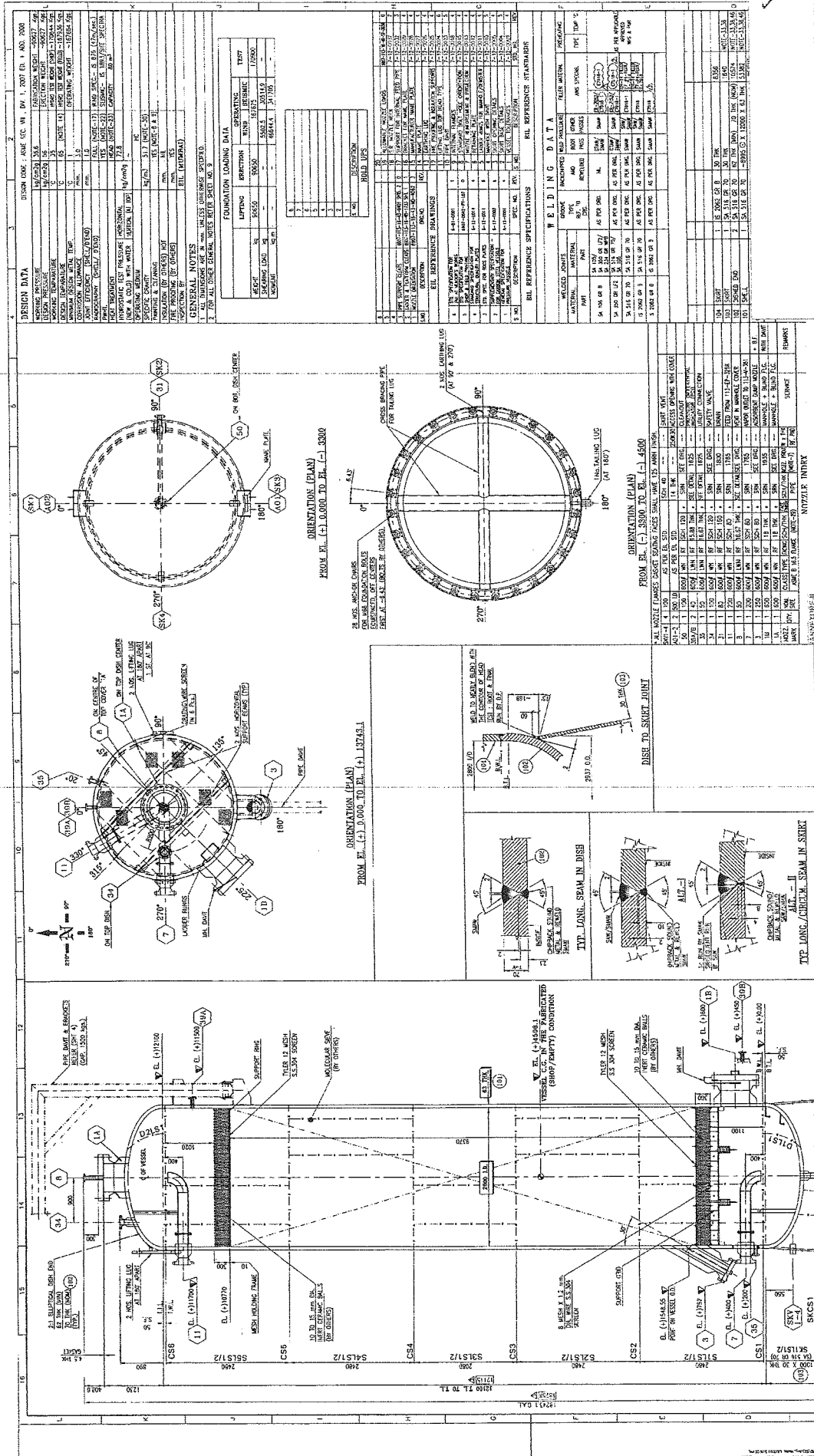
ANNEXURE-II  
ETHYLENE DRYERS-113-VV-403A/B  
DETAILS OF SUPPORT GRID

313

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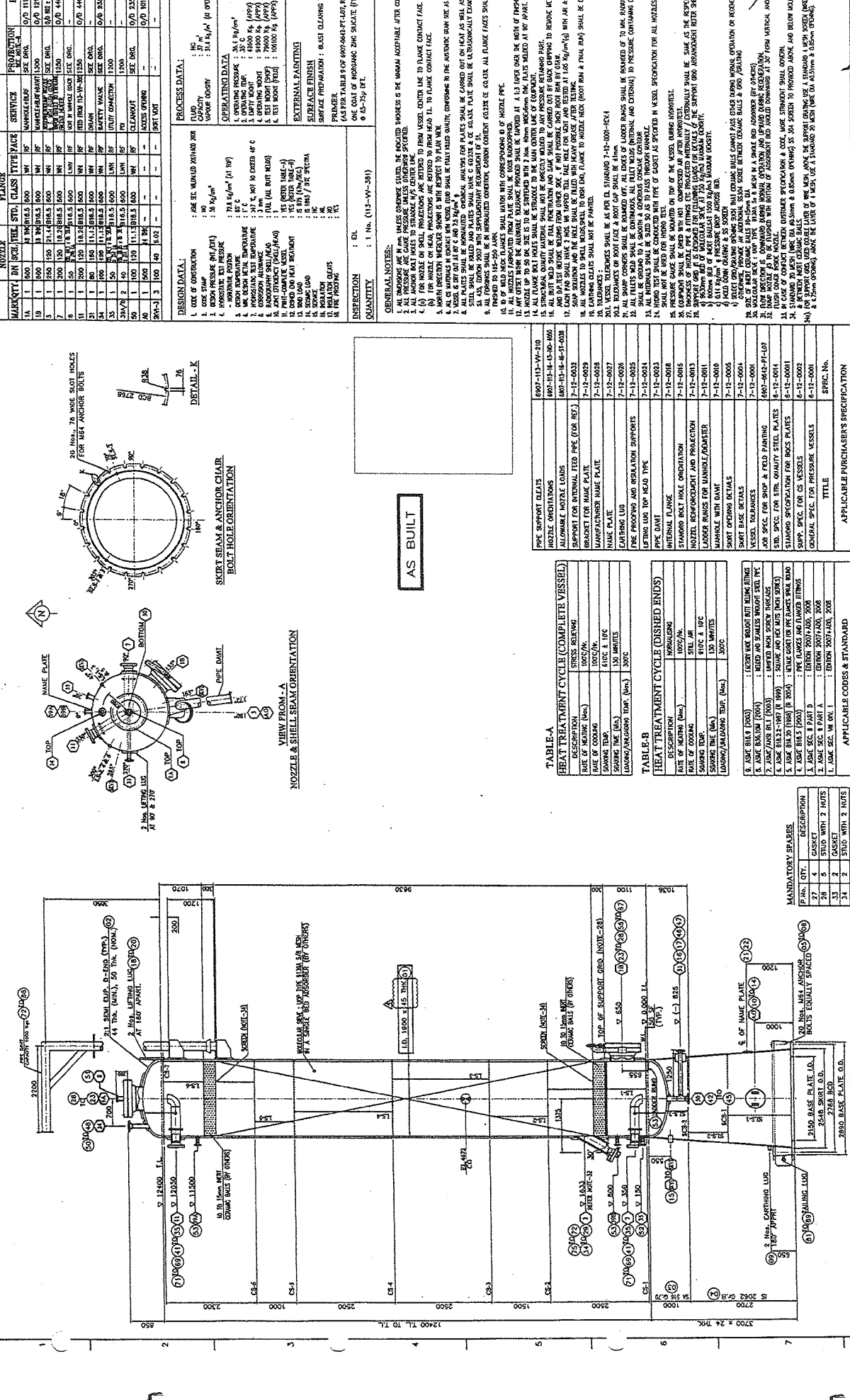




ANNEXURE A  
ANNEXURE B  
ANNEXURE C



DO NOT SCALE- IF IN DOUBT ASK

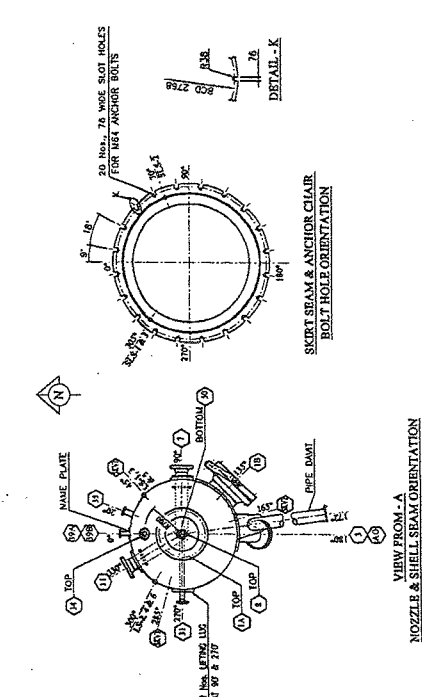


ANNEXURE-II  
CHLORINE GUARD BED  
113-VV-381

| NOZZLE LOAD TABLE |           |             |               |
|-------------------|-----------|-------------|---------------|
| NO.               | SIZE (mm) | Weight (kg) | Moment (kg-m) |
| 1                 | 100 (4)   | 1000        | 1000          |
| 2                 | 150 (6)   | 2250        | 3375          |
| 3                 | 200 (8)   | 4000        | 8000          |
| 4                 | 250 (10)  | 6250        | 15625         |
| 5                 | 300 (12)  | 9000        | 27000         |
| 6                 | 350 (14)  | 12250       | 42875         |
| 7                 | 400 (16)  | 16000       | 64000         |

| FOUNDATION LOADING DATA (OPERATING CONDITION) |                          |                            |                               |
|-----------------------------------------------|--------------------------|----------------------------|-------------------------------|
| TYPE                                          | MAX. WEIGHT AT BASE (kg) | MAX. MOMENT AT BASE (kg-m) | MAX. SHEAR FORCE AT BASE (kg) |
| CHLORINE GUARD BED                            | 10000                    | 10000                      | 10000                         |
| CHLORINE GUARD BED                            | 22500                    | 33750                      | 22500                         |
| CHLORINE GUARD BED                            | 40000                    | 80000                      | 40000                         |
| CHLORINE GUARD BED                            | 62500                    | 156250                     | 62500                         |
| CHLORINE GUARD BED                            | 90000                    | 270000                     | 90000                         |
| CHLORINE GUARD BED                            | 122500                   | 428750                     | 122500                        |
| CHLORINE GUARD BED                            | 160000                   | 640000                     | 160000                        |



| HEAT TREATMENT CYCLE (COMPLETE VESSEL) |                  |
|----------------------------------------|------------------|
| DESCRIPTION                            | STRESS RELIEFING |
| RATE OF HEATING (°C/hr)                | 100°C/hr         |
| HEATING TIME (hr)                      | 100°C/hr         |
| SOAKING TIME (hr)                      | 100°C/hr         |
| COOLING TIME (hr)                      | 100°C/hr         |
| LOADING/UNLOADING TIME (hr)            | 100°C/hr         |

| HEAT TREATMENT CYCLE (COINED ENDS) |                  |
|------------------------------------|------------------|
| DESCRIPTION                        | STRESS RELIEFING |
| RATE OF HEATING (°C/hr)            | 100°C/hr         |
| HEATING TIME (hr)                  | 100°C/hr         |
| SOAKING TIME (hr)                  | 100°C/hr         |
| COOLING TIME (hr)                  | 100°C/hr         |
| LOADING/UNLOADING TIME (hr)        | 100°C/hr         |

| MANDATORY SPARES |                                           |
|------------------|-------------------------------------------|
| ITEM NO.         | DESCRIPTION                               |
| 1                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 2                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 3                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 4                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 5                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 6                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 7                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 8                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 9                | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 10               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 11               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 12               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 13               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 14               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 15               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 16               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 17               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 18               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 19               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |
| 20               | 20 Nos. MFL ANCHOR BOLTS (EQUALLY SPACED) |

| NOZZLE SCHEDULE (PER EQUIPT.)   |        |        |         |
|---------------------------------|--------|--------|---------|
| MARKET, IN. SCH. 40, STD. CLASS | NOZZLE | FLANGE | SERVICE |
| 1. 1/2                          | 1/2    | 1/2    | 1/2     |
| 2. 1/2                          | 1/2    | 1/2    | 1/2     |
| 3. 1/2                          | 1/2    | 1/2    | 1/2     |
| 4. 1/2                          | 1/2    | 1/2    | 1/2     |
| 5. 1/2                          | 1/2    | 1/2    | 1/2     |
| 6. 1/2                          | 1/2    | 1/2    | 1/2     |
| 7. 1/2                          | 1/2    | 1/2    | 1/2     |
| 8. 1/2                          | 1/2    | 1/2    | 1/2     |
| 9. 1/2                          | 1/2    | 1/2    | 1/2     |
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| 27. 1/2                         | 1/2    | 1/2    | 1/2     |
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GENERAL NOTES:  
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.  
2. ALL DIMENSIONS ARE TO BE TAKEN FROM THE CENTER LINE OF THE VESSEL.  
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ANNEXURE-II  
CHLORINE GUARD BED  
113-VV-381  
DETAILS OF SUPPORT

