Open Art, Coke Drum Specification

COKE DRUM SPECIFICATION

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1. **GENERAL**

1.1. **REVISION NUMBER:** __________ **REVISION DATE:** ________________

1.2. **BY:** __________ **CHECKED:** __________ **APPROVED:** __________

1.3. **Client:** ________________________________

1.4. **Project Name:** ________________________________

1.5. **Project Location:** ________________________________

1.6. **Project Number:** ________________________________

1.7. **Item Numbers:** ________________________________

1.8. **Name:** ________________________________

1.9. **Service:** ________________________________

1.10. **Request For Quotation Number:** ________________________________

1.11. **Purchase Order Number:** ________________________________

1.12. **Owner/Engineer Contact:** ________________________________

1.13. **Owner/Engineer Contact Information:**

   o ________________________________

   o ________________________________

   o ________________________________

1.14. **Supplier/Fabricator:** ________________________________

1.15. **Supplier/Fabricator Contact:** ________________________________

1.16. **Supplier/Fabricator Contact Information:**

   o ________________________________

   o ________________________________

   o ________________________________

1.17. **Shop Location:** ________________________________

1.18. **Shop Order Number:** ________________________________

1.19. ________________________________

1.20. ________________________________
2. **CODE**

2.1. **Design Code**

2.1.1. These vessels to be designed and fabricated in accordance with ASME Code Section VIII Division 1, Section II, Section V, and Section IX and latest Addendums.

2.1.2. Vessels to be code stamped: **YES**

2.1.3. Vessels require National Board Registration: **YES ____NO ____**

2.2. ________________________________________________________________

2.3. ________________________________________________________________

3. **DIMENSIONS AND QUANTITIES**

3.1. **Dimensions List/No Duplication** - All dimensions and quantities are to be listed in this section below and not to be duplicated elsewhere within this document. All revisions to dimensions and quantities are to be listed in this section below and not to be duplicated elsewhere within this document. Only dimensions and quantities are to be included in this section; that is, all notes, clarifications, requirements, etc. are to be included in subsequent sections.

3.2. **Reference Dimensions and Quantities** - All referenced dimensions, lengths, diameters, radii, angles, quantities, etc. required are in accordance with the attached sketches, see paragraphs 3.6 through 3.13, below.

3.3. **Origination and Verification** - The Owner/Engineer specifies certain dimensions and quantities and the Supplier/Fabricator verifies the dimensions and quantities are per Code and specification. The Supplier/Fabricator specifies certain other dimensions and quantities and the Owner/Engineer verifies the dimensions and quantities are acceptable and per requirements.

3.4. **Dimensional System** –

   o Customary Units, English (feet, inches, etc.) or
   o SI Units, Metric (meters, millimeters, etc.)
3.5. **Input – Quantities and Dimensional Data** (for multiple drums, Quantities and Dimensional Data may vary).

### 3.5.1. Quantities

- **X1** - ________ Number of Drums
- **X2** - ________ Duration of coking cycle (see Para 5.13.7)
- **X3** - ________ Number of years expected before first shutdown due to major repairs
- **X4** - ________ Number of anchor bolts
- **X5** - ________ Number of skirt slots
- **X6** - ______________
- **X7** - ______________

### 3.5.2. Diameters

- **D1** - ________ Drum inside diameter
- **D2** - ________ Inside base plate diameter
- **D3** - ________ Inside skirt diameter
- **D4** - ________ Outside skirt diameter
- **D5** - ________ Anchor bolt circle diameter
- **D6** - ________ Outside base plate diameter
- **D7** - ________ Skirt slot hole diameter, top and bottom of slot
- **D8** - ________ Anchor bolt diameter
- **D9** - ________ Top anchor bolt chair plate hole diameter
- **D10** - ______________
- **D11** - ______________

### 3.5.3. Lengths

- **L1** - ________ Overall Length
- **L2** - ________ Tangent to Tangent Length
- **L3** - ________ Top tangent line to top nozzles flange face length
- **L4** - ________ Bottom tangent line to bottom nozzle flange face, M1
L5 - ________ Bottom tangent line to bottom of base plate length
L6 - ________ Bottom tangent line to centerline of feed nozzle, N1
L7 - ________ Bottom tangent line to centerline of level instrument LV1
L8 - ________ Bottom tangent line to centerline of level instrument LV2
L9 - ________ Bottom tangent line to centerline of level instruments LV3 and LV4
L10 - ________ Bottom tangent line to nominal top of coke during coking cycle
L11 - ________ Anchor bolt length above top of concrete
L12 - ________ Baseplate anchor bolt slotted hole length
L13 - ________ Baseplate anchor bolt slotted hole width
L14 - ________ Height of anchor bolt chair plate
L15 - ________ Top of Skirt to bottom tangent line (for overlapping skirt)
L16 - ________ Skirt slot distance to bottom tangent line
L17 - ________ Skirt slot length
L18 - ________ Skirt slot width
L19 - ________ Hot box distance to bottom tangent line
L20 - ________ Nozzle M1 face of flange to weld bevel length
L21 - ________ Cone, lower straight flange length
L22 - ________ Cone, upper straight flange length
L23 - ________
L24 - ________

3.5.4. Radii

R1 - ________ N1 nozzle flange face to centerline of drum radius
R2 - ________ N2 nozzle centerline to centerline of drum radius
R3 - ________ N3 nozzle centerline to centerline of drum radius
R4 - ________ N4 nozzle centerline to centerline of drum radius
R5 - ________ N5 nozzle centerline to centerline of drum radius
R6 - ________ N6 nozzle centerline to centerline of drum radius
R7 - ________ Cone, inside top knuckle radius, IKRT
R8 - ________ Cone, outside bottom knuckle radius, OKRB
R9 - ________ Inside (weld) junction radius, see Para. 3.8
R10 - ________ ___________________________________________________
R11 - ________ ___________________________________________________

3.5.5. **Angles**

Θ - ________ Cone angle
Θ1 - ________ N1 nozzle orientation
Θ2 - ________ N2 nozzle orientation
Θ3 - ________ N3 nozzle orientation
Θ4 - ________ N4 nozzle orientation
Θ5 - ________ ___________________________________________________
Θ6 - ________ ___________________________________________________
Θ7 - ________ LV1 level detector orientation
Θ8 - ________ LV2 level detector orientation
Θ9 - ________ LV3 level detector orientation
Θ10 - ________ LV4 level detector orientation
Θ11 - ________ ___________________________________________________
Θ12 - ________ ___________________________________________________

3.5.6. **Thicknesses** (including Corrosion Allowance, see Para. 5.3 and 6.4, as applicable)

T1 - ________ Head

If uniform shell:

T2 - ________ Shell

If stepped shell:

T21 - ________ Shell course from Btm tan line to ________
T22 - ________ Shell course from ________ to ________
T23 - ________ Shell course from ________ to ________
T2₄ - _________ Shell course from _________ to _________
T2₅ - _________ Shell course from _________ to _________
T3₁ - _________ Cone
T3₂ - _________ Cone, upper straight flange
T3₃ - _________ Cone, lower straight flange
T4 - _________ Baseplate
T5 - _________ Skirt
T6 - _________ Anchor Bolt Chair Top Plate
T7 - _________ Anchor Bolt Chair Support Plates
T8 - _________ Hot Box Ring
T9 - _________ Insulation Support Rings
T1₀ - _________ Insulation thickness
T₁₁ - _________ ______________________________________
T₁₂ - _________ ______________________________________

3.5.7. Nozzle Schedule

<table>
<thead>
<tr>
<th>Mark</th>
<th>Qty</th>
<th>Size</th>
<th>Rating</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>M₁</td>
<td>1</td>
<td>72” I.D.</td>
<td>Special</td>
<td>Bottom Outlet/Manway</td>
</tr>
<tr>
<td>M₂</td>
<td>1</td>
<td>Special</td>
<td></td>
<td>Top Access/Manway</td>
</tr>
<tr>
<td>N₁</td>
<td></td>
<td></td>
<td></td>
<td>Feed Inlet (specify number of inlet nozzles)</td>
</tr>
<tr>
<td>N₂</td>
<td>1</td>
<td></td>
<td></td>
<td>Vapor Outlet</td>
</tr>
<tr>
<td>N₃</td>
<td>1</td>
<td></td>
<td></td>
<td>Anti-Foam</td>
</tr>
<tr>
<td>N₄</td>
<td>1</td>
<td></td>
<td></td>
<td>Relief Valve</td>
</tr>
</tbody>
</table>
3.5.8. **Top Head** (specify type)

- _____ 2:1 Elliptical
- _____ Hemispherical

3.5.9. **Deheading Devices** (specify)

3.5.9.1. **Bottom**

- o Included (yes/no) ____________
- o Manufacturer ________________________
- o Vessel flange provided by _____________ and installed by vessel Supplier/Fabricator.

3.5.9.2. **Top**

- o Included (yes/no) ____________
- o Manufacturer ________________________
- o Vessel flange provided by _____________ and installed by vessel Supplier/Fabricator.

3.5.10. **Skirt/Cone/Junction** (specify type)

- _____ In-line
- _____ Overlapping
- _____ Proprietary
- _____ ________________________________
3.6. Drum Outline

Drum Outline

- Diagram showing various dimensions and labels such as L1 = OAL, L2 = Tan to Tan, T1 = Hd. Thk., T2 = Thk., T3 = Cone Thk, D1 = I.D., and others.

- Various points of interest including LV1, LV2, LV3, LV4, LV5, and others.

- Diagram notes and details such as 'See Cone/Skirt/ Baseplate Detail', 'See Feed Nozz to Cone Detail', and 'See Bottom Cone Detail'.

- Diagram also includes notes on tail dimensions from Btm Tan Line.
3.7. Drum Orientation

**Drum Orientation**

(later)

Near side
M2
Far side
M1
3.8. Cone/Skirt/Baseplate Detail – shown with In Line Skirt

Cone / Skirt / Baseplate Detail
(Shell to Cone weld omitted)

- Shell
- Inside Top Knuckle Radius = R7
- Top of Skirt Slots
- Top of Hot Box Ring
- Bottom Tangent Line
- Hot Box Bottom Ring, T8
- Centerline of (X4) - D8 Dia. Anchor Bolts x L11 Long.
- Top Chair Plate with D9 hole.
- Base Plate L12 x L13 slotted hole.
- (2) T7 Chair Support Plates, ea. bolt
- Skirt Thickness, T5
- D2 = I.S. Base Plate
- D3 = I.S. Skirt
- D4 = O.S. Skirt
- D5 = B.C.
- D6 = O.S. Base Plate

See Skirt to Cone Weld Detail
See Skirt Slot Detail
3.9. Skirt to Cone Weld Detail – In Line Skirt

**Skirt to Cone Weld Detail**

- Remove corner from inside skirt prior to welding
- Grind smooth and taper
- R9 Inside Junction Radius
- Grind smooth

Cone

Skirt
3.10. Skirt to Cone Weld Detail – Overlapping Skirt

**Skirt to Cone Weld Detail**
*(Shell to Cone weld omitted)*

- Grind smooth and Taper
- L15
- T3₂
- Cone upper straight flange
- Bottom Tangent Line
- Cone
- Skirt
3.11. Skirt Slot Detail

Skirt Slot Detail

(X5) Skirt Slots equally spaced around skirt circumference

SECTION A-A

All corners to be radiused (typical)

D7 diameter holes, top and bottom. Round corners inside and outside, typical

Corners to be radiused (typical)
3.12. Feed Nozzle to Cone Detail

Feed Nozzle to Cone Detail
(Nozzle to Cone weld omitted)
3.13. **Bottom Cone Detail**

**Bottom Cone Detail**

- Cone
- Outside Bottom Knuckle Radius = R8
- Bottom Knuckle Tan Line
- T3
- Face of Flange
- Nozzle M1 I.D.
- M1 Length = L20
4. **OPERATING CONDITIONS**

4.1. **Operating Pressure**, maximum at top (psig): __________

4.2. **Operating Temperature**, maximum (°F): at Top: __________

at Bottom: __________

4.3. **Operating Conditions** - Coke drums operate on a X2 hour cycle (that is, preheat–steam, preheat-hot vapor, coking, steam stripping, water quench, drain, drill, decoke, rehead, purge, and test; see Pressure-Temperature Profile, below.

4.4. ________________________________

5. **DESIGN CONDITIONS**

5.1. **Design Pressure** (psig): at top flange: __________

at ________: __________

at ________: __________

at ________: __________

at feed nozzle: __________

5.2. **Design Temperature** (°F): at ________: __________

at ________: __________

at ________: __________

5.3. **Corrosion Allowance**, see Para. 3.5.6 and 6.4:

Head ________________________________

Shell ________________________________

Cone ________________________________

Nozzles ________________________________

5.4. **External Design Pressure** (psig): __________ at ________

5.5. **Minimum Design Metal Temperature**: __________

5.6. **Coking**

- Coke density: __________
- Coke level: equal to L10
- ________________________________
5.7. **Quenching**

- Coke and water density: ___________
- Coke and water level: equal to L10
- Water only level: from L10 to top flange
- Quench design temperature (°F): _____
- ________________________________

5.8. **Wind:**

- Design Code: ___________
- Wind Speed: ___________
- Exposure: ________________
- ______________________________

5.9. **Seismic:**

- Design Code: ___________
- Zone: ________________
- ________________
- ________________

5.10. **Radiography:** Full

5.11. **Joint Efficiency:** 100%

5.12. **Design Conditions:**

5.12.1. A uniform shell thickness is considered to be current best practice in coke drum design, but should stepped shell thickness be specified or allowed, the number of shell thicknesses should be minimized.

5.12.2. Deheading device (bottom and/or top) supports are not to be welded to the drum shell or heads.

5.12.3. Bottom deheading device weight to be supported by drum table top only; no additional loads on drum are to be imposed by deheading device.

5.12.4. ________________________________

5.12.5. ________________________________
5.12.6. Concurrent Design Conditions – All concurrent design conditions are to be calculated, see table below.

5.12.7. Supplier/Fabricator to design, provide calculations, and detail drawings in accordance the Concurrent Design Conditions.

5.12.8. Supplier/Fabricator to provide shipping and loading diagram.

5.12.9. Supplier/Fabricator to design, provide calculations, detail drawings, and supply temporary hydrotest/shipping saddles, lifting lug, and tailing beam.
## CONCURRENT DESIGN CONDITIONS

<table>
<thead>
<tr>
<th>Design Condition</th>
<th>Concurrent Conditions</th>
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<tr>
<td></td>
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<tr>
<td>Design</td>
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<tr>
<td>Design Pressure</td>
<td>X</td>
</tr>
<tr>
<td>Design Temperature</td>
<td>X</td>
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<tr>
<td>Corrosion Allowance</td>
<td>X</td>
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<tr>
<td>External Design Pressure</td>
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<td>Other</td>
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<td>Coke Density</td>
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<td>Coke and Water Density</td>
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<td>Coke and Water Level</td>
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<td>Water Density</td>
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<td>Water Only Level</td>
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<td>Other</td>
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<tr>
<td>External</td>
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<tr>
<td>Wind</td>
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<tr>
<td>Seismic</td>
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<td>Other</td>
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<td>Hydrotest</td>
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<td>New (horizontal – shop fabricated)</td>
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<tr>
<td>New (vertical – field fabricated)</td>
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<tr>
<td>Future (vertical)</td>
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<td>Other</td>
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<tr>
<td>Lifting and Shipping</td>
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<td>Horizontal - Shipping</td>
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<td>Initial Lift - Horizontal</td>
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<td>Final Lift - Vertical</td>
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<td>Weight</td>
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<td>Insulation</td>
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<td>Fireproofing</td>
<td>X</td>
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<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Shaded cells dependent on execution strategy and special cases

5.13. **Finite Element Analysis:**
5.13.1. FEA is to be performed by others on skirt/cone/shell junction, including all concurrent loads, as a minimum. Any adjustments or changes will be provided immediately to drum Supplier/Fabricator.

5.13.2. Each drum is cycled through the attached Design Pressure-Temperature Profile.

5.13.3. The skirt/cone/shell junction is expected to be in-service X2 years before shutdown for major repairs.

5.13.4. To meet the skirt/cone/shell junction design criteria, above, the following dimensions and quantities may be considered as variables. Prior approval of Owner/Engineer is required.

- Alternate skirt/cone/shell junction designs
- Number of skirt slots
- Skirt slot hole diameter
- Skirt slot length
- Skirt slot width
- Skirt slot distance from bottom tangent line
- Skirt thickness
- Inside top knuckle radius
- Inside (weld) junction radius
- Hot box distance from bottom tangent line
- Insulation detail
- Fireproofing detail
- ________________________________

5.13.5. ________________________________

5.13.6. ________________________________
5.13.7. Design Pressure-Temperature Profile:

### Design Pressure - Temperature Profile

*Single Drum, One Complete Cycle*

<table>
<thead>
<tr>
<th>Temperature (deg F)</th>
<th>Pressure (psig)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle Duration (hours)</td>
<td></td>
</tr>
</tbody>
</table>

### COKING CYCLE

#### PRESSURE-TEMPERATURE PROFILE

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Duration (hours)</th>
<th>Initial Temp. (°F)</th>
<th>Final Temp. (°F)</th>
<th>Initial Press. (psig)</th>
<th>Final Press. (psig)</th>
</tr>
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<tbody>
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<td>Vapor Preheat</td>
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<td>Coking</td>
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<td>Steam Stripping</td>
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<td>Water Quench</td>
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<td>Drain</td>
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<td>Drill</td>
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<td>Decoking</td>
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<td></td>
</tr>
<tr>
<td>Rehead</td>
<td></td>
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<tr>
<td>Steam Purge</td>
<td></td>
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<tr>
<td>Test</td>
<td></td>
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</tr>
<tr>
<td><strong>CYCLE TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total Cycle Time, X2 (see Para. 3.5.1)</strong></td>
</tr>
</tbody>
</table>
6. MATERIALS

6.1. Head: ______________________________________________

6.2. Shell: ______________________________________________

6.3. Cone: ______________________________________________

6.4. Clad: _______________________________________________

(See Para. 3.5.6 and 5.3)

6.5. Nozzles: ___________________________________________

6.6. Flanges: ___________________________________________

6.7. Pipe: _______________________________________________

6.8. Fittings: ___________________________________________

6.9. Skirt: ______________________________________________

6.10. Weld Metal, base material: __________________________

6.11. Weld Metal, clad material: __________________________

6.12. Weld Metal, overlay material: _______________________

6.13. Hot Box Ring: _____________________________________


6.15. Lifting Supports: __________________________________

6.16. Insulation Studs: __________________________________

6.17. Insulation Supports: ________________________________

6.18. Nuts: _____________________________________________


6.20. Gaskets: __________________________________________

6.21. Other: _____________________________________________

6.22. Plate Material Purchase Requirements -

6.22.1. Material is to be purchased to meet the following additional

6.22.1.2. The Watanabe J Factor is to be calculated for plate material and is to be less than 150.

6.22.1.3. Plate material is to be purchased with the following maximum trace components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur</td>
<td>_____%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>_____%</td>
</tr>
</tbody>
</table>

6.22.2. Plate material is to be purchased to meet the following additional requirements in accordance with ASME Material Specification SA-20, Specification for General Requirements for Steel Plate for Pressure Vessels.

6.22.2.1. S1 Vacuum Treatment

6.22.2.2. S2 Product Analysis

6.22.2.3. S3 Simulated Post-Weld Heat Treatment of Mechanical Test Coupons

6.22.2.4. S5 Charpy V-Notch Impact Test

   o Orientation of test specimens are to be:
      ___________________________ (Longitudinal and/or Transverse)

   o Temperature, if other than SA-20, paragraph 12.1 ______ deg F

   o Acceptance criteria, if other than SA-20, paragraph 12.1

6.22.2.5. S7 High Temperature Tension Tests

6.22.2.6. S9 Magnetic Particle Examination

6.22.2.7. Ultrasonic Testing (Specify which applies)
- S8 Ultrasonic Examination in Accordance with A435 – Straight beam examination of Plain (unclad) plate
- S11 Ultrasonic Examination in Accordance with A577 – Angle beam examination
- S12 Ultrasonic Examination in Accordance with A578 – Straight beam examination of Plain and Clad Plate for Special Application

6.22.2.8. ____________________________________________________________

6.22.3. ____________________________________________________________

6.22.4. Shell plate material is to be purchased to maximize the shell course length and to minimize the number of circumferential weld seams.

6.23. **Weld Material** –

6.23.1. It is current coke drum best practice for weld material yield strength to match base weld material yield strength as close as possible.

6.23.2. The Bruscato X Factor (X Bar) is to be calculated for weld material and is to be less than 15.

6.24. **Heat Treatment**

6.24.1. Heat treatment is to be performed in accordance with ASME Section VIII, Division 1.

6.24.2. Material manufacturer to supply material based upon all heat treatment requirements including mill, fabrication, post weld heat treatment, and shop repairs, requirements, and two additional cycles in field.

6.24.3. All heat treatment is to be documented with time-temperature charts and provided to Owner/Engineer.

6.24.4. Where a possibility of deformation or distortion may occur during heat treatment, temporary reinforcing is to be provided.

6.24.5. ____________________________________________________________

6.25. **Material Alternates** - Any material alternates or substitutes must be prior approved by Owner/Engineer in writing.
7. **HYDROTEST PRESSURE (psig):**
   - Horizontal (shop) __________
   - Vertical (field) _____________
   - Future Field _____________

8. **MAXIMUM ALLOWABLE WORKING PRESSURE (psig):**
   __________________________________________
   Limited by _________________________________

9. **WEIGHTS**
   9.1. Fabrication: ________________
   9.2. Shipping: ________________
   9.3. Operating (Coking): __________
   9.4. Operating (Quench): ______________
   9.5. Field Hydrotest: ________________
   9.6. _________________________________

10. **NOZZLES AND APPURTE NANCES**
   10.1. Feed nozzle(s) to enter cone perpendicular to cone wall (feed enters drum angled up).
   10.2. Bottom outlet/manway and top access/manway nozzle dimensions to be provided by top and bottom deheading device Supplier/Fabricator, if so equipped.
   10.3. Vapor outlet nozzle and anti-foam nozzle to be oriented 180° from each other.
   10.4. All nozzles to be integrally reinforced (self reinforcing) type and radiographable in accordance with ASME Section VIII, Division 1, Figure 16.1 (f-1 through f-4).
   10.5. Reinforcing pads are not allowed.
   10.6. No structural, piping, and/or electrical supports are to be welded to
10.7. Nozzle orientations are to be in accordance with the attached nozzle orientation detail.

10.8. Level detector attachments are to be in accordance with the attached level detector details.

10.9. Insulation support details are to be in accordance with the attached insulation details.

10.10. Fireproofing support details are to be in accordance with the attached fireproofing details.

10.11. Grounding lugs (2) are to be in accordance with the attached ground lug detail.

11. FABRICATION

11.1. Shell sections to be fabricated using maximum available width plate or other techniques to minimize the number of circumferential weld seams.

11.2. Unequal wall thicknesses, if specified or allowed, are to be tapered on the vessel exterior, ground flush and smooth to a minimum 10:1 taper.

11.3. Shell out-of-roundness tolerances are to be well within Code requirements.

11.4. All temporary fabrication attachments should be minimized.

11.5. All corners, edges, immediate direction changes, etc. are to be radiused, ground flush and smooth, or otherwise eased to eliminate stress concentrations.

11.6. All nozzles are to be flush and smooth with the inside drum surface.

11.7. Bolt holes (nozzle and anchor bolts) are to straddle natural centerlines, vertical, horizontal, and north-south, east-west.

11.8. All nozzle projections are to the face of flange.

11.9. If the coke drum is a replacement for an existing drum and the base
plate is also to be replaced, then the existing anchor bolts locations are
to be surveyed and this survey provided to the vessel
Supplier/Fabricator.

11.10.  

12. WELDING
12.1. All welding is to be performed in accordance with ASME Section VIII,
Division 1, Section II, and Section IX.
12.2. Welding procedure specifications (WPS) and procedure qualification
records (PQR) must be prior approved by Owner/Engineer in writing.
12.3. Welder performance qualification records are to be made available for
Owner/Engineer review.
12.4. Applicable welding procedure and preheating requirements for each
weld are to be shown on Supplier/Fabricator’s drawings.
12.5. All pressure containing welds are to be double welded, full penetration
welds, and ground flush and smooth.
12.6. All double welded connection’s root passes are to be chipped, gouged,
and/or ground to sound metal prior to back welding.
12.7. All double welded connection root passes which cannot be chipped,
gouged, and/or ground are to made using Gas Tungsten (GTAW) weld
process.
12.8. Weld joint alignment tolerances are to be well within Code
requirements.
12.9. Clad restoration welding and all weld overlay is to be applied by a
minimum of two passes.
12.10. Nozzle and appurtenance welds are to be located such that nozzle and
appurtenance weld heat affected zones (HAZ) and circumferential and
longitudinal HAZ do not overlap.
12.11. All nozzle necks and flange faces to be clad or weld overlaid with
material matching clad material.
12.12. Preheat requirements are to be in accordance with ASME Section VIII, Division 1 and preheat temperature is to be maintained until the weld is completed.

12.13. All welds are to be free of undercutting.

12.14. All non-pressure containing welds are to be full penetration, if possible, radiused, and ground flush and smooth.

12.15. Upon removal all temporary fabrication attachment welds to be repaired, ground flush and smooth.

12.16. All corners, edges, and immediate direction changes are to be radiused, ground, or otherwise eased to eliminate stress concentrations.

12.17. No welding is to be performed on the coke drum after Post Weld Heat Treatment unless prior approved by Owner/Engineer in writing.

12.18. 

13. POST WELD HEAT TREATMENT

13.1. Heat treatment is to be performed in accordance with ASME Section VIII, Division 1.

13.2. All heat treatment, whether intermediate stress relief, post weld heat treatment, or local post weld heat treatment, is to be documented with time-temperature charts and provided to Owner/Engineer.

13.3. Where a possibility of deformation or distortion may occur during heat treatment, temporary reinforcing is to be provided.

13.4. Flange gasket surfaces are to be protected from excessive oxidation during heat treatment.

14. INSPECTION AND TESTING

14.1. Tolerances – Minimum acceptable fabrication tolerances are to be in accordance with ASME Section VIII, Division 1 and as shown on the attached detail drawing.

14.2. Drawing Requirements - Applicable nondestructive testing procedures
for each weld and component are to be shown on Supplier/Fabricator’s drawings.

14.3. **Testing Personnel** - Testing personnel are to be qualified in accordance with American Society of Nondestructive Testing recommended practice SNT-TC-1A.

14.4. **Positive Material Identification (PMI)**

14.4.1. All alloy materials (plate, clad, overlay, forgings, pipe, fittings, flanges, supports, bolts, gaskets, weld metal, etc.) are to be positive material identified as a minimum upon completion of post weld heat treatment.

14.4.2. Standard methods of analysis listed in ASTM A751 are acceptable and with instruments and methods capable of quantitative measurement of major alloying elements.

14.4.3. All materials are to comply with the applicable ASME Section II material specifications as to alloy content and percentage content must fall within specified ranges.

14.4.4.

14.5. **Radiographic examination (RT)**

14.5.1. All welds are to be 100% radiographically tested as a minimum upon completion of post weld heat treatment.

14.5.2. Radiographic examination is to be performed in accordance with ASME Section VIII, Division 1 and Section V.

14.5.3.

14.6. **Ultrasonic examination (UT)**

14.6.1. All clad material is to be ultrasonically tested for lack of bonding after forming.

14.6.2. All clad plate is to be 100% ultrasonically tested as a minimum upon completion of post weld heat treatment.

14.6.3. Ultrasonic examination is to be performed in accordance with ASME Section VIII, Division 1 and Section V.

14.6.4.
14.7. **Magnetic particle (MT)**

14.7.1. All welds are to be 100% magnetic particle tested as a minimum upon completion of post weld heat treatment.

14.7.2. Magnetic particle examination is to be performed in accordance with ASME Section VIII, Division 1 and Section V.

14.8. **Liquid penetrant (PT)**

14.8.1. All attachment welds, temporary fabrication attachment welds, overlay welds, and weld repairs are to be liquid penetrant tested upon completion of post weld heat treatment.

14.8.2. Liquid penetrant examination is to be performed in accordance with ASME Section VIII and Section V.

14.9. **Brinell hardness (BHN)**

14.9.1. All pressure containing welds, heat affected zone (HAZ), and base metal on either side of the weld are to be Brinell hardness tested after post weld heat treatment.

14.9.2. The maximum acceptable reading is to be 225 BHN.

14.9.3. The defined locations for hardness testing are every ten feet of each longitudinal weld and each circumferential weld, all nozzle attachment welds, and additional locations or frequencies may be requested by Owner representative.

14.10. **Hydrotest**

14.10.1. Hydrostatic testing is to be performed in accordance with ASME Section VIII, Division 1.

14.10.2. Test gaskets material and type are to be as specified above.

14.10.3. Clad drums are to be tested with water limited to 50 ppm chloride content.

14.10.4. Test water temperature is not to be less than 60 deg F.
15. **SURFACE PREPARATION AND PAINT**

15.1. Surface preparation, priming, and painting are to be in accordance with the attached specification.

15.2. All external surfaces not insulated are to be sandblasted, primed, and coated.

15.3. Flange faces are not to be sandblasted and coated.

15.4. _________________________________________________________________

16. **INSULATION AND FIREPROOFING**

16.1. Insulation and fireproofing are to be in accordance with the attached detail drawings.

16.2. Insulation around the skirt/cone/shell junction and shell welds is to be removable to aid inspection.

16.3. Insulation support rings are not to be welded to the head, shell, or cone.

16.4. Insulation support technique is to minimize local stress and through shell wall cracking.

16.5. Additional personnel protection insulation is to be installed where necessary.

16.6. _________________________________________________________________

17. **SHIPPING AND LIFTING**

17.1. Shipping and lifting supports and devices design, details, and supply are to be provided by Supplier/Fabricator.

17.2. Lifting and tailing devices are to be designed with an impact factor of 1.5.

17.3. Lifting support connections to drum shell and/or head to minimize local stresses and through wall cracking.

17.4. Supplier/Fabricator to load, adequately tie down, and secure the
equipment for shipping.

17.5. If the drums are shipped over salt water the Supplier/Fabricator is to provide all necessary shipping preparations, including all closures.

17.6. Spare gaskets for each nozzle are to be shipped with drum by Supplier/Fabricator.

17.7. _______________________________________________________________

18. ORDER OF PRECEDENCE

18.1. The order of precedence should there be a conflict between or among any of the codes, specifications, drawings, documents, purchase order, etc. shall be: the applicable code, this specification, Owner/Engineer provided drawings and documents, and Owner/Engineer reviewed drawings and documents.

18.2. If there is any doubt as to requirements, Supplier/Fabricator is to request clarifications, in writing, from the Owner/Engineer, who will respond in writing.

18.3. _______________________________________________________________

19. REFERENCE DRAWINGS AND STANDARDS

19.1. Level Detector Details

19.2. Insulation Details

19.3. Fireproofing Details

19.4. Grounding Lug Detail

19.5. Minimum Acceptable Fabrication Tolerances

19.6. Surface Preparation and Painting Specification

19.7. _______________________________________________________________

19.8. _______________________________________________________________