TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

GENERAL INFORMATION ABOUT RETROFITTING OF STORAGE TANKS

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1. DESIGN CODE AND STANDARDS FOR STORAGE TANK

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API-650

Welded Steel Tanks for Oil Storage

API STANDARD 650
TENTH EDITION, NOVEMBER 1998

ADDENDUM 1, MARCH 2000

STEP
Strategies for Today's Environmental Partnership

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APPENDIX E—SEISMIC DESIGN OF STORAGE TANKS

E.1 Scope

This appendix provides minimum requirements that may be specified by the purchaser for the design of storage tanks subject to seismic load. These requirements represent accepted practice for application to flat-bottom tanks; however, other procedures and applicable factors or additional requirements may be specified by the purchaser or jurisdictional authorities. Any deviation from the requirements of this appendix must be by agreement between the purchaser and the manufacturer.

Note: The basis for these requirements, together with the formulas for the design curves in Figures E-2 through E-5 and information for calculating other seismic effects, is included in a paper by R. S. Wozniak and W. W. Mitchell, "Basis of Seismic Design Provisions for Welded Steel Oil Storage Tanks."[14]

E.2 General

The design procedure considers two response modes of the tank and its contents:

a. The relatively high-frequency amplified response to lateral ground motion of the tank shell and roof, together with the portion of the liquid contents that moves in unison with the shell.
b. The relatively low-frequency amplified response of the portion of the liquid contents that moves in the fundamental sloshing mode.

The design requires the determination of the hydrodynamic mass associated with each mode and the lateral force and overturning moment applied to the shell as a result of the response of the masses to lateral ground motion. Provisions are included to assure stability of the tank shell with respect to overturning and to preclude buckling of the tank shell as a result of longitudinal compression.

This appendix has no provisions for determining the increased hoop tension that would result from earthquake motion. The increased hoop tension, correctly calculated from the lateral force coefficients specified in this appendix, would not increase the hoop stresses above a generally acceptable stress level that could be used for seismic design of the tank shell.

E.3 Design Loading

E.3.1 OVERTURNING MOMENT

Note: The overturning moment determined in E.3.1 is the moment applied to the bottom of the shell only. The tank foundation is subjected to an additional overturning moment as a result of lateral displacement of the tank contents; this additional moment may need to be considered in the design of some foundations, such as pile-supported concrete mats.

The overturning moment due to seismic forces applied to the bottom of the shell shall be determined as follows:

$$M = ZI\,(C_1 W_S X_S + C_1 W_r H_t + C_1 W_1 X_1 + C_2 W_2 X_2)$$

where

M = overturning moment applied to the bottom of the tank shell, in N-m (ft-lbf),

Z = seismic zone factor (horizontal seismic acceleration) as determined by the purchaser or the appropriate government authority that has jurisdiction. The seismic zone maps of Figure E-1, the seismic zone tabulation for areas outside the United States (see Table E-1), or the *Supplement to National Building Code of Canada* may be used as an aid to determine the seismic zone. Table E-2 can be used to determine the seismic zone factor, Z,

I = importance factor,
= 1.0 for all tanks unless a larger importance factor is specified by the purchaser. The I factor should not exceed 1.25, and this maximum value should be applied only to tanks that must provide emergency post-earthquake service or to tanks that store toxic or explosive substances in areas where an accidental release of product would be considered to be dangerous to the safety of the general public,

C_1, C_2 = lateral earthquake force coefficients determined according to E.3.3,

W_s = total weight of the tank shell, in N (lbf),

X_s = height from the bottom of the tank shell to the shell's center of gravity, in m (ft),

W_r = total weight of the tank roof (fixed or floating) plus a portion of the snow load, if any, specified by the purchaser, in N (lbf),

H_t = total height of the tank shell, in m (ft),

W_1 = weight of the effective mass of the tank contents that move in unison with the tank shell, as determined according to E.3.2.1, in N (lbf),

X_1 = height from the bottom of the tank shell to the centroid of lateral seismic force applied to W_1, as determined according to E.3.2.2, in m (ft),

W_2 = weight of the effective mass of the tank contents that move in the first sloshing mode, as determined according to E.3.2.1, in N (lbf),

X_2 = height from the bottom of the tank shell to the centroid of lateral seismic force applied to W_2, as determined according to E.3.2.2, in m (ft).

[14] R. S. Wozniak and W. W. Mitchell, "Basis of Seismic Design Provisions for Welded Steel Oil Storage Tanks," *1978 Proceedings—Refining Department*, Volume 57, American Petroleum Institute, Washington, D.C., 1978, pp. 485–501.

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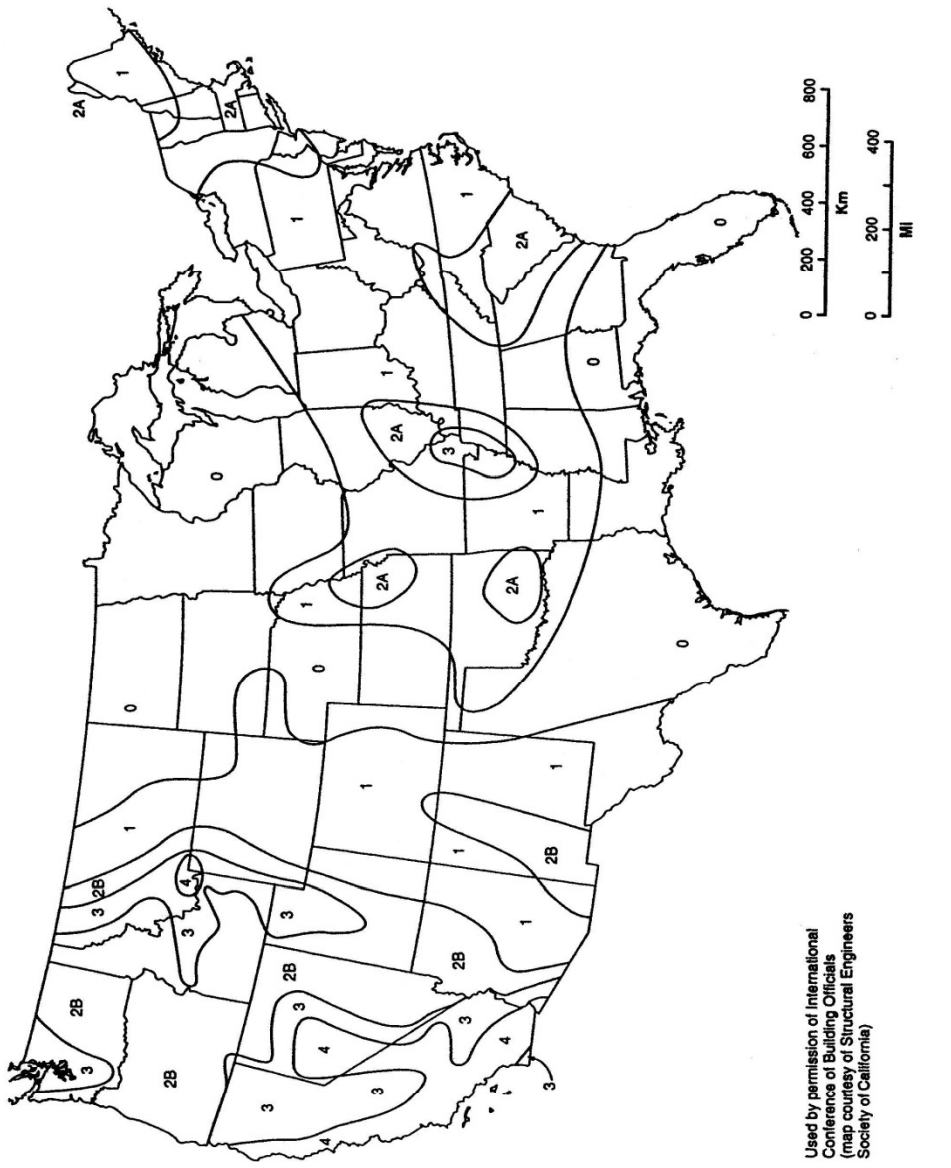


Figure E-1—Seismic Zones

Used by permission of International Conference of Building Officials (map courtesy of Structural Engineers Society of California)

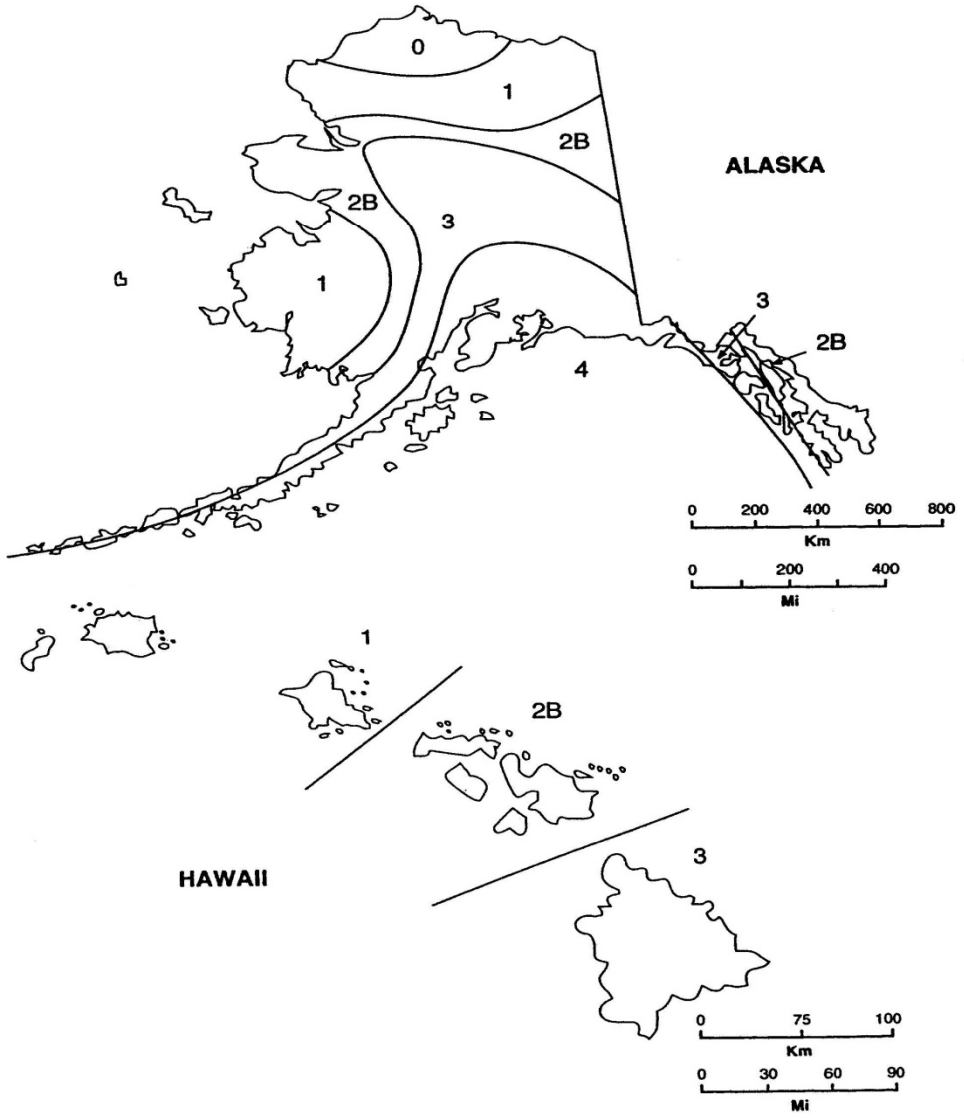


Figure E-1—Seismic Zones (continued)

Table E-1—Seismic Zone Tabulation for Areas Outside the United States

Location	Seismic Zone	Location	Seismic Zone
Asia		Pacific Ocean area	
Turkey		Caroline Islands	
Ankara	2B	Koror, Paulau	2B
Karamursel	3	Ponape	0
Atlantic Ocean area		Johnston Island	1
Azores	2B	Kwajalein	1
Bermuda	1	Mariana Island	
Caribbean		Guam	3
Bahama Islands	1	Saipan	3
Canal Zone	2B	Tinain	3
Leeward Islands	3	Marcus Island	1
Puerto Rico	3	Okinawa	3
Trinidad Island	2B	Philippine Islands	3
North America		Samoa Islands	3
Greenland	1	Wake Island	0
Iceland			
Keflavik	3		

E.3.2 EFFECTIVE MASS OF TANK CONTENTS

E.3.2.1 The effective masses W_1 and W_2 may be determined by multiplying W_T by the ratios W_1/W_T and W_2/W_T, respectively, obtained from Figure E-2 for the ratio D/H.

where

W_T = total weight of the tank contents, in pounds. (The specific gravity of the product shall be specified by the purchaser.),

D = nominal tank diameter, in m (ft) (see 3.6.1.1, Note 1),

H = maximum design liquid level, in m (ft) (see 3.6.3.2).

E.3.2.2 The heights from the bottom of the tank shell to the centroids of the lateral seismic forces applied to W_1 and W_2, X_1 and X_2, may be determined by multiplying H by the ratios X_1/H and X_2/H, respectively, obtained from Figure E-3 for the ratio D/H.

E.3.2.3 The curves in Figures E-2 and E-3 are based on a modification of the equations presented in ERDA Technical Information Document 7024.[15] Alternatively, W_1, W_2, X_1, and X_2 may be determined by other analytical procedures based on the dynamic characteristics of the tank.

E.3.3 LATERAL FORCE COEFFICIENTS

E.3.3.1 The lateral force coefficient C_1 shall be 0.60 unless the product of ZIC_1 and the product of ZIC_2 are determined as outlined in E.3.3.3.

[15]ERDA Technical Information Document 7024, *Nuclear Reactors and Earthquakes* (prepared by Lockheed Aircraft Corporation and Holmes & Narver, Inc.), U.S. Atomic Energy Commission, August 1963.

Table E-2—Seismic Zone Factor

Seismic Factor (from Figure E-1 or other sources)	Seismic Zone Factor (horizontal acceleration)
1	0.075
2A	0.15
2B	0.20
3	0.30
4	0.40

E.3.3.2 The lateral force coefficient C_2 shall be determined as a function of the natural period of the first sloshing mode, T, and the soil conditions at the tank site unless otherwise determined by the method given in E.3.3.3. When T is less than or equal to 4.5,

$T < 4.5 \Rightarrow C_2 = \dfrac{0.75S}{T}$ $\quad C_1 = 0.6$

When T is greater than 4.5,

$T > 4.5 \Rightarrow C_2 = \dfrac{3.375S}{T^2}$

where

S = site coefficient from Table E-3,

T = natural period of the first sloshing mode, in seconds. T may be determined from the following equation:

$$T = k(D^{0.5})$$

k = factor obtained from Figure E-4 for the ratio D/H.

● **E.3.3.3** Alternatively, by agreement between the purchaser and the manufacturer, the lateral force determined by the products of ZIC_1 and ZIC_2 may be determined from response spectra established for the specific tank site and furnished by the purchaser; however, the lateral force ZIC_1 shall not be less than that determined in accordance with E.3.1 and E.3.3.1.

The response spectra for a specific site should be established considering the active faults within the region, the types of faults, the magnitude of the earthquake that could be generated by each fault, the regional seismic activity rate, the proximity of the site to the potential source faults, the attenuation of the ground motion between the faults and the site, and the soil conditions at the site. The spectrum for the factor ZIC_1 should be established for a damping coefficient of 2% of critical. Scaling of the response spectrum to account for the reserve capacity of the tank is permissible. The acceptable reserve capacity shall be specified by the purchaser and can be determined from table tests, field observations, and the ductility of the structure.

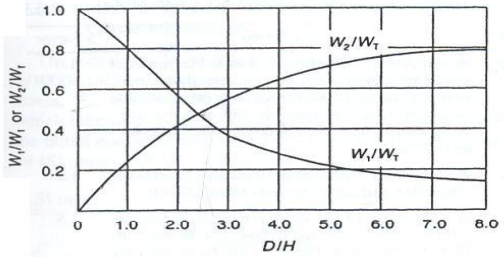


Figure E-2—Effective Masses

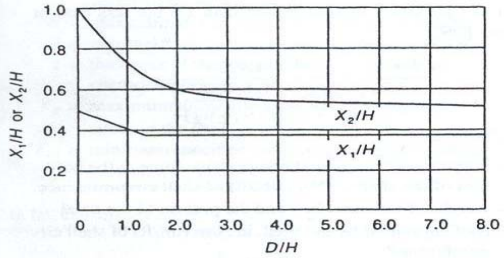


Figure E-3—Centroids of Seismic Forces

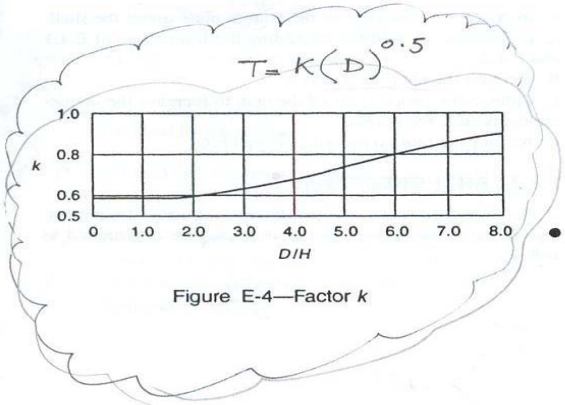


Figure E-4—Factor *k*

The spectrum for the factor ZIC_2 should correspond to the spectrum for ZIC_1 modified for a damping coefficient of 0.5% of critical. In determining the factor ZIC_1 from the spectrum, the fundamental period of the tank with its contents shall be taken into account unless the maximum spectral acceleration is used.

E.4 Resistance to Overturning

E.4.1 Resistance to the overturning moment at the bottom of the shell may be provided by the weight of the tank shell and by the anchorage of the tank shell or, for unanchored tanks, the weight of a portion of the tank contents adjacent to the shell. For unanchored tanks, the portion of the contents that may be used to resist overturning depends on the width of the bottom plate under the shell that lifts off the foundation and may be determined as follows:

In SI units:

$$w_L = 99 t_b \sqrt{F_{by} GH} \quad < 196GHD$$

However, w_L shall not exceed $196GHD$

where

w_L = maximum weight of the tank contents that may be used to resist the shell overturning moment, in N/m of shell circumference,
t_b = thickness of the bottom plate under the shell, in mm, used to calculate w_L (see E.4.2), 00
F_{by} = minimum specified yield strength of the bottom plate under the shell, MPa,
G = design specific gravity of the liquid to be stored, as specified by the purchaser,
H = maximum design liquid level, m (see 3.6.3.2),
D = nominal tank diameter, m (see 3.6.1.1, Note 1). 98

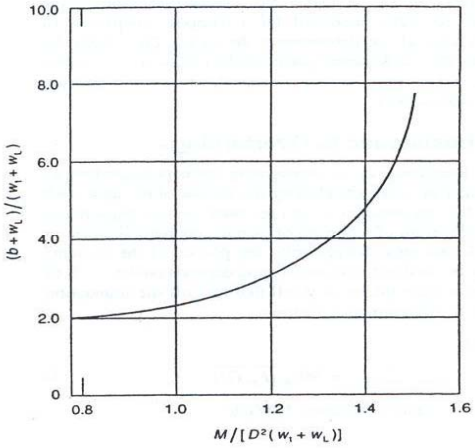
In US Customary units:

$$w_L = 7.9 t_b \sqrt{F_{by} GH} \quad < 1.25GHD$$

However, w_L shall not exceed $1.25GHD$

where

w_L = maximum weight of the tank contents that may be used to resist the shell overturning moment, in lbf/ft of shell circumference,
t_b = thickness of the bottom plate under the shell in inches, used to calculate w_L (see E.4.2), 00
F_{by} = minimum specified yield strength of the bottom plate under the shell (lbf/in.^{2}),
G = design specific gravity of the liquid to be stored, as specified by the purchaser.
H = maximum design liquid level (ft) (see 3.6.3.2),
D = nominal tank diameter (ft) (see 3.6.1.1, Note 1). 98



Note: This figure may be used to compute b when $M/[D^2(w_t + w_L)]$ is greater than 0.785 but less than or equal to 1.5 (see E.5.1).

Figure E-5—Compressive Force b

E.4.2 The thickness of the bottom plate under the shell may be greater than or equal to t_b, but the thickness, t_b, used to calculate w_L shall not exceed the larger of 6 mm ($^1/_4$ in.) or the first shell course thickness less the shell corrosion allowance, nor shall t_b exceed the actual thickness of the bottom plate under the shell less the corrosion allowance for the bottom plate. Where the bottom plate under the shell is thicker than the remainder of the bottom, the width of the thicker plate under the shell, in mm (ft) shall be equal to or greater than $0.0274\, w_L/GH$.

E.5 Shell Compression

E.5.1 UNANCHORED TANKS

For unanchored tanks, the maximum longitudinal compressive force at the bottom of the shell may be determined as follows: When $M/[D^2(w_t + w_L)]$ is less than or equal to 0.785,

$$b = w_t + \frac{1.273M}{D^2}$$

When $M/[D^2(w_t + w_L)]$ is greater than 0.785 but less than or equal to 1.5, b may be computed from the value of the following parameter obtained from Figure E-5:

$$\frac{b + w_L}{w_t + w_L}$$

Table E-3—Site Coefficients (See Note)

Type	Description	S Factor
S_1	A soil profile with either a) a rock-like material characterized by a shear wave velocity greater than 760 m/sec (2500 ft/sec) or by other suitable means of classification or b) stiff or dense soil conditions where the soil depth is less than 60 m (200 ft).	1.0
S_2	A soil profile with stiff or dense soil conditions where the soil depth exceeds 60 m (200 ft).	1.2
S_3	A soil profile 12 m (40 ft) or more in depth containing more than 6 m (20 ft) of soft to medium stiff clay but more than 12 m (40 ft) of soft clay.	1.5
S_4	A soil profile containing more than 12 m (40 ft) of soft clay.	2.0

Note: The site factor shall be established from properly substantiated geotechnical data. In locations where the soil properties are not known in sufficient detail to determine the soil profile type, soil profile S_3 shall be used. Soil profile S_4 need not be assumed unless the building official determines that soil profile S_4 may be present at the site or in the event that soil profile S_4 is established by geotechnical data.

When $M/[D^2(w_t + w_L)]$ is greater than 1.5 but less than or equal to 1.57,

$$\frac{b + w_L}{w_t + w_L} = \frac{1.490}{\left[1 - \frac{0.637M}{D^2(w_t + w_L)}\right]^{0.5}}$$

where

b = maximum longitudinal compressive force at the bottom of the shell, in N/m (lbf/ft) of shell circumference,

w_t = weight of the tank shell and the portion of the fixed roof supported by the shell, in N/m (lbf/ft) of shell circumference.

When $M/[D^2(w_t + w_L)]$ is greater than 1.57 or when $b/12t$ is greater than F_a (see E.5.3), the tank is structurally unstable. It is then necessary to take one of the following measures:

a. Increase the thickness of the bottom plate under the shell, t_b, to increase w_L without exceeding the limitations of E.4.1 and E.4.2.
b. Increase the shell thickness, t.
c. Change the proportions of the tank to increase the diameter and reduce the height.
d. Anchor the tank in accordance with E.6.

E.5.2 ANCHORED TANKS

For anchored tanks, the maximum longitudinal compressive force at the bottom of the shell may be determined as follows:

$$b = w_t + \frac{1.273M}{D^2}$$

E.5.3 MAXIMUM ALLOWABLE SHELL COMPRESSION

The maximum longitudinal compressive stress in the shell, $b/1000t$ ($b/12t$), shall not exceed the maximum allowable stress, F_a, determined by the following formulas for F_a, which take into account the effect of internal pressure due to the liquid contents. When GHD^2/t^2 is greater than or equal to 44 (SI units) [10^6 U.S. Customary Units)],

In SI units:

$$F_a = \frac{83t}{D}$$

When GHD^2/t^2 is less than 44,

$$F_a = \frac{83(t)}{2.5D} + 7.5\sqrt{GH}$$

However, F_a shall not be greater than $0.5F_{ty}$

where

G = design specific gravity of the liquid to be stored, as specified by the purchaser,
H = maximum design liquid level, m (see 3.6.3.2),
D = nominal tank diameter, m (see 3.6.1.1, Note 1).
t = thickness of the bottom shell course, excluding any corrosion allowance, in mm.
F_a = maximum allowable longitudinal compressive stress in the shell, in MPa.
F_{ty} = minimum specified yield strength of the bottom shell course, in MPa.

In US Customary units:

$$F_a = \frac{10^6 t}{D}$$

When GHD^2/t^2 is less than 10^6

$$F_a = \frac{10^6(t)}{2.5D} + 600\sqrt{GH}$$

However, F_a shall not be greater than $0.5F_{ty}$

where

G = design specific gravity of the liquid to be stored, as specified by the purchaser,
H = maximum design liquid level (ft) (see 3.6.3.2),
D = nominal tank diameter (ft) (see 3.6.1.1, Note 1),
t = thickness of the bottom shell course, excluding any corrosion allowance (in.),
F_a = maximum allowable longitudinal compressive stress in the shell (lbf/in.^{2}),
F_{ty} = minimum specified yield strength of the bottom shell course (lbf/in.^{2}).

E.5.4 UPPER SHELL COURSES

If the thickness of the lower shell course calculated to resist the seismic overturning moment is greater than the thickness required for hydrostatic pressure, both excluding any corrosion allowance, then the calculated thickness of each upper shell course for hydrostatic pressure shall be increased in the same proportion, unless a special analysis is made to determine the seismic overturning moment and corresponding stresses at the bottom of each upper shell course.

E.6 Anchorage of Tanks

E.6.1 MINIMUM ANCHORAGE

When tanks are anchored, then w_L (see E.4.1) shall not be used to reduce the uplifting load on the anchors. The anchors shall be sized to provide for at least the following minimum anchorage resistance, in N/m (lbf/ft) of shell circumference:

$$\frac{1.273M}{D^2} - w_t$$

plus any uplift, in N/m (lbf/ft) of shell circumference, due to internal design pressure. Wind loading need not be considered in combination with seismic loading. The stresses due to anchor forces in the tank shell at the points where the anchors are attached shall be investigated. (For a design procedure, see AISI E-1, Volume II, Part VII, "Anchor Bolt Chairs.")

E.6.2 DESIGN CONSIDERATIONS

E.6.2.1 If an anchored tank is not properly designed, its shell can be susceptible to tearing. Care should be taken to ensure that the strength of the anchorage attachments is greater than the specified minimum yield strength of the anchors so that the anchors yield before the attachments fail. Experience has shown that properly designed anchored tanks retain greater reserve strength with respect to seismic overload than unanchored tanks retain. In addition to the requirements of E.6.1, anchor design shall take into account the requirements of E.6.2.2 through E.6.2.7.

E.6.2.2 The spacing between anchors shall not exceed 3 m (10 ft). On tanks less than 15 m (50 ft) in diameter, the spacing between anchors shall not exceed 1.8 m (6 ft). When anchor bolts are used, they shall have a minimum diameter of 25 mm (1 in.), excluding any corrosion allowance.

E.6.2.3 The maximum allowable stress for the anchorage parts shall not exceed the following values:

a. For anchors designed for seismic loading alone or in combination with other loading, an allowable tensile stress equal to 0.80 yield stress (0.60 of yield stress multiplied by 1.33).
b. For other parts, 133% of the allowable stress in accordance with 3.10.3.

c. The maximum allowable design stress in the shell at the anchor attachment shall be limited to 170 MPa (25,000 psi) with no increase for seismic loading.

These stresses can be used in conjunction with other loads for seismic loading when the combined loading governs.

E.6.2.4 The anchor attachment assembly and the attachment to the shell shall be designed for a load equal to the minimum specified yield strength multiplied by the as-built minimum cross-sectional area of the anchor.

E.6.2.5 The embedment strength of the anchor in the foundation shall be sufficient to develop the specified minimum yield strength of the anchor. Hooked anchors or end plates may be used to resist pullout.

● **E.6.2.6** The purchaser should specify any corrosion allowance that is to be added to the anchor dimensions. The furnished anchors, including their corrosion allowance, shall be used to determine the design loads for the shell attachment and embedment requirements.

● **E.6.2.7** When specified by the purchaser, the anchors shall be designed to allow for thermal expansion of the tank resulting from a shell temperature greater than 90°C (200°F).

E.7 Piping

Suitable flexibility shall be provided in the vertical direction for all piping attached to the shell or to the bottom of the tank. On unanchored tanks subject to bottom uplift, piping connected to the bottom shall be free to lift with the bottom or shall be located so that the horizontal distance measured from the shell to the edge of the connecting reinforcement is equal to the width of the bottom hold-down, as calculated in E.4.2, plus 300 mm (12 in.).

E.8 Additional Considerations

● **E.8.1** The purchaser shall specify any freeboard desired to minimize or prevent overflow and damage to the roof and upper shell that may be caused by sloshing of the liquid contents.

● **E.8.2** The base of the roof-supporting columns shall be restrained to prevent lateral movement during earthquakes. When specified by the purchaser, the columns shall be designed to resist the forces caused by sloshing of the liquid contents.

E.8.3 The additional vertical forces at the shell caused by the seismic overturning moment shall be considered in the design of the tank foundation.

E.8.4 Unless otherwise required, tanks that may be subject to sliding due to earthquake shall use a maximum allowable sliding friction of 0.40 multiplied by the force against the tank bottom.

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2- DIFFERENT TYPES OF STORAGE TANK

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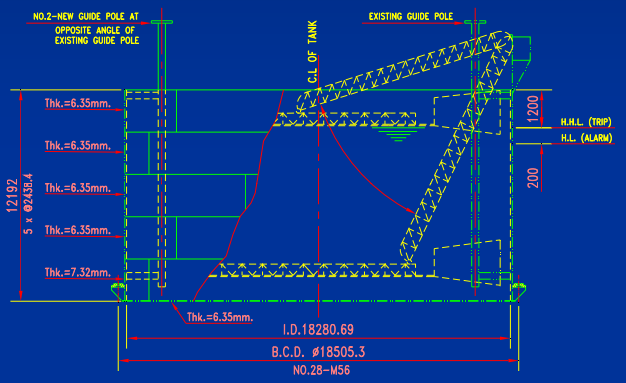
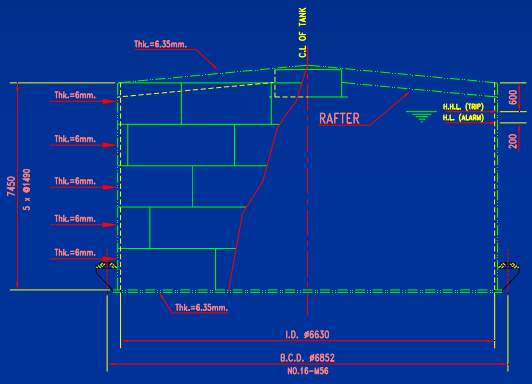
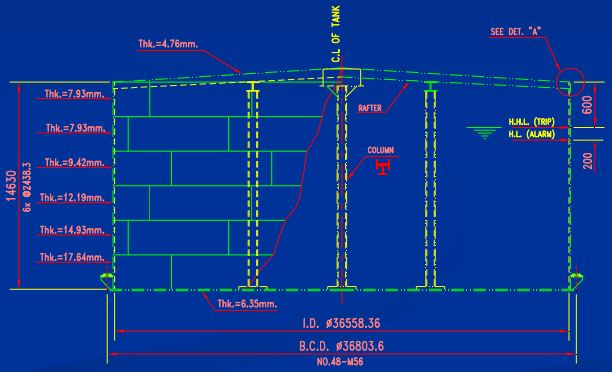
Storage Tanks



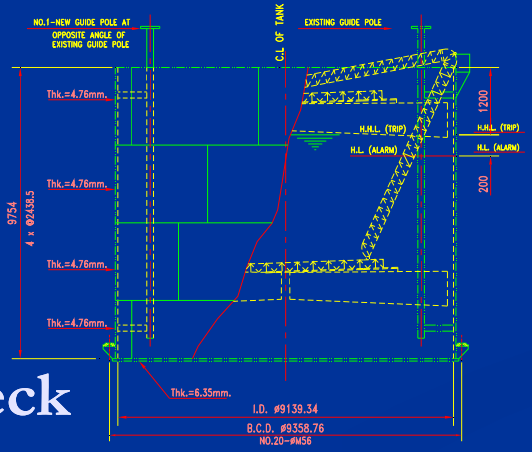
Single Deck



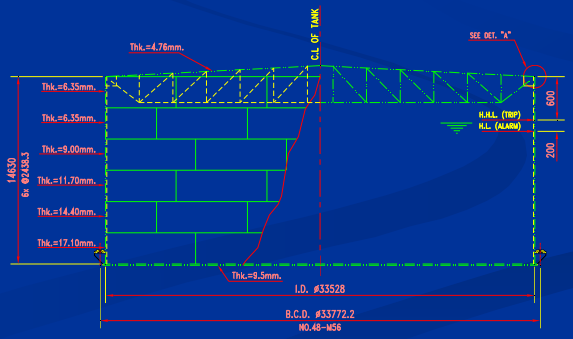
Fixed Roof with Rafters



Fixed Roof with Column & Rafter



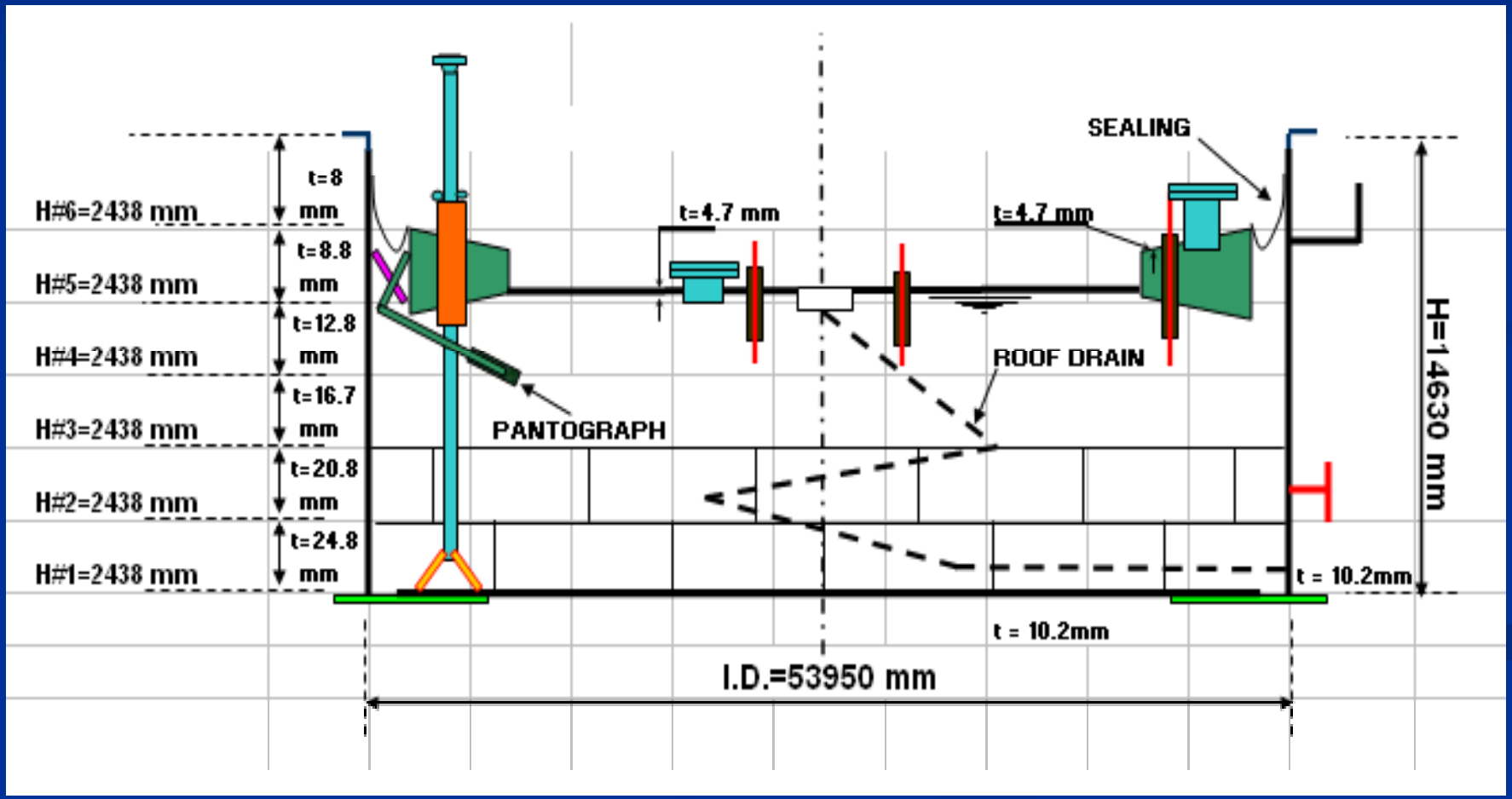
Double Deck



Fixed Roof With Truss & Rafters

Single Deck Floating Roof

Storage Tank



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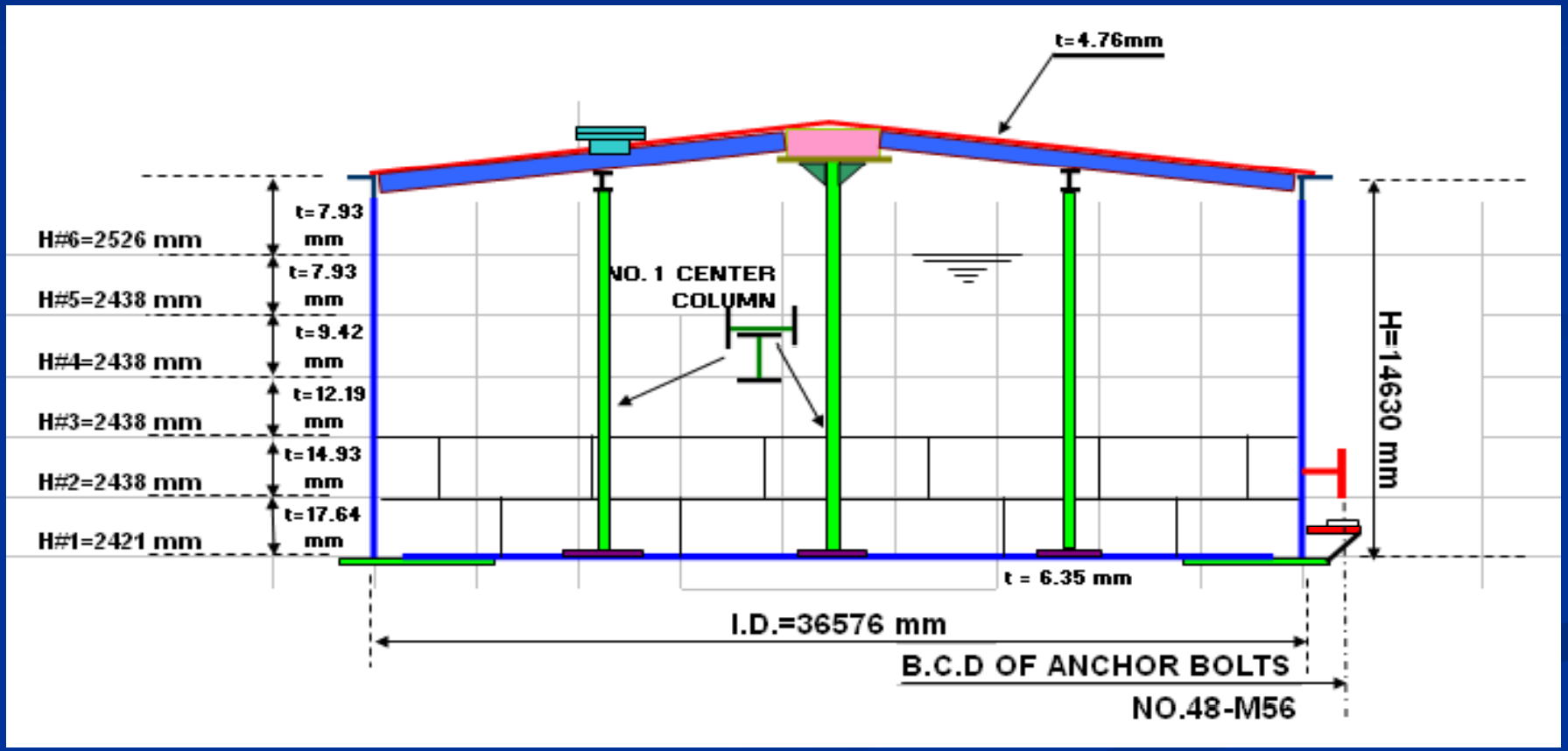
Fixed Roof With Column

& Rafter Storage Tank



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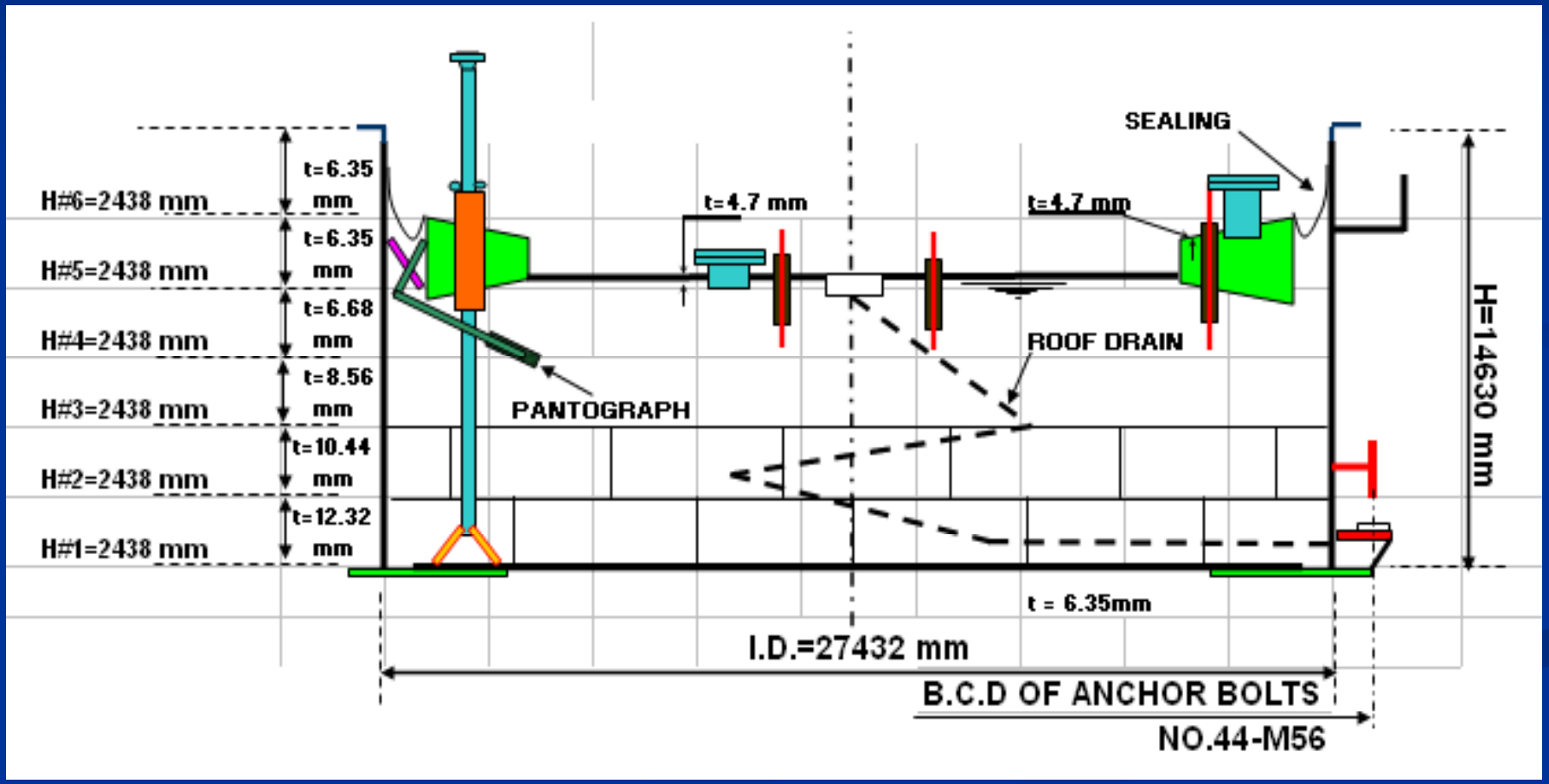
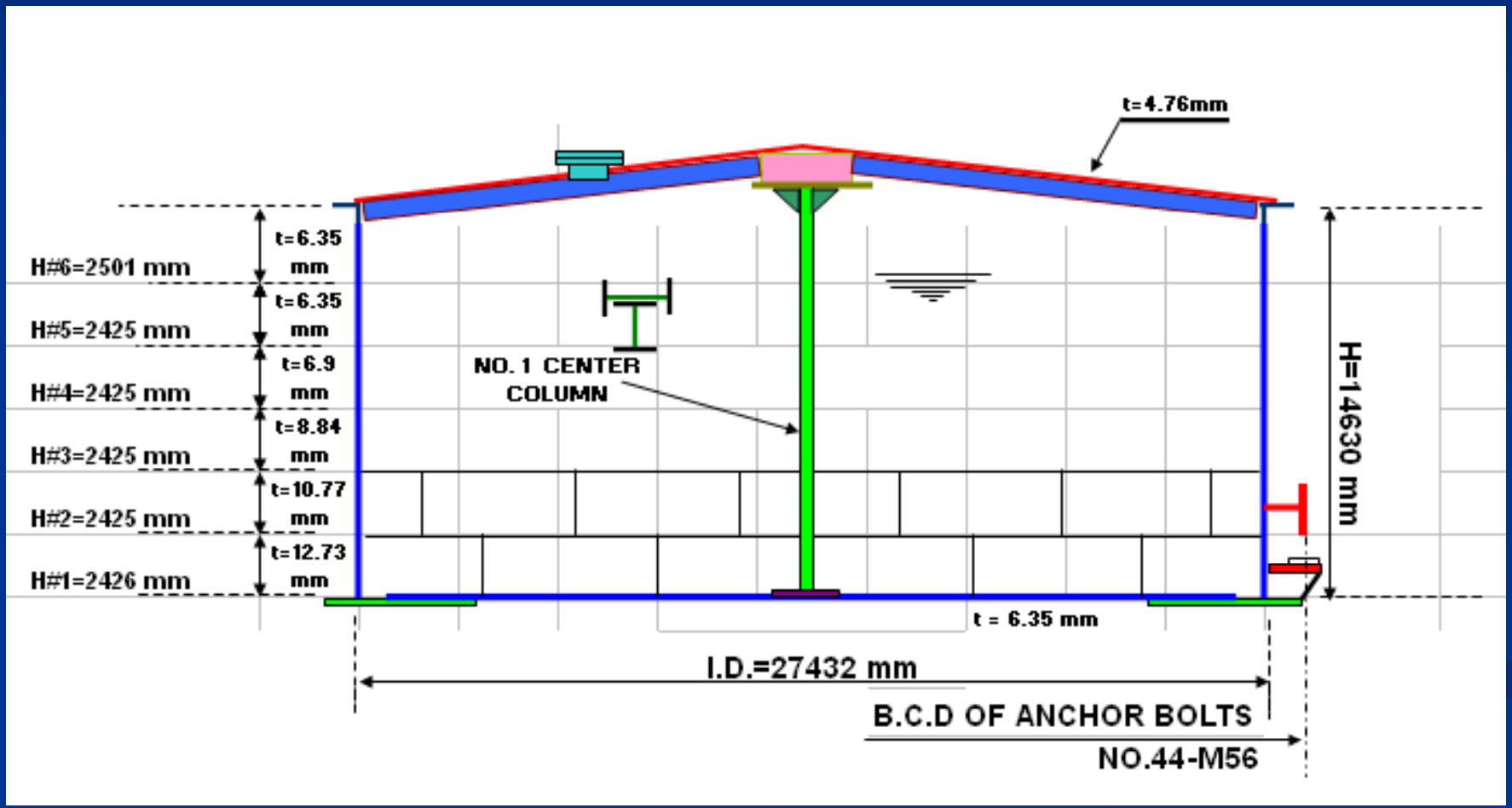
Single Deck Floating Roof

Storage Tank



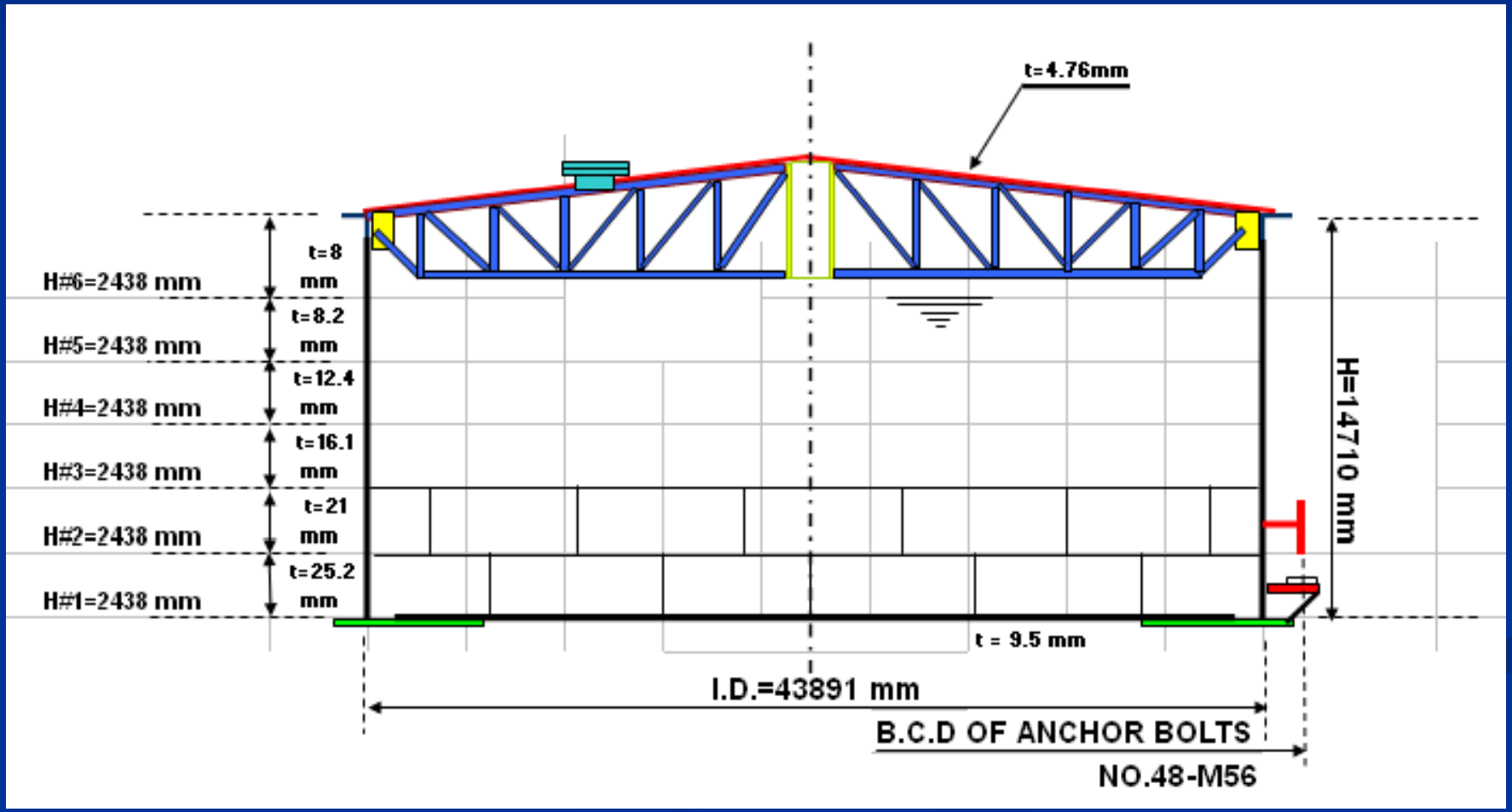
Fixed Roof With Column & Rafter Storage Tank



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Fixed Roof With Truss

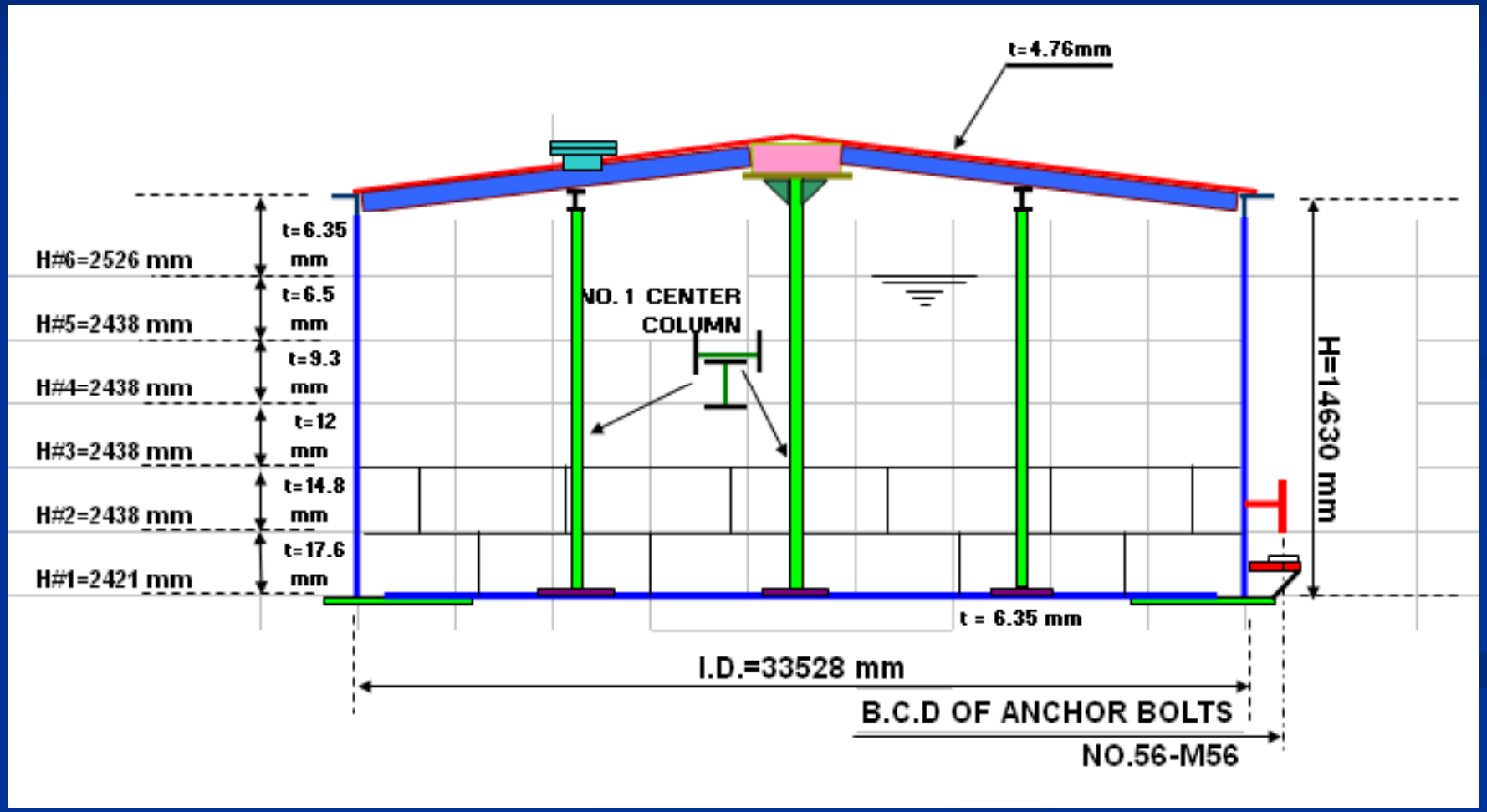
Storage Tank



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

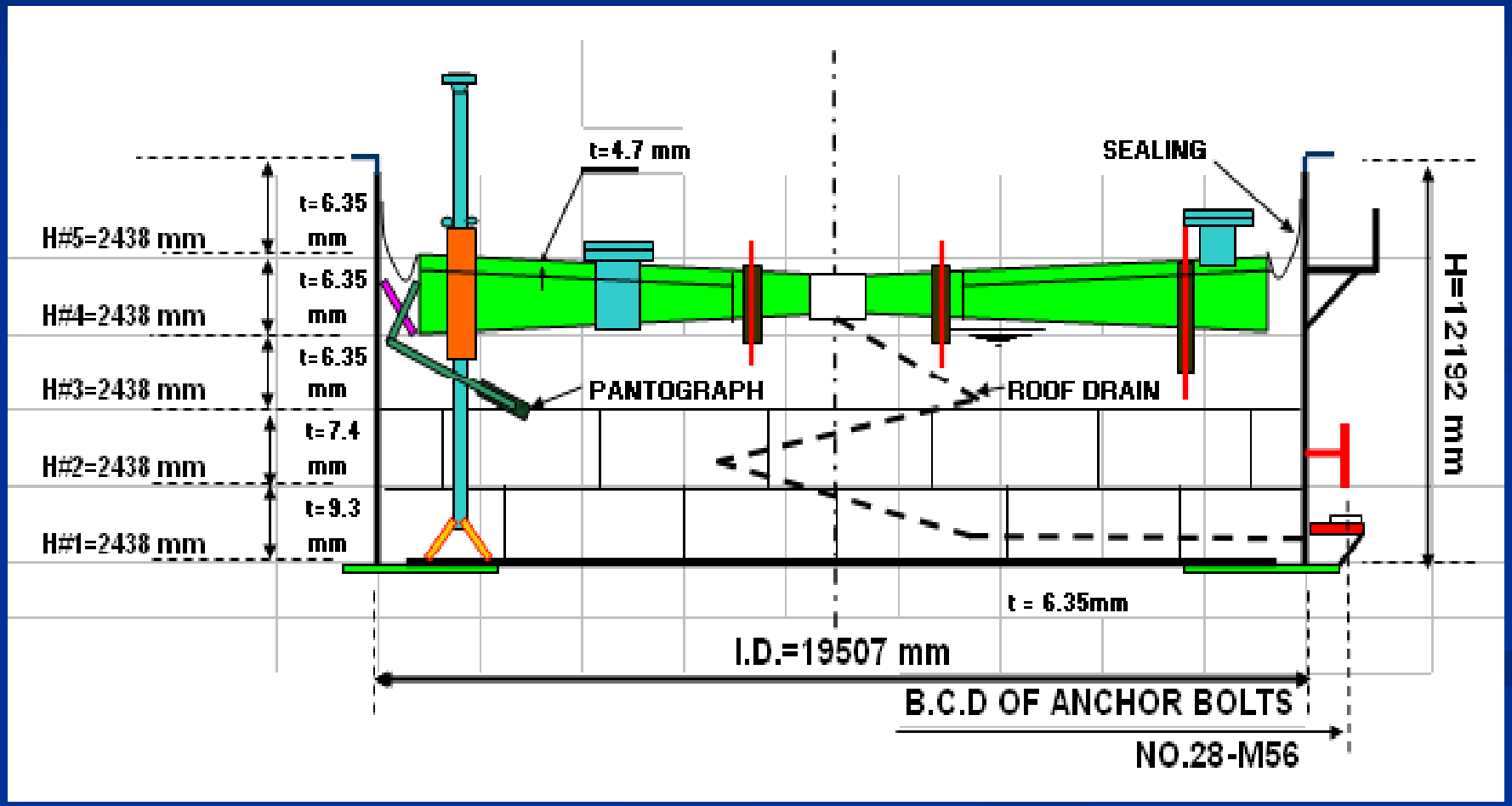
Fixed Roof With Column

& Rafter Storage Tank



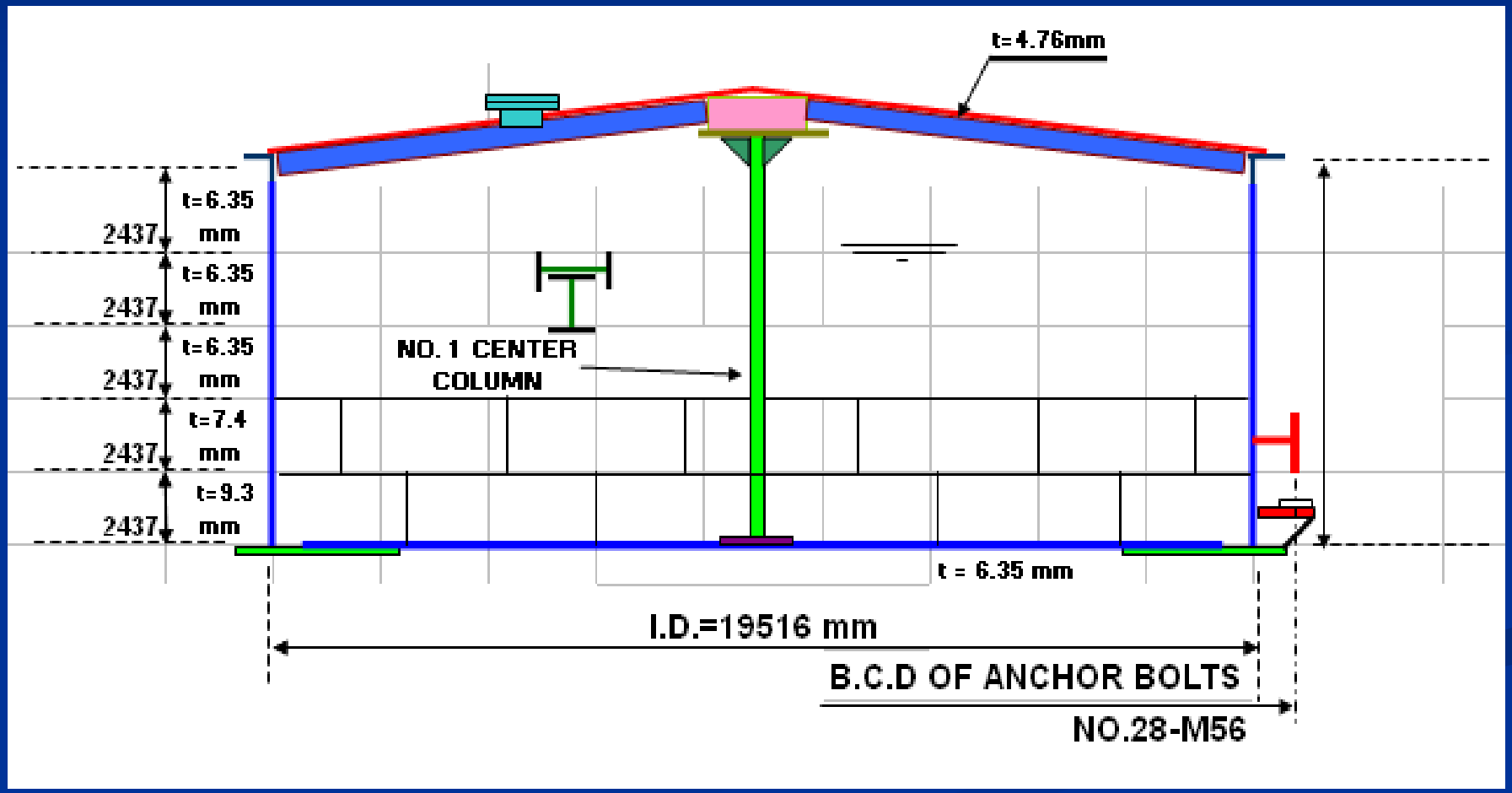
Double Deck Floating Roof

Storage Tank



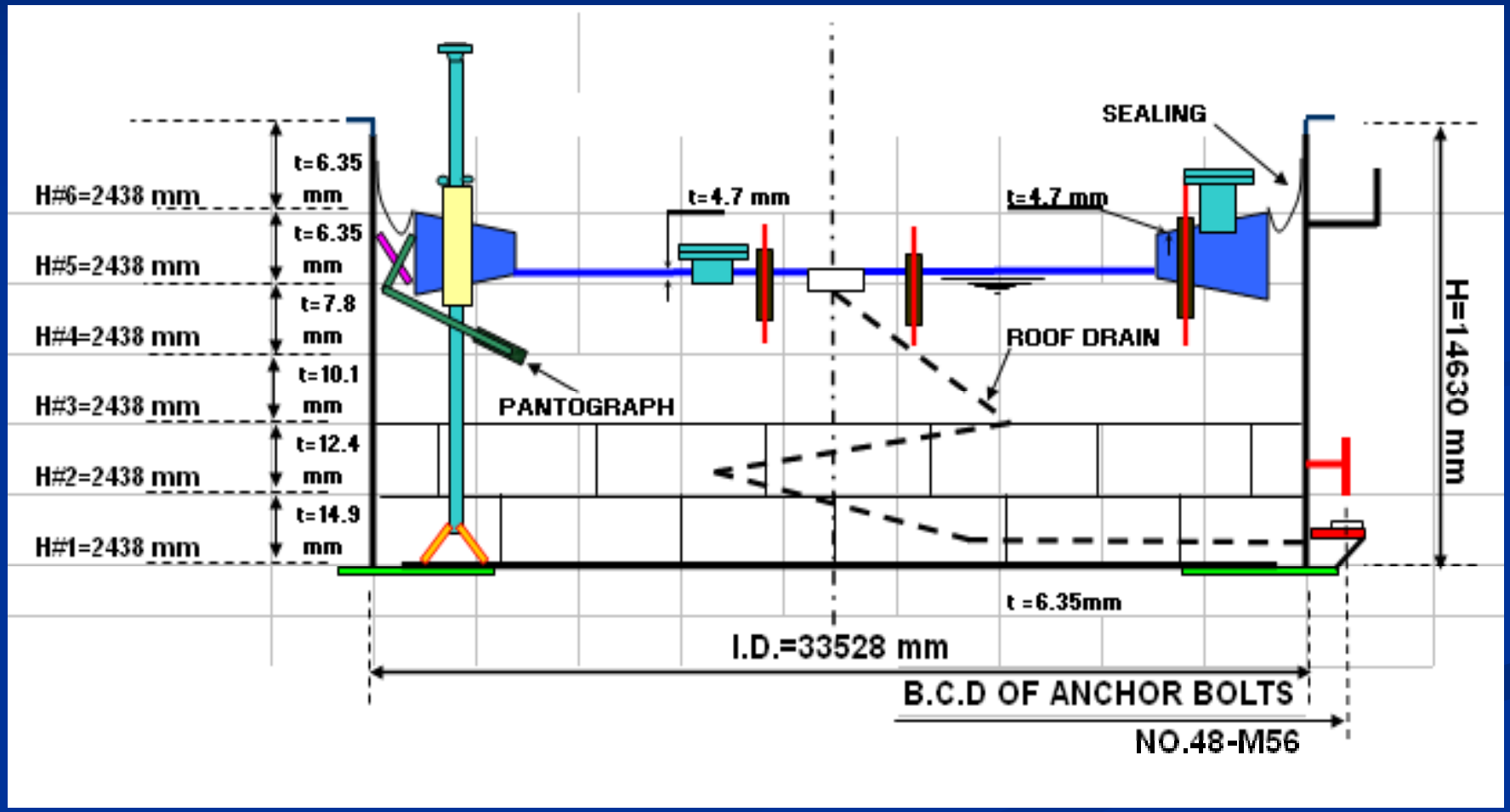
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Fixed Roof With Column & Rafter Storage Tank



Single Deck Floating Roof

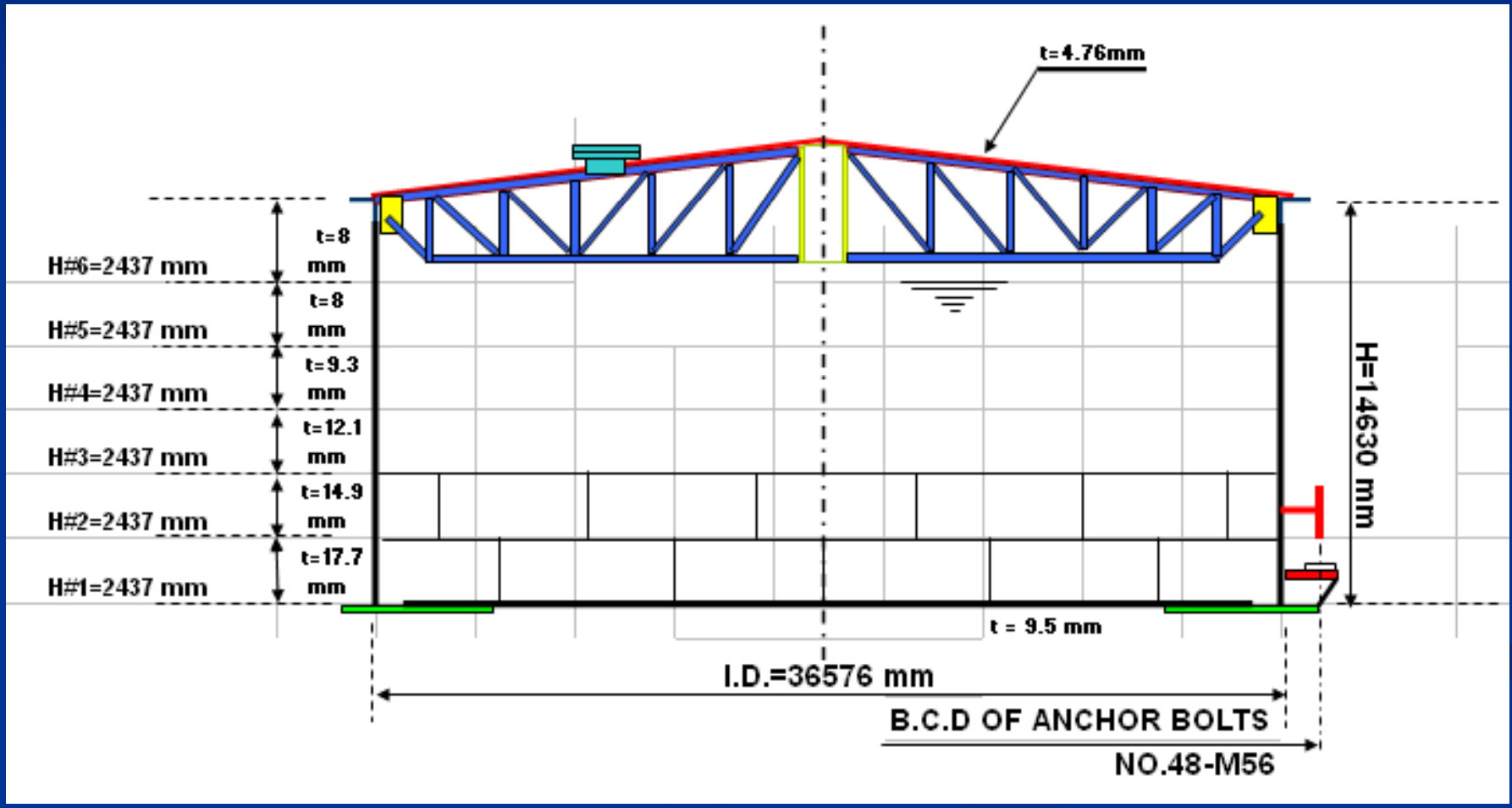
Storage Tank



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

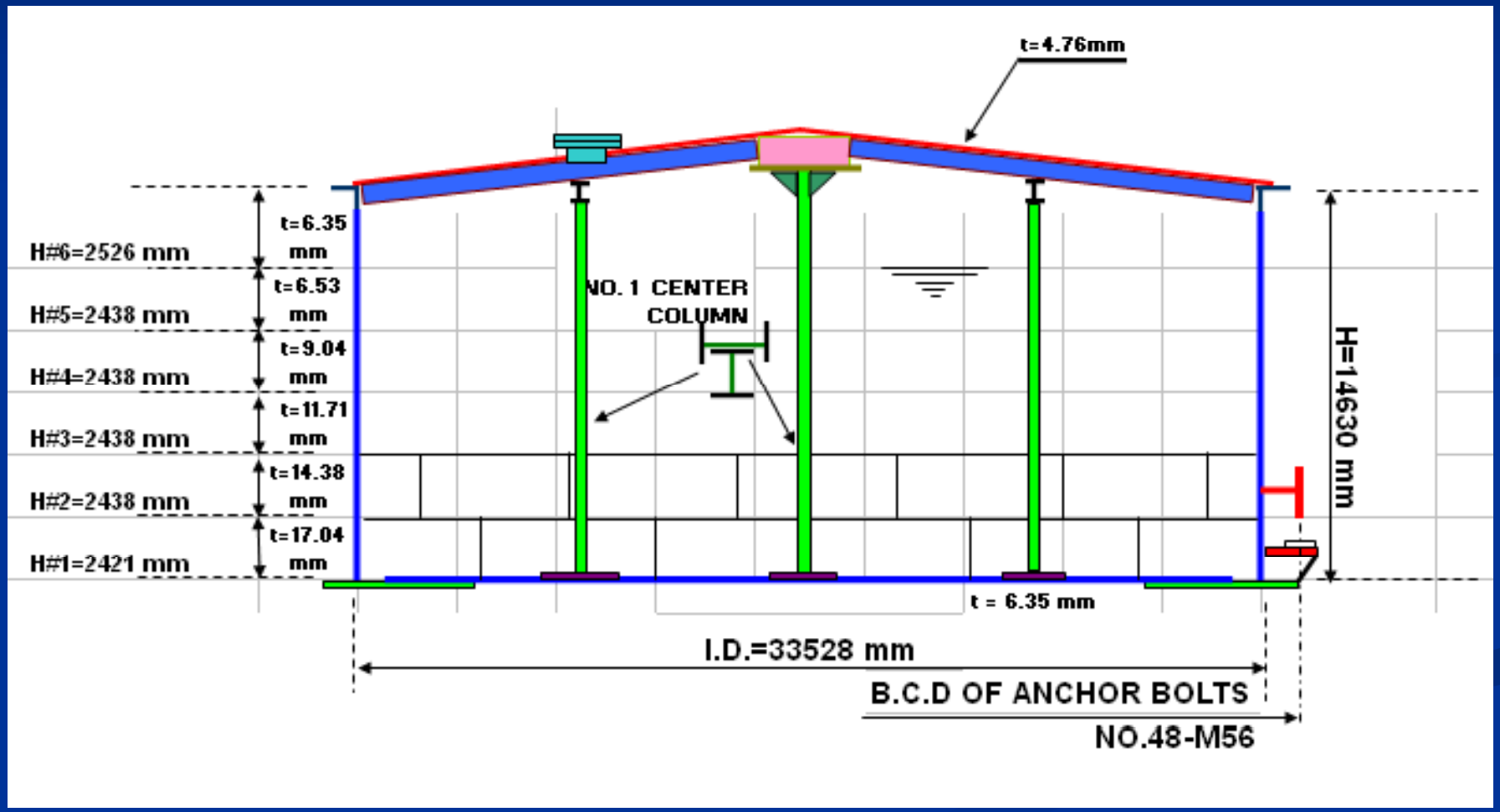
Fixed Roof With Truss

Storage Tank

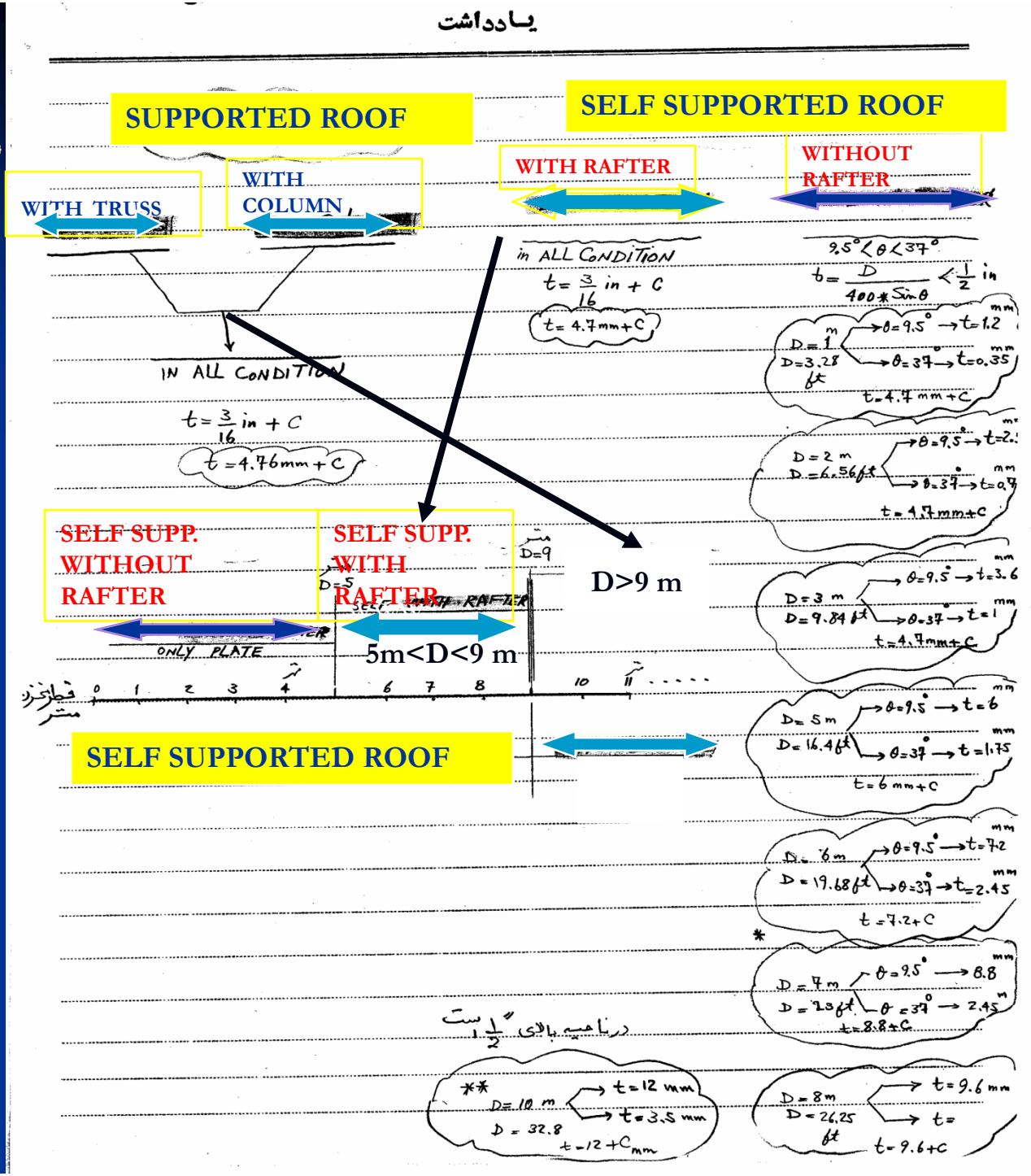


TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Fixed Roof With Column & Rafter Storage Tank



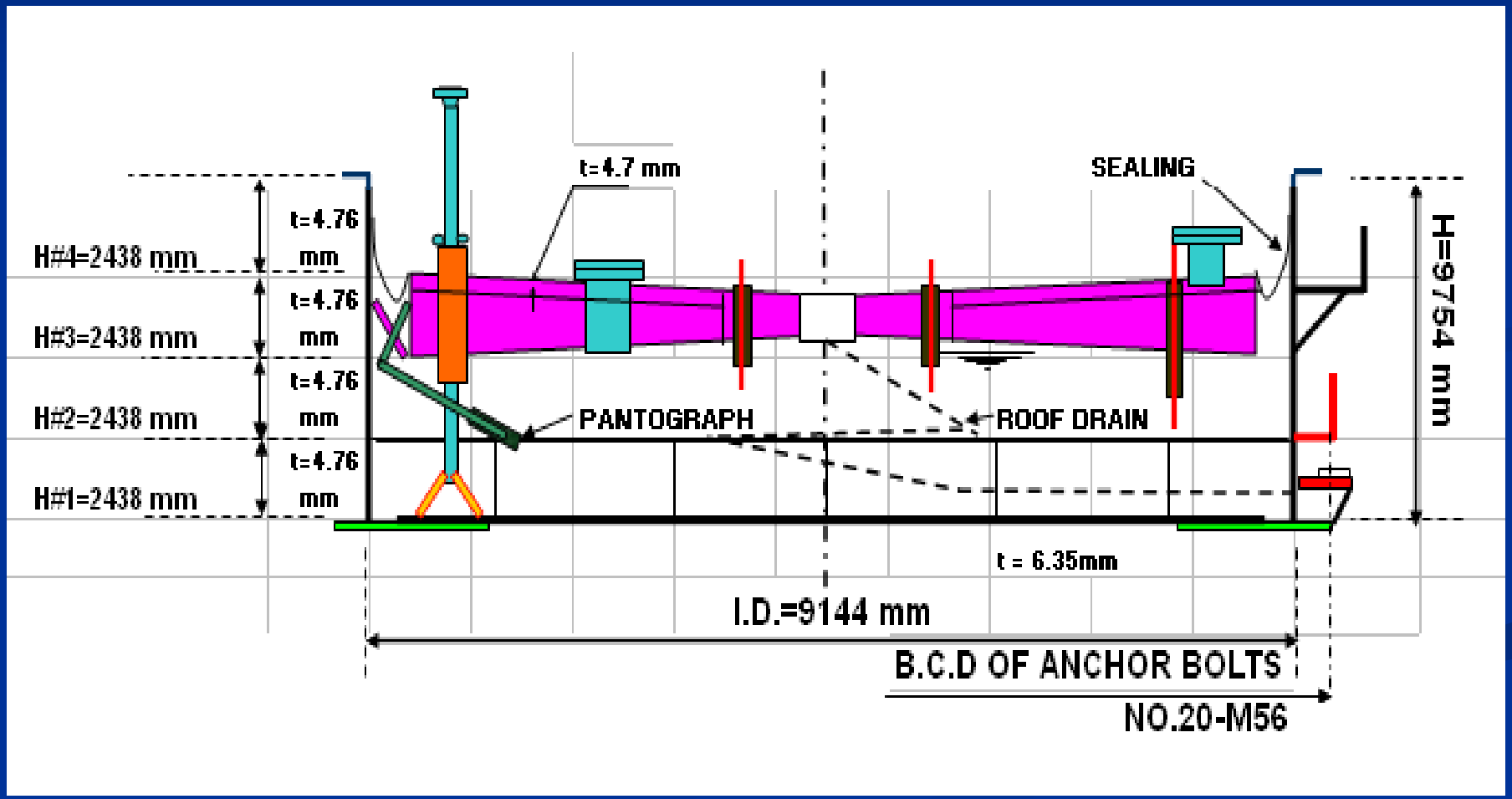
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Double Deck Floating Roof

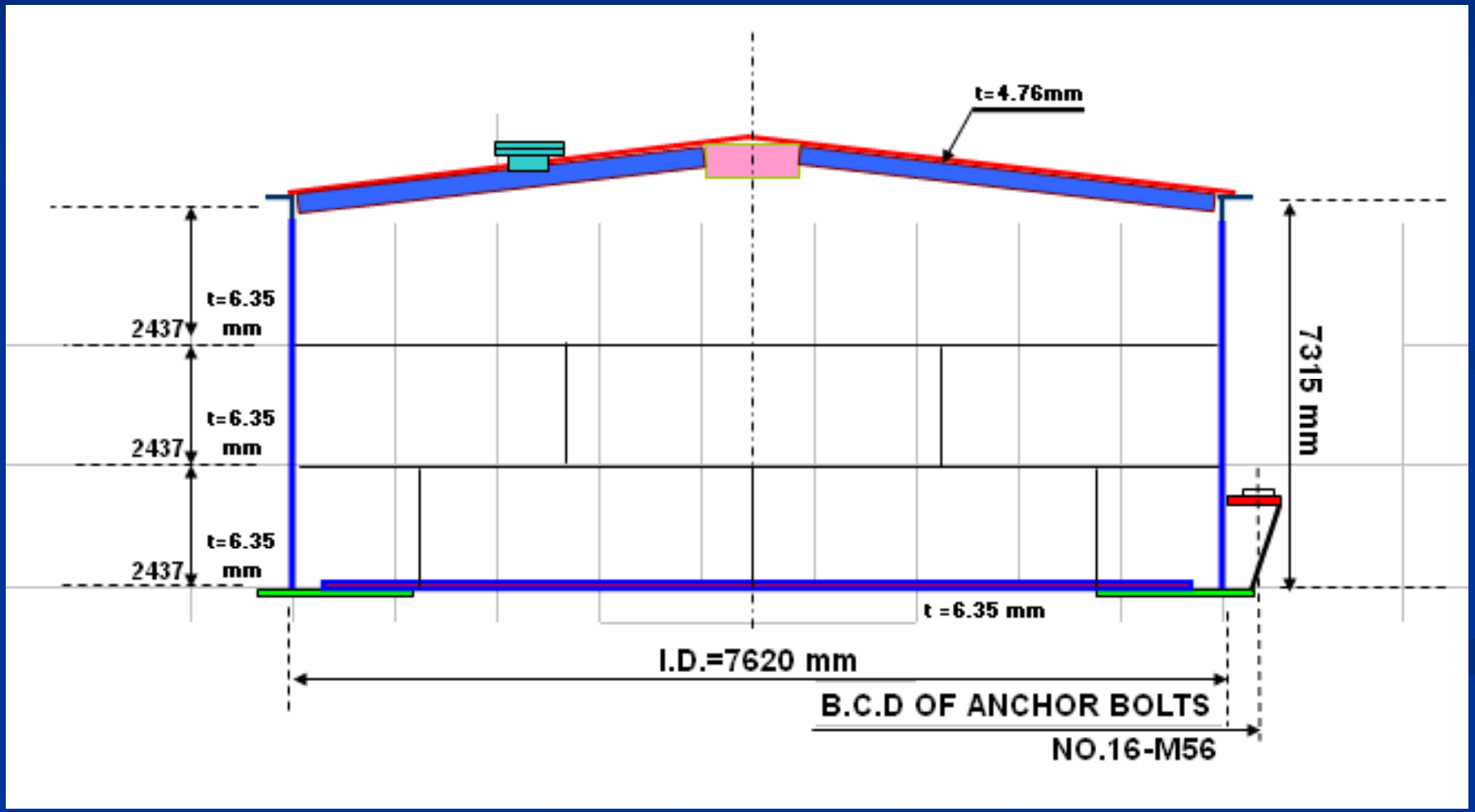
Storage Tank



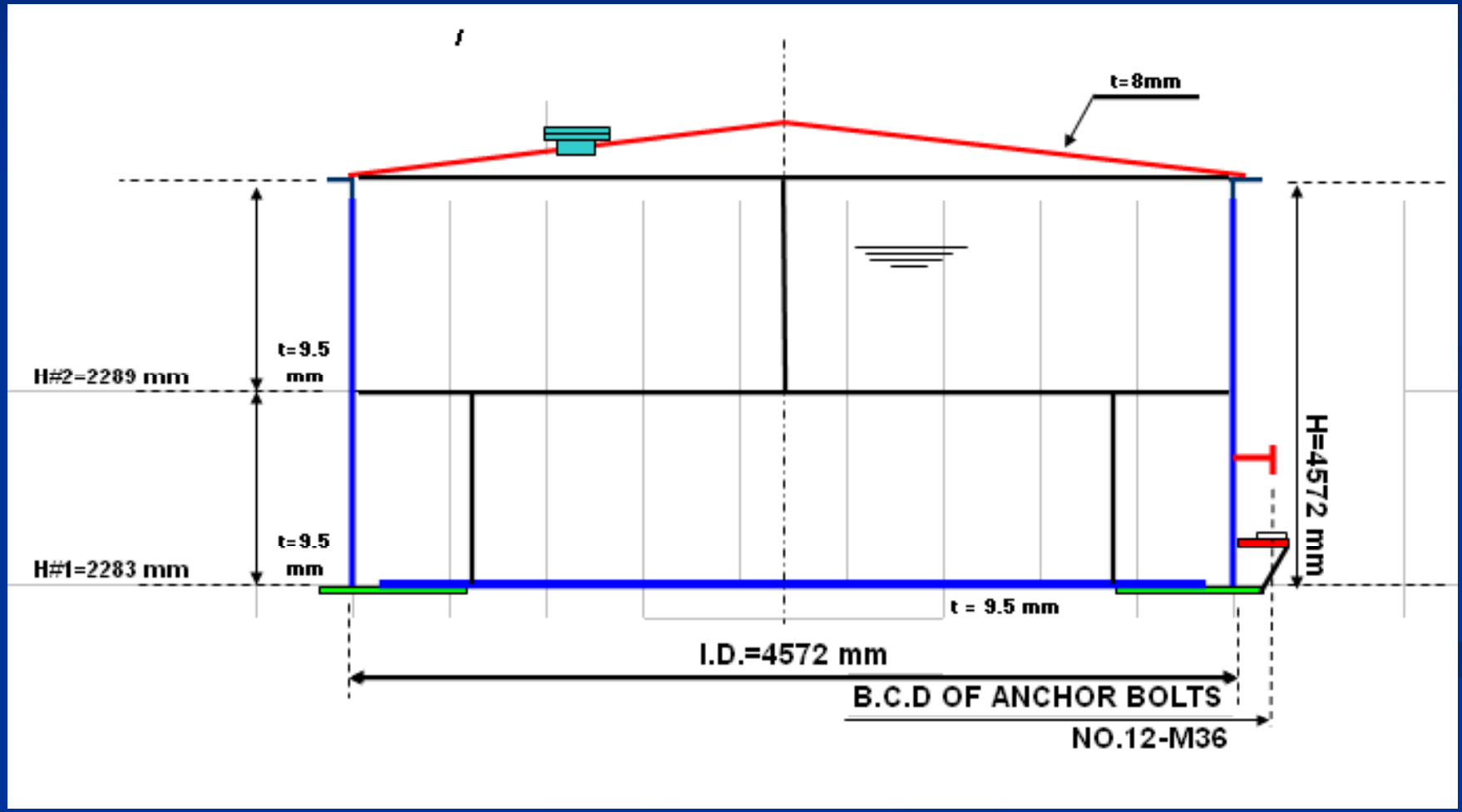
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Fixed Roof With Ratfter

Storage Tank



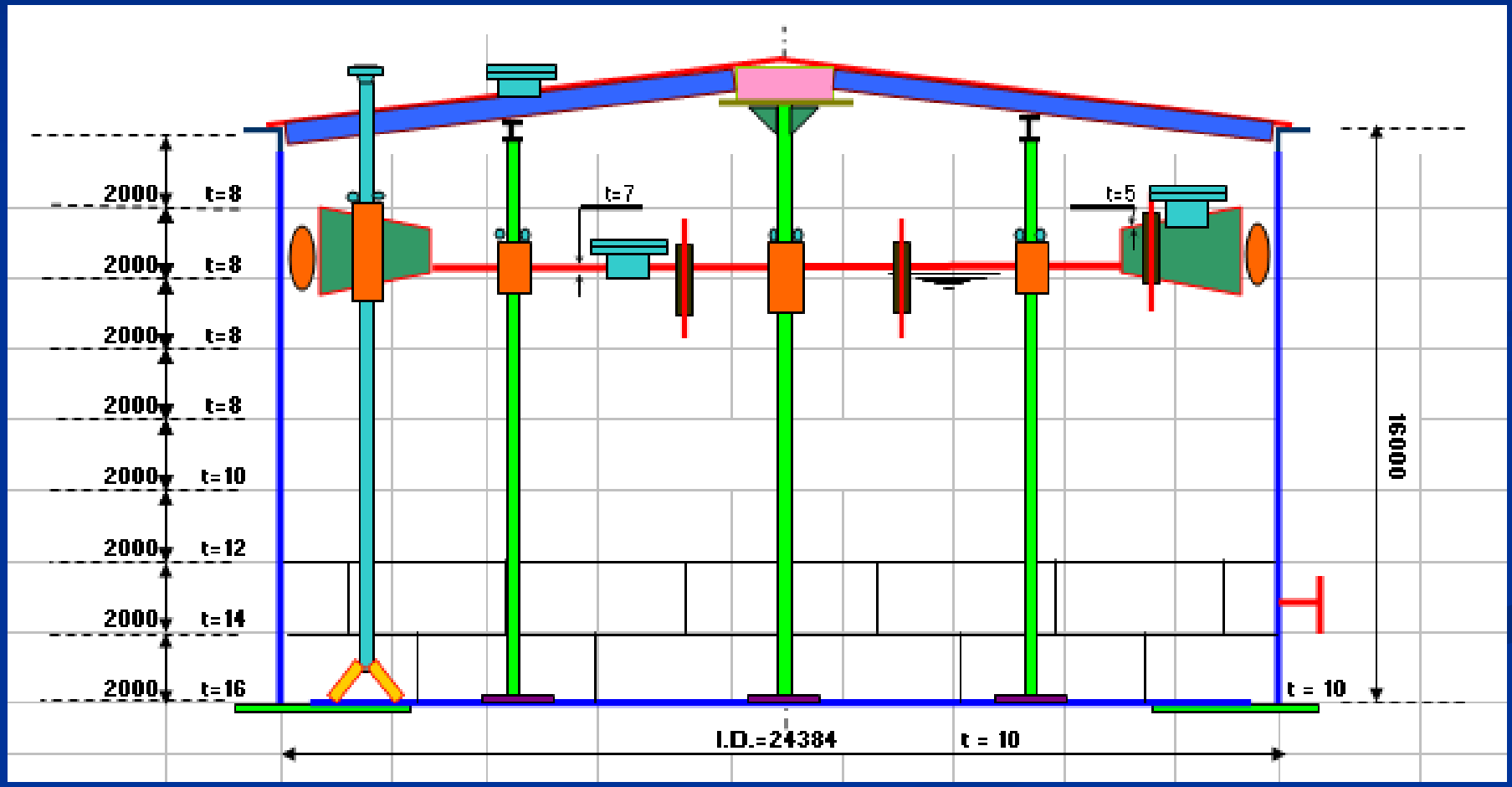
Self Supported Fixed Roof Storage Tank



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

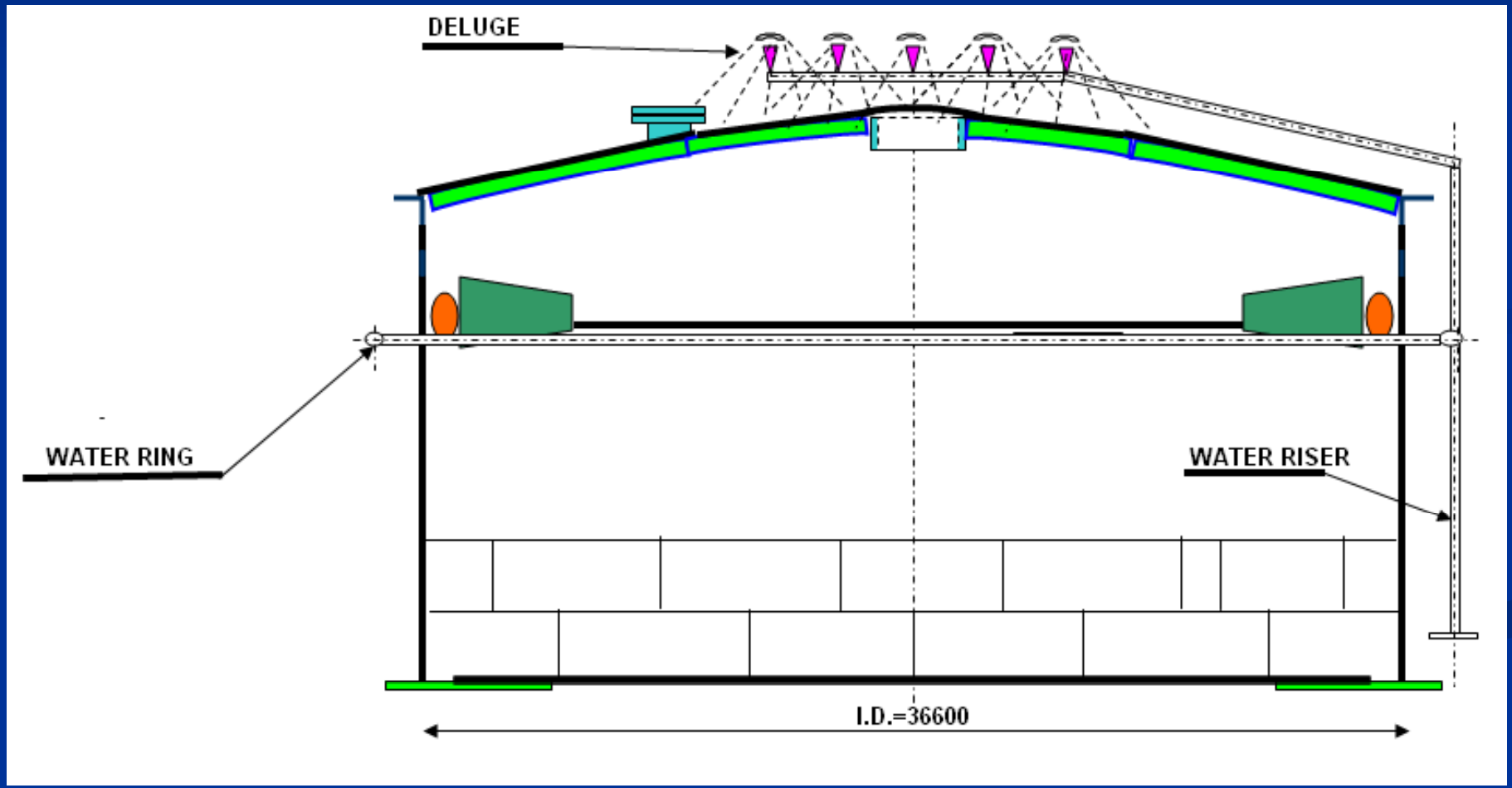
Fixed & Floating Roof

Storage Tank

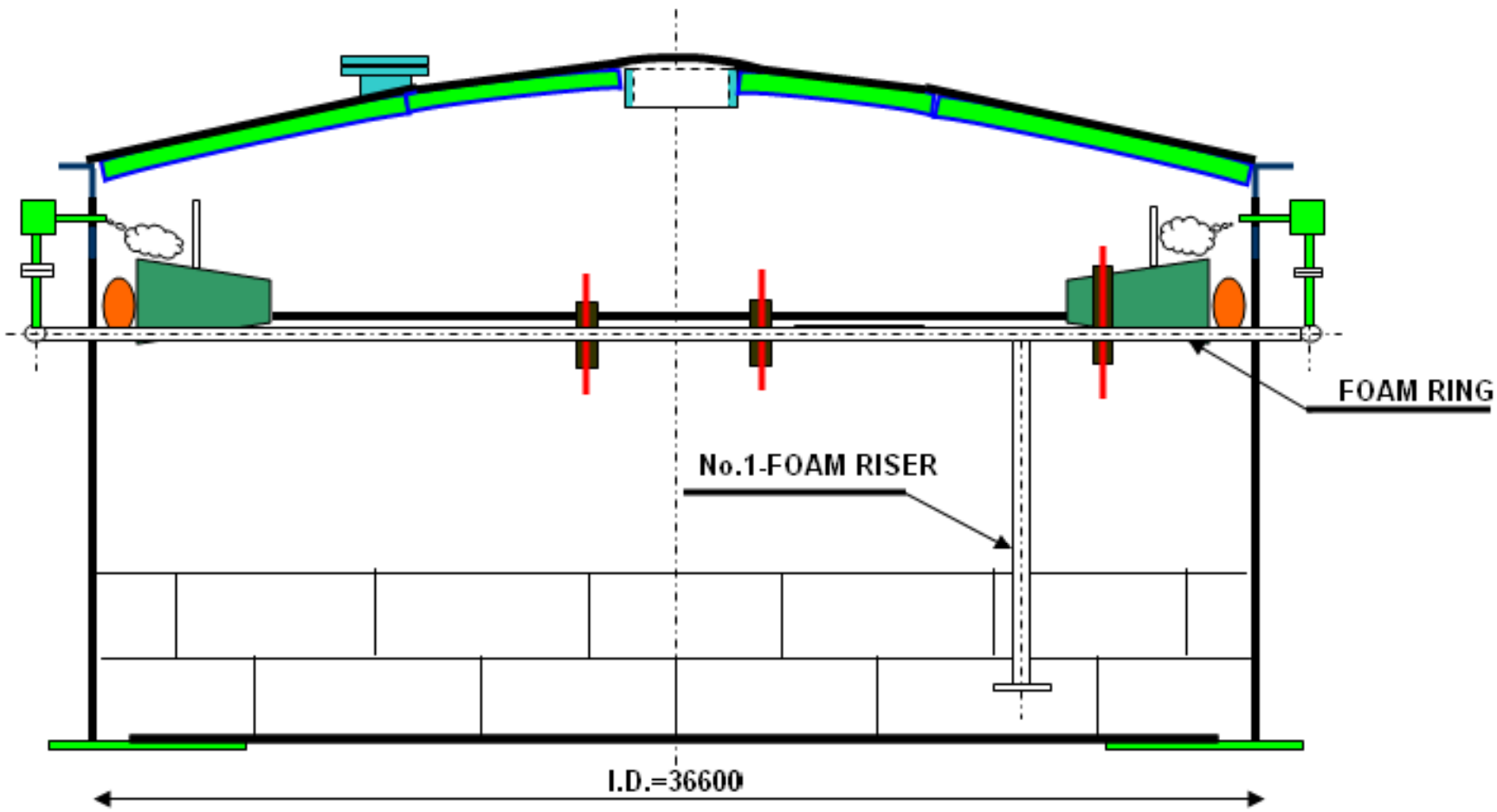


TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

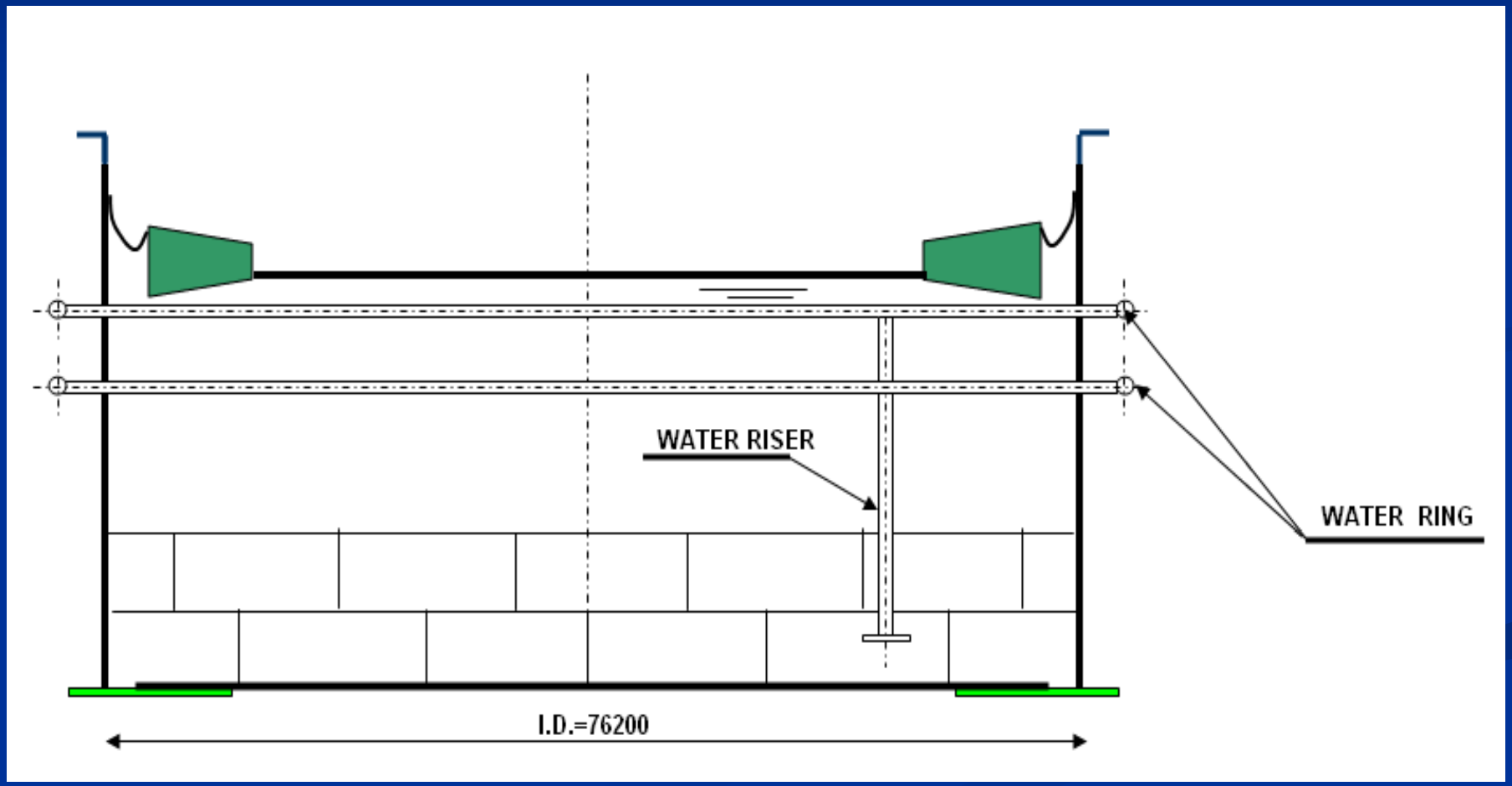
Fire Fighting of Storage Tank (Water Cooling)



Fire Fighting of Storage Tank (Foam)

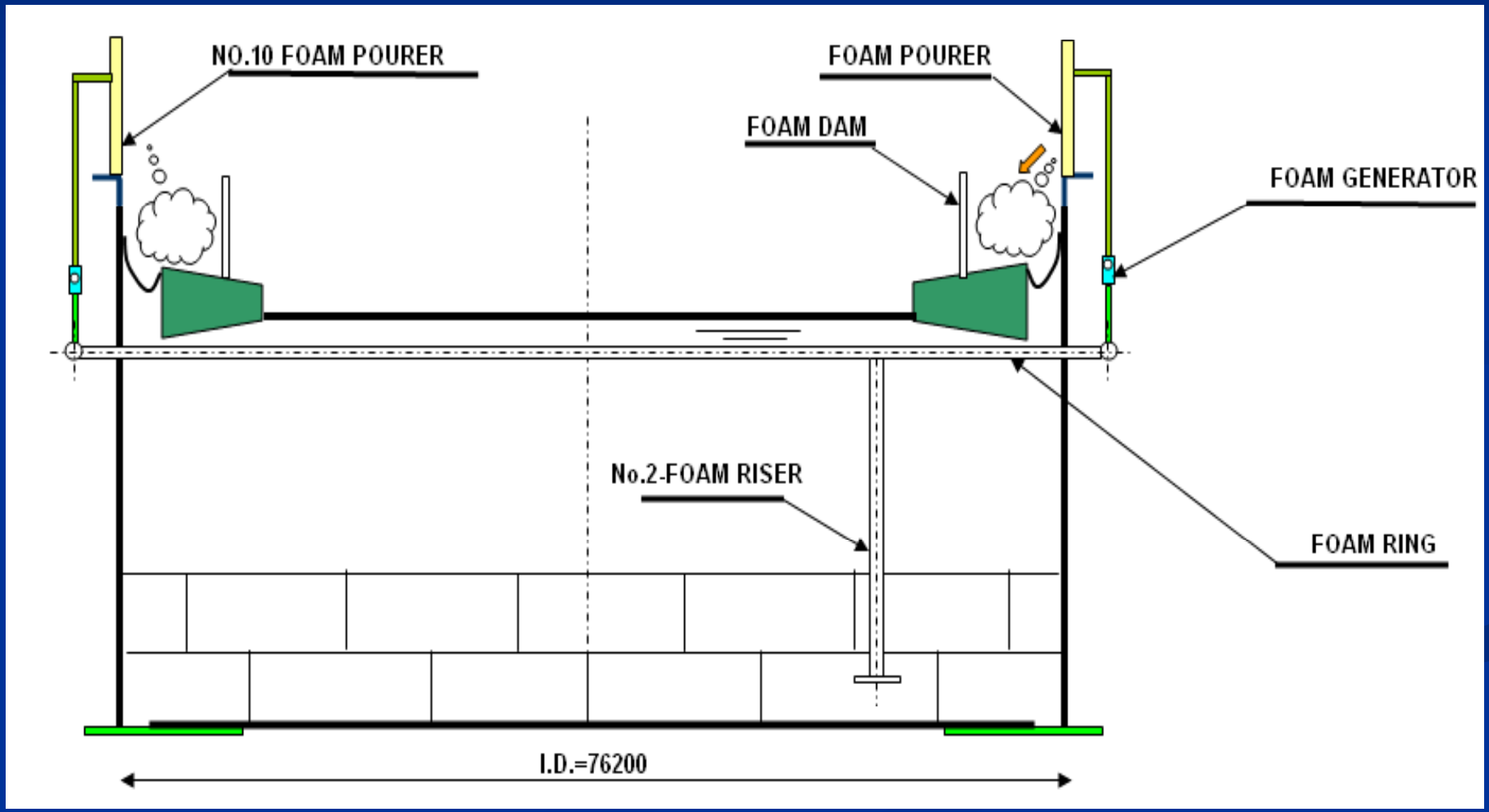


Fire Fighting of Storage Tank (Water Cooling)



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Fire Fighting of Storage Tank (Foam)

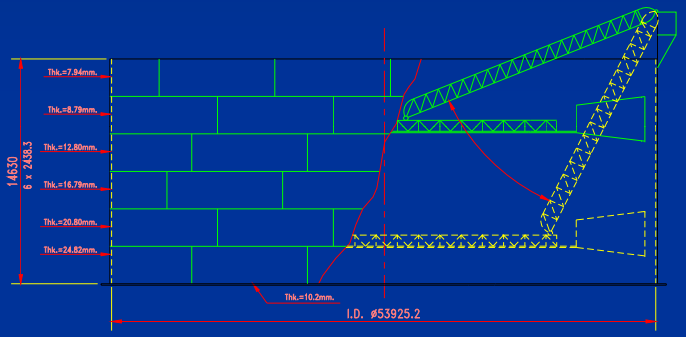


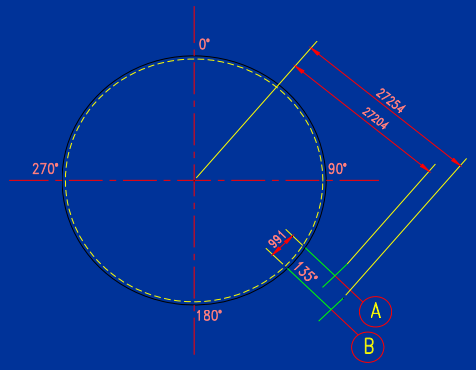
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

3- SAMPLE DATA SHEETS OF STORAGE TANK.

Single Deck Floating Roof

Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES					
NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A	12"	#300,W.N.,R.F.	1	519	FILL LINE
B	16"	#300,W.N.,R.F.	1	560	SUCTION

MATERIALS	
SHELL #1,#2 / #3,...,#6	SA131-Gr.B / SA283-Gr.C
ROOF PLATE	-
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE	ZONE	4	-	-
DESIGN PRESSURE	ATM.	1	-	-
DESIGN TEMPERATURE	°C	60	-	-
FLUID SPECIFIC GRAVITY	Kg/dm³	0.9	-	-
TANK SURFACE	m²	-	-	-
HEAT TREATMENT		NO	-	-
X-RAY TEST		SPOT	-	-
JOINT EFFICIENCY	(%)	100	-	-
CORROSION ALLOWANCE	mm	1.27	-	-
GEOMETRIC CAPACITY	m³	33400	-	-
INSPECTION INSTITUTE		-	-	-
		-	-	-
		-	-	-

DESIGN CODE : API 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY .....753944.7..Kg

WATER FILLED .....32791867.8.....Kg

LOADS AT SUPPORT BASE			
M Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	849785.7	22067346.9	24424489.8
Q Kg	15000000	3794285.7	4199183.7

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.21	FIRST ISSUED	M.H.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF TK-2002

LOCATION:
SOUTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

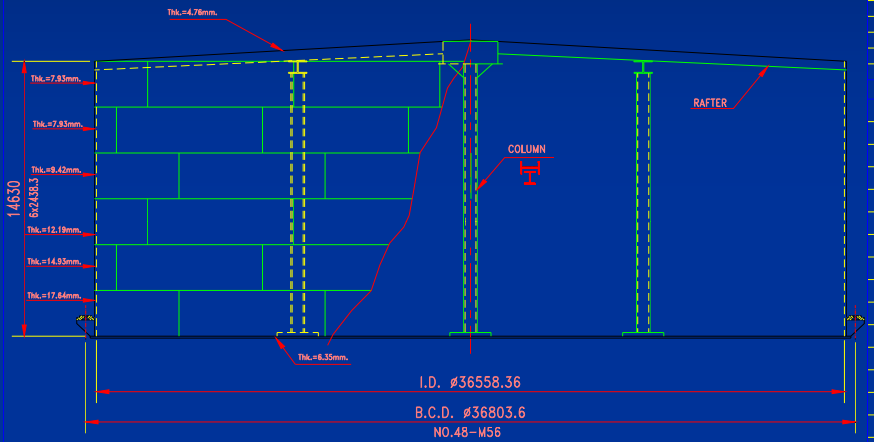
DRAWING NO. EQ-S-M-D-TK2002-01-00

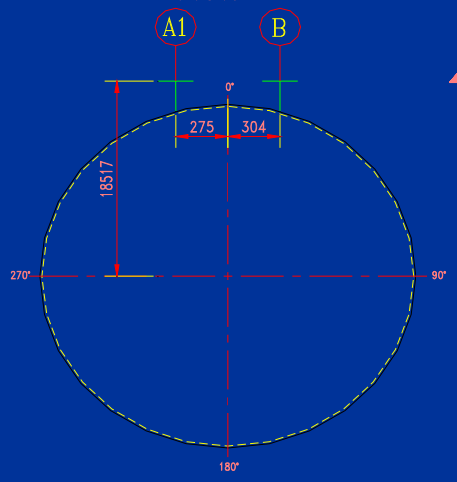
SHEET NO. 1 OF 1

REV. 0

Fixed Roof With Column &

Rafter Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	ELE.	SERVICE
A1	6"	#150-W.N.,R.F.	1	305	INLET
B	8"	#150-W.N.,R.F.	1	330	OUTLET

MATERIALS

SHELL #1,#2 / #3,...,#6	SA131-Gr.C/SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLE NECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	-

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	-	
DESIGN PRESSURE	ATM g	1	-	
DESIGN TEMPERATURE	°C	37.8	-	
FLUID SPECIFIC GRAVITY	Kg/dm³	0.92	-	
TANK SURFACE	m²	-	-	
HEAT TREATMENT		NO	-	
X-RAY TEST		SPOT	-	
JOINT EFFICIENCY	(%)	100	-	
CORROSION ALLOWANCE	mm	1.27	-	
GEOMETRIC CAPACITY	m³	15300	-	
INSPECTION INSTITUTE		-	-	
		-	-	
		-	-	

DESIGN CODE : API 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 360882 .....Kg

WATER FILLED ..... 15085747 .....Kg

LOADS AT SUPPORT BASE

M Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	928846.9	15270408	16517346
Q Kg	99161.2	2545510.2	2758265.3

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.21	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE
FOR
TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF
TK-2009

LOCATION:
SOUTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

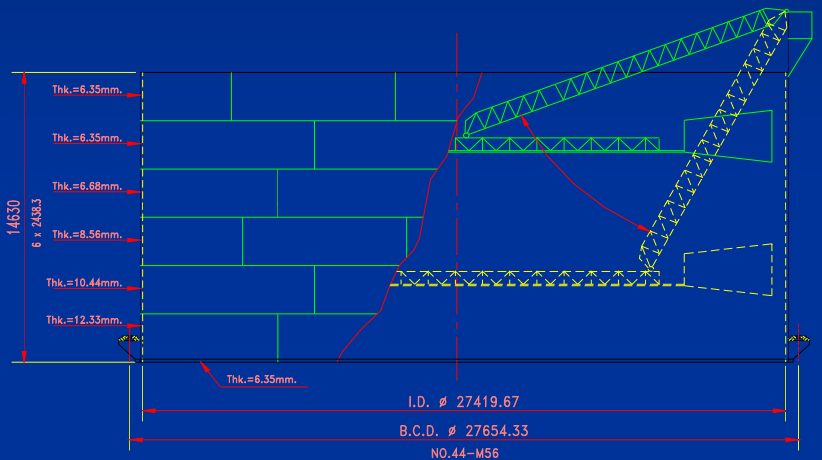
DRAWING NO. EQ-S-M-D-TK2009-01-00

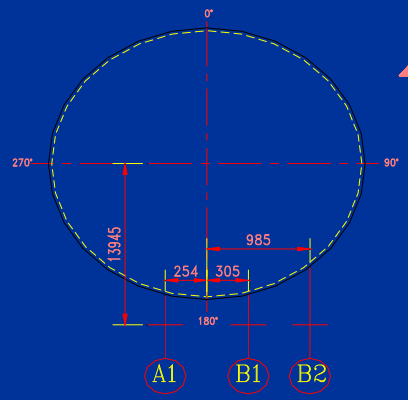
SHEET NO. 1 OF 1

REV. 0

Floating Roof

Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES					
NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A	4"	#150-W.N.,R.F.	1	305	INLET
B1	8"	#150-W.N.,R.F.	1	330	OUTLET
B2	8"	#150-W.N.,R.F.	1	330	OUTLET

MATERIALS	
SHELL	SA283-Gr.C
ROOF PLATE	-
NOZZLE FLANGES	SA181-Gr.I
NOZZLE NECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	-	
DESIGN PRESSURE	ATM g	1	-	
DESIGN TEMPERATURE	°C	32.2	-	
FLUID SPECIFIC GRAVITY	Kg/dm³	0.83	-	
TANK SURFACE	m²	-	-	
HEAT TREATMENT		NO	-	
X-RAY TEST		SPOT	-	
JOINT EFFICIENCY	(%)	100	-	
CORROSION ALLOWANCE	mm	1.27	-	
GEOMETRIC CAPACITY	m³	8600	-	
INSPECTION INSTITUTE			-	
			-	
			-	

DESIGN CODE : API 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 198753 ...Kg

WATER FILLED ..... 8481687.3 ...Kg

LOADS AT SUPPORT BASE			
M Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	238030.6	9104285.7	10920408.2
Q Kg	38040.8	1535306.1	1842040.8

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.21	FIRST ISSUED	M.H.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE
FOR
TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF
TK-2016

LOCATION:
SOUTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

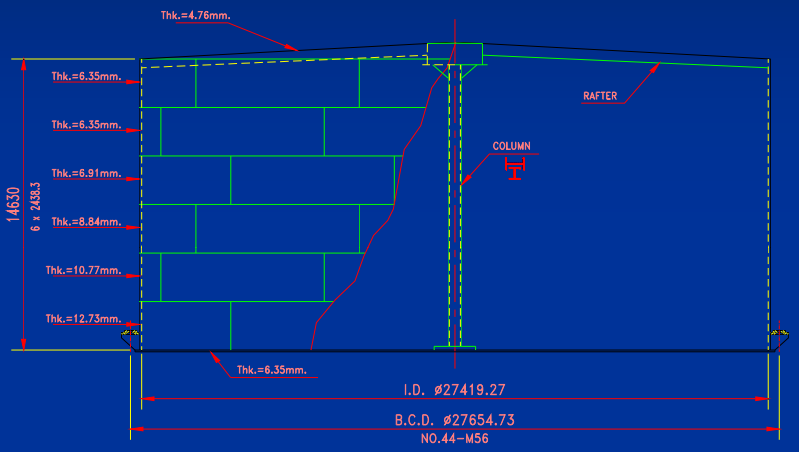
DRAWING NO.
EQ-S-M-D-TK2016-01-00

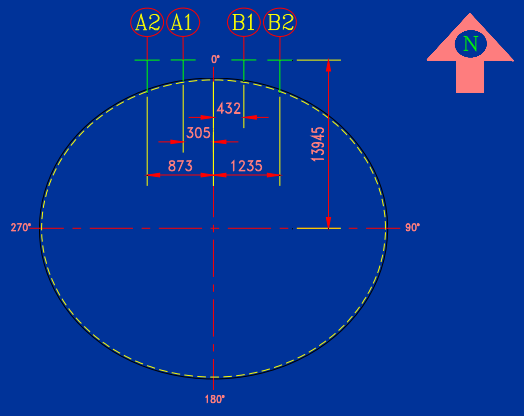
SHEET NO.
1 OF 1

REV.
0

Fixed Roof With Column &

Rafter Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A1	8"	#150-W.N.R.F.	1	380	INLET
A2	6"	#150-W.N.R.F.	1	354	INLET
B1	12"	#150-W.N.R.F.	1	432	OUTLET
B2	10"	#150-W.N.R.F.	1	406	OUTLET

MATERIALS

SHELL #1 / #2,...,#6	SA131-Gr.B / SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	-

DESIGN DATA

		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	-	
DESIGN PRESSURE	ATM.	1	-	
DESIGN TEMPERATURE	°C	32.2	-	
FLUID SPECIFIC GRAVITY	Kg/dm³	0.86	-	
TANK SURFACE	m²	-	-	
HEAT TREATMENT		NO	-	
X-RAY TEST		SPOT	-	
JOINT EFFICIENCY	(%)	100	-	
CORROSION ALLOWANCE	mm	0.05	-	
GEOMETRIC CAPACITY	m³	8600	-	
INSPECTION INSTITUTE		-	-	
		-	-	
		-	-	

DESIGN CODE : API 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY .....181150.....Kg

WATER FILLED .....8463963.3.....Kg

LOADS AT SUPPORT BASE

	ERECTION	OPERATION	HYDR. TEST
M Kg.m	558173.4	9744796	1239795
Q Kg	54712.2	1606122.4	1858775.5

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.21	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF TK-2035

LOCATION:
SOUTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

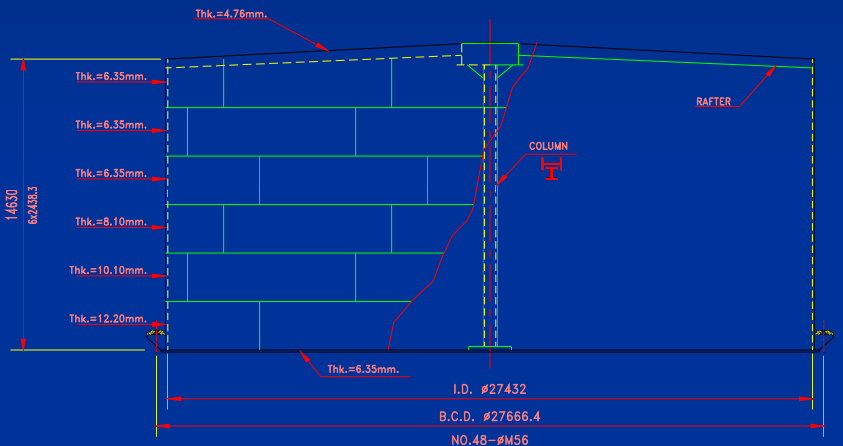
DRAWING NO. EQ-S-M-D-TK2035-01-00

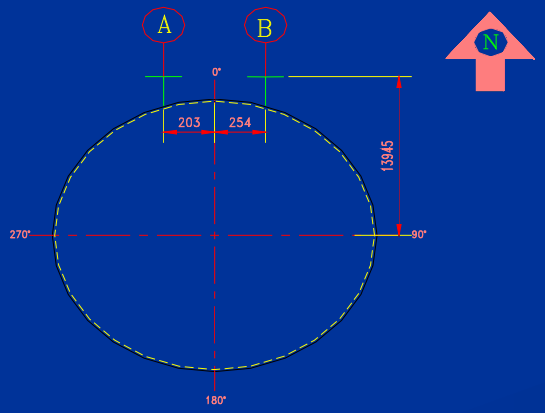
SHEET NO. 1 OF 1

REV. 0

Double Deck Floating Roof

Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A	4"	#150-W.N.R.F.	1	254	INLET
B	6"	#150-W.N.R.F.	1	279	OUTLET

MATERIALS

SHELL	SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	–	–
DESIGN PRESSURE	ATM.	1	–	–
DESIGN TEMPERATURE	°C	37.78	–	–
FLUID SPECIFIC GRAVITY	Kg/dm³	0.77	–	–
TANK SURFACE	m²	–	–	–
HEAT TREATMENT		NO	–	–
X-RAY TEST		SPOT	–	–
JOINT EFFICIENCY	(%)	100	–	–
CORROSION ALLOWANCE	mm	1.27	–	–
GEOMETRIC CAPACITY	m³	8600	–	–
INSPECTION INSTITUTE		–	–	–
		–	–	–
		–	–	–

DESIGN CODE : API – 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 173519.8 Kg

WATER FILLED ..... 8456587 Kg

LOADS AT SUPPORT BASE

M, Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	445918.4	8671428.6	11128571.4
Q Kg	46819.4	1435918.4	1850816

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE
FOR
TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF
2TK-2005

LOCATION:
NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

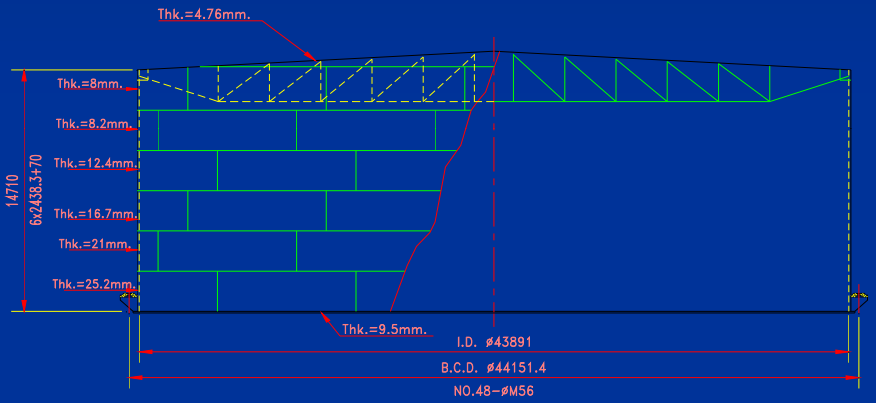
DRAWING NO.
EQ-N-M-D-2TK2005-01-00

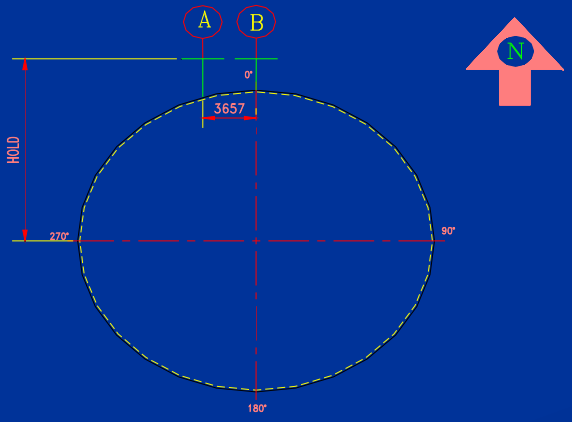
SHEET NO.
1 OF 1

REV.
0

Fixed Roof With Truss Storage

Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	ELE.	SERVICE
A	4"	#150,W.N.,R.F.	1	457	INLET
B	4"	#150,W.N.,R.F.	1	457	OUTLET

MATERIALS

SHELL #1,#2 / #3,...,#6	SA131-Gr.C/SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLE NECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE	ZONE	4	–	
DESIGN PRESSURE	ATM g	1	–	
DESIGN TEMPERATURE	°C	93.34	–	
FLUID SPECIFIC GRAVITY	Kg/dm³	1	–	
TANK SURFACE	m²	–	–	
HEAT TREATMENT		NO	–	
X-RAY TEST		SPOT	–	
JOINT EFFICIENCY	(%)	100	–	
CORROSION ALLOWANCE	mm	0	–	
GEOMETRIC CAPACITY	m³	15300	–	
INSPECTION INSTITUTE		–	–	
		–	–	
		–	–	

DESIGN CODE : API – 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY .....548717.....Kg

WATER FILLED .....21751103.7.....Kg

LOADS AT SUPPORT BASE

		ERECTION	OPERATION	HYDR. TEST
M	Kg.m	1264387.8	18819387.8	20345918.4
Q	Kg	140326.5	3145102	3406428.6

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

DOC. TITLE: DATA SHEET FOR SEISMIC ANALYSIS OF 2TK-2010

LOCATION: NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

DRAWING NO. EQ-N-M-D-2TK2010-01-00

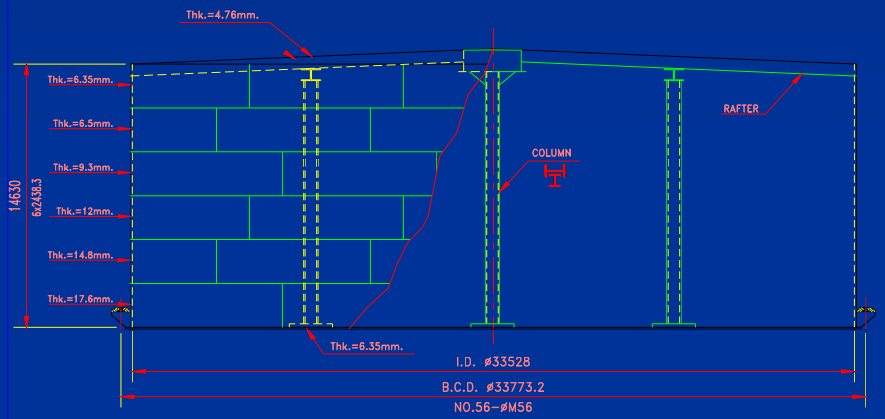
SHEET NO. 1 OF 1

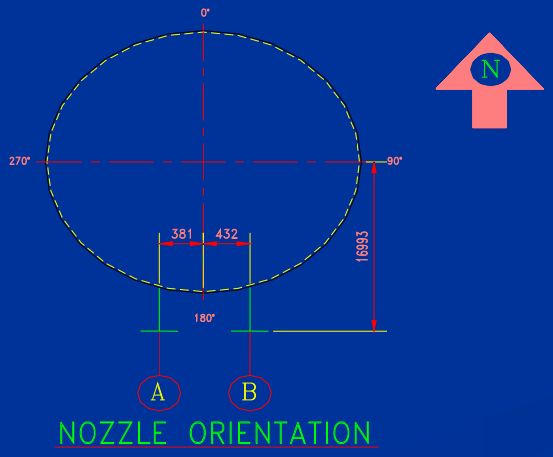
REV. 0

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Fixed Roof With Column &

Rafter Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	ELE.	SERVICE
A	10"	#150-W.N.R.F.	1	504	INLET
B	12"	#150-W.N.R.F.	1	529	OUTLET

MATERIALS

SHELL #1,...,#3 / #4,...,#6	SA131-Gr.B/SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLE NECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE	ZONE	4	-	
DESIGN PRESSURE	ATM g	1	-	
DESIGN TEMPERATURE	°C	93.34	-	
FLUID SPECIFIC GRAVITY	Kg/dm³	1	-	
TANK SURFACE	m²	-	-	
HEAT TREATMENT		NO	-	
X-RAY TEST		SPOT	-	
JOINT EFFICIENCY	(%)	100	-	
CORROSION ALLOWANCE	mm	0	-	
GEOMETRIC CAPACITY	m³	12800	-	
INSPECTION INSTITUTE		-	-	
		-	-	
		-	-	

DESIGN CODE : API - 650

EARTH QUAKE CODE UBC 1997

WEIGHTS

EMPTY .....316760.....Kg

WATER FILLED .....12733739.6.....Kg

LOADS AT SUPPORT BASE

		ERECTION	OPERATION	HYDR. TEST
M	Kg.m	744040.8	14772449	14772449
Q	Kg	88525.5	2477142.9	2477142.9

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE
FOR
TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF
2TK-2011

LOCATION:
NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

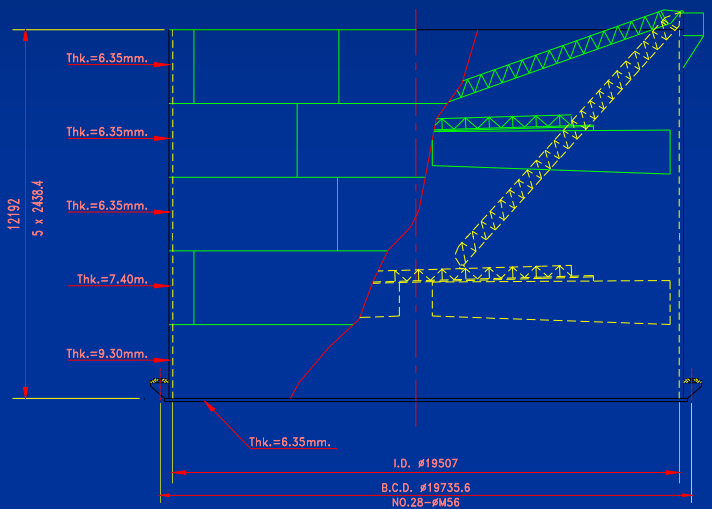
DRAWING NO.
EQ-N-M-D-2TK2011-01-00

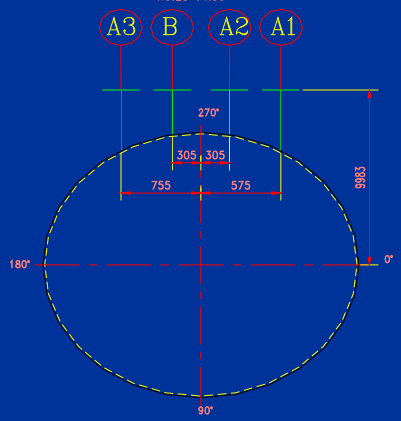
SHEET NO.
1 OF 1

REV.
0

Double Deck Floating Roof

Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	ELE.	SERVICE
A1	4"	#150-W.N.R.F.	1	278	INLET
A2	6"	#150-W.N.R.F.	1	304	INLET
A3	4"	#150-W.N.R.F.	1	278	INLET
B	6"	#150-W.N.R.F.	1	304	OUTLET

MATERIALS

SHELL	SA283-Gr.C
ROOF PLATE	-
NOZZLE FLANGES	SA181-Gr.I
NOZZLE NECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	–	
DESIGN PRESSURE	ATM g	1	–	
DESIGN TEMPERATURE	°C	49.44	–	
FLUID SPECIFIC GRAVITY	Kg/dm³	1	–	
TANK SURFACE	m²	–	–	
HEAT TREATMENT		NO	–	
X-RAY TEST		SPOT	–	
JOINT EFFICIENCY	(%)	100	–	
CORROSION ALLOWANCE	mm	0	–	
GEOMETRIC CAPACITY	m³	3590	–	
INSPECTION INSTITUTE		–	–	
		–	–	
		–	–	

DESIGN CODE : API – 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 105675 .....Kg

WATER FILLED ..... 2565277 .....Kg

LOADS AT SUPPORT BASE

	ERECTION	OPERATION	HYDR. TEST
M Kg.m	116061.2	4441734.7	4441734.7
Q Kg	20643.9	870959.2	870959.2

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

DOC. TITLE: DATA SHEET FOR SEISMIC ANALYSIS OF 2TK-2024

LOCATION: NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

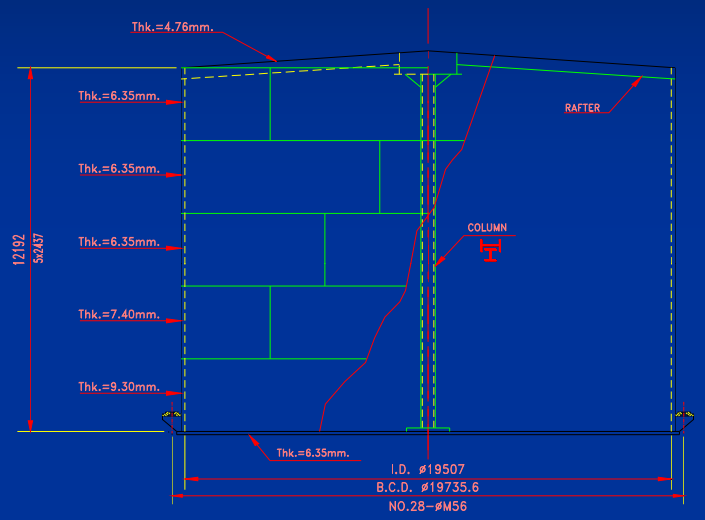
DRAWING NO. EQ-N-M-D-2TK2024-01-00

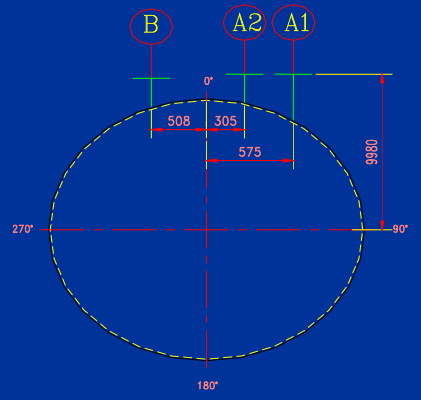
SHEET NO. 1 OF 1

REV. 0

Fixed Roof With Column &

Rafter Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	ELE.	SERVICE
A1	4"	#150-W.N.R.F.	1	278	INLET
A2	6"	#150-W.N.R.F.	1	305	INLET
B	8"	#150-W.N.R.F.	1	330	OUTLET

MATERIALS

SHELL	SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLE NECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	–	
DESIGN PRESSURE	ATM g	1	–	
DESIGN TEMPERATURE	°C	–	–	
FLUID SPECIFIC GRAVITY	Kg/dm³	0.97	–	
TANK SURFACE	m²	–	–	
HEAT TREATMENT		NO	–	
X-RAY TEST		SPOT	–	
JOINT EFFICIENCY	(%)	100	–	
CORROSION ALLOWANCE	mm	0	–	
GEOMETRIC CAPACITY	m³	3590	–	
INSPECTION INSTITUTE		–	–	
		–	–	
		–	–	

DESIGN CODE : API – 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY .....246894.3.....Kg

WATER FILLED .....3706496.....Kg

LOADS AT SUPPORT BASE

		ERECTION	OPERATION	HYDR. TEST
M	Kg.m	461071.4	4656938.8	4786734.7
Q	Kg	71366.3	896173.5	921683.7

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

DOC. TITLE: DATA SHEET FOR SEISMIC ANALYSIS OF 2TK-2040

LOCATION: NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

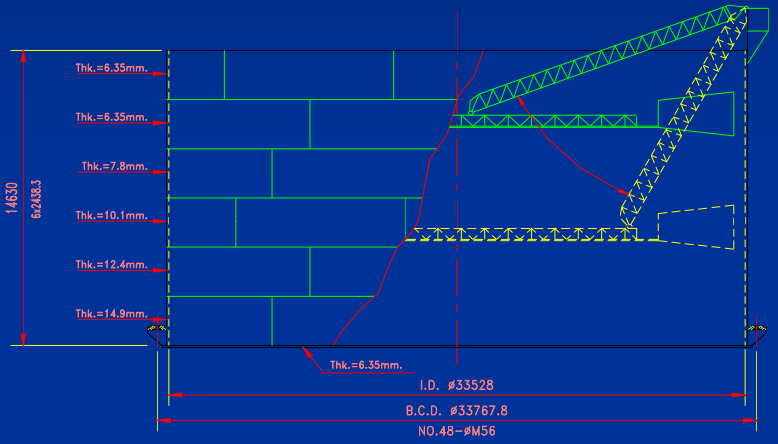
DRAWING NO. EQ-N-M-D-2TK2040-01-00

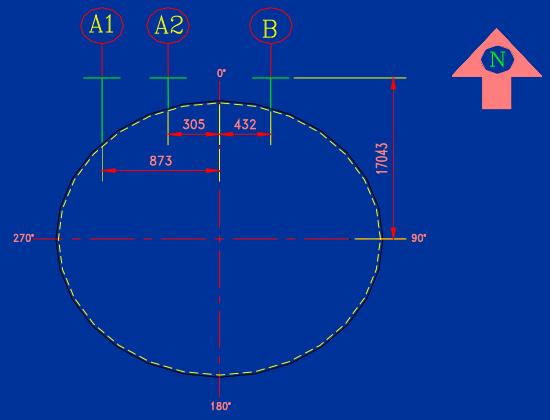
SHEET NO. 1 OF 1

REV. 0

Single Deck Floating Roof

Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A1	8"	#150-W.N.R.F.	1	380	INLET
A2	6"	#150-W.N.R.F.	1	354	INLET
B	14"	#150-W.N.R.F.	1	432	OUTLET

MATERIALS

SHELL	SA283-Gr.C
ROOF PLATE	-
NOZZLE FLANGES	SA181-Gr.I
NOZZLE NECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	-	-
DESIGN PRESSURE	ATM.	1	-	-
DESIGN TEMPERATURE	°C	48.89	-	-
FLUID SPECIFIC GRAVITY	Kg/dm³	0.82	-	-
TANK SURFACE	m²	-	-	-
HEAT TREATMENT		NO	-	-
X-RAY TEST		SPOT	-	-
JOINT EFFICIENCY	(%)	100	-	-
CORROSION ALLOWANCE	mm	1.27	-	-
GEOMETRIC CAPACITY	m³	12800	-	-
INSPECTION INSTITUTE		-	-	-
		-	-	-
		-	-	-

DESIGN CODE : API - 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ....2505156....Kg

WATER FILLED ....12624265.7....Kg

LOADS AT SUPPORT BASE

M / Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	270826	1174897 9.6	14268367
Q Kg	45256	1999489.7	2428469

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF 2TK-2031

LOCATION:
NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

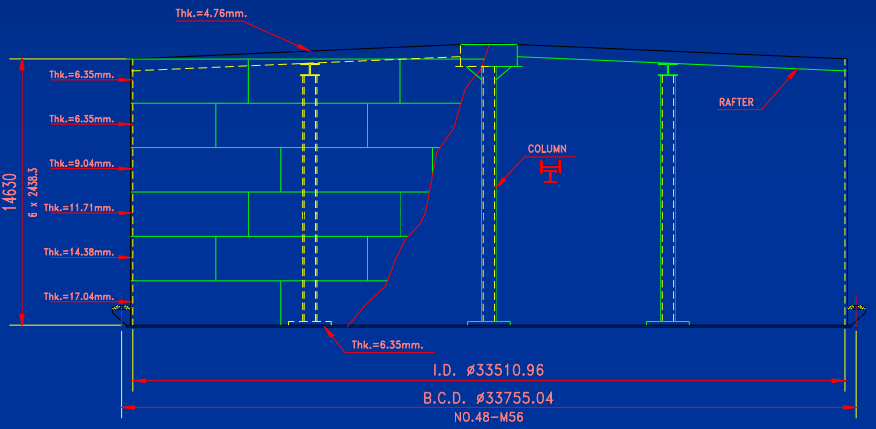
DRAWING NO. EQ-N-M-D-2TK2031-01-00

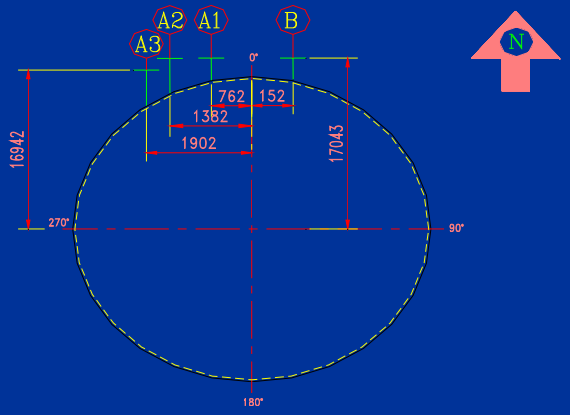
SHEET NO. 1 OF 1

REV. 0

Fixed Roof With Column &

Rafter Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A1	8"	#150-W.N.R.F.	1	467	INLET
A2	8"	#150-W.N.R.F.	1	467	INLET
A3	4"	#150-W.N.R.F.	1	414	INLET
B	16"	#150-W.N.R.F.	1	560	OUTLET

MATERIALS

SHELL #1,#2 / #3,...,#6	SA131-Gr.B / SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	-

DESIGN DATA

		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	-	
DESIGN PRESSURE	ATM.	1	-	
DESIGN TEMPERATURE	°C	50	-	
FLUID SPECIFIC GRAVITY	Kg/dm³	0.97	-	
TANK SURFACE	m²	-	-	
HEAT TREATMENT		NO	-	
X-RAY TEST		SPOT	-	
JOINT EFFICIENCY	(%)	100	-	
CORROSION ALLOWANCE	mm	1.27	-	
GEOMETRIC CAPACITY	m³	12800	-	
INSPECTION INSTITUTE		-	-	
		-	-	
		-	-	

DESIGN CODE : API 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 276082 ..... Kg

WATER FILLED ..... 12648924 ..... Kg

LOADS AT SUPPORT BASE

	ERECTION	OPERATION	HYDR. TEST
M Kg.m	706796	14283673.5	14703061
Q Kg	74528.6	2386122.4	2457653

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.21	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

DOC. TITLE: DATA SHEET FOR SEISMIC ANALYSIS OF 2TK-2037

LOCATION: NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

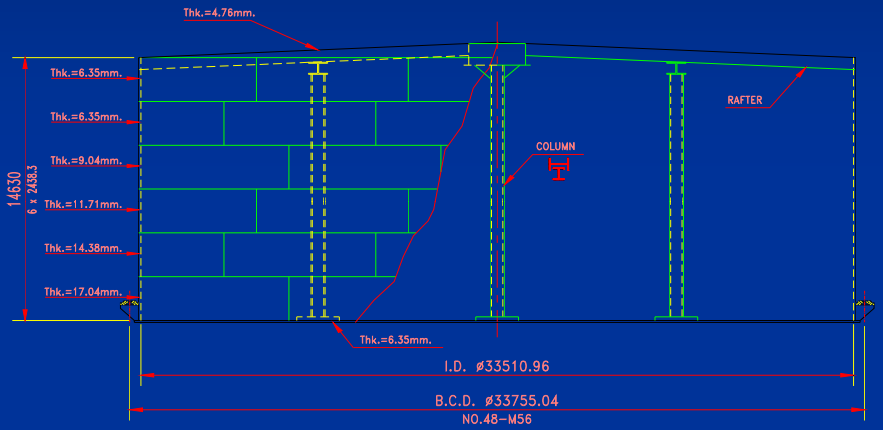
DRAWING NO. EQ-N-M-D-2TK2037-01-00

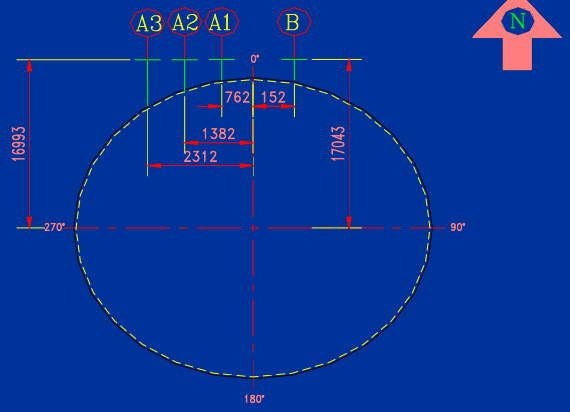
SHEET NO. 1 OF 1

REV. 0

Fixed Roof With Column &

Rafter Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A1	8"	#150-W.N.R.F.	1	467	INLET
A2	8"	#150-W.N.R.F.	1	467	INLET
A3	10"	#150-W.N.R.F.	1	414	INLET
B	16"	#150-W.N.R.F.	1	560	OUTLET

MATERIALS

SHELL #1,#2 / #3,...,#6	SA131-Gr.B / SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	-

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	-	
DESIGN PRESSURE	ATM.	1	-	
DESIGN TEMPERATURE	°C	50	-	
FLUID SPECIFIC GRAVITY	Kg/dm³	0.97	-	
TANK SURFACE	m²	-	-	
HEAT TREATMENT		NO	-	
X-RAY TEST		SPOT	-	
JOINT EFFICIENCY	(%)	100	-	
CORROSION ALLOWANCE	mm	1.27	-	
GEOMETRIC CAPACITY	m³	12800	-	
INSPECTION INSTITUTE		-	-	
		-	-	
		-	-	

DESIGN CODE : API 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 275623.2 ..... Kg

WATER FILLED ..... 12648495.5 ..... Kg

LOADS AT SUPPORT BASE

M / Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	706571.4	14283673.5	14703061.2
Q Kg	706571.4	2386020.4	2457448.9

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.21	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

DOC. TITLE: DATA SHEET FOR SEISMIC ANALYSIS OF TK-2039

LOCATION: SOUTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

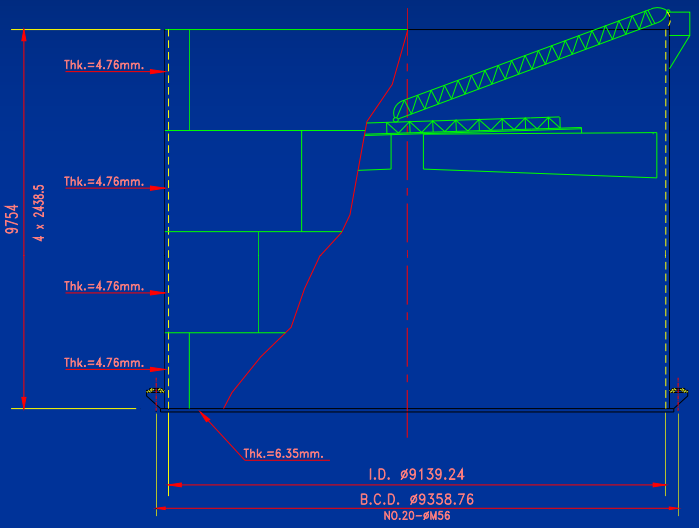
DRAWING NO. EQ-S-M-D-TK2039-01-00

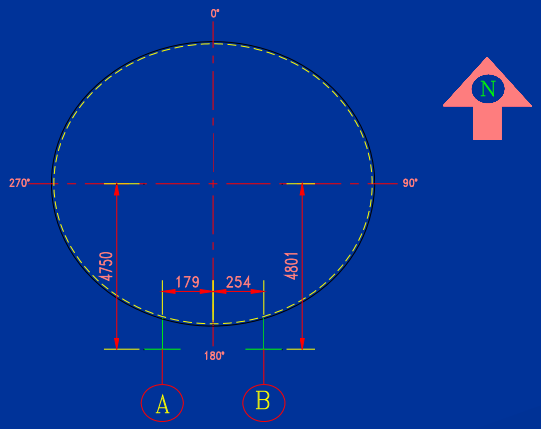
SHEET NO. 1 OF 1

REV. 0

Double Deck Floating Roof

Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES

NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A	3"	#150-W.N.R.F.	1	239	INLET
B	6"	#150-W.N.R.F.	1	279	OUTLET

MATERIALS

SHELL	SA283-Gr.C
ROOF PLATE	–
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C
DECK PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	–	
DESIGN PRESSURE	ATM.	1	–	
DESIGN TEMPERATURE	°C	54	–	
FLUID SPECIFIC GRAVITY	Kg/dm³	0.8	–	
TANK SURFACE	m²	–	–	
HEAT TREATMENT		NO	–	
X-RAY TEST		SPOT	–	
JOINT EFFICIENCY	(%)	100	–	
CORROSION ALLOWANCE	mm	1.27	–	
GEOMETRIC CAPACITY	m³	640	–	
INSPECTION INSTITUTE		–	–	
		–	–	
		–	–	

DESIGN CODE : API 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 30294.5 ..Kg

WATER FILLED ..... 630255.6 .....Kg

LOADS AT SUPPORT BASE

M Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	29023.5	602847	746296
Q Kg	5951.2	143500	177887.8

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.6.21	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

DOC. TITLE: DATA SHEET FOR SEISMIC ANALYSIS OF TK-2034

LOCATION: SOUTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

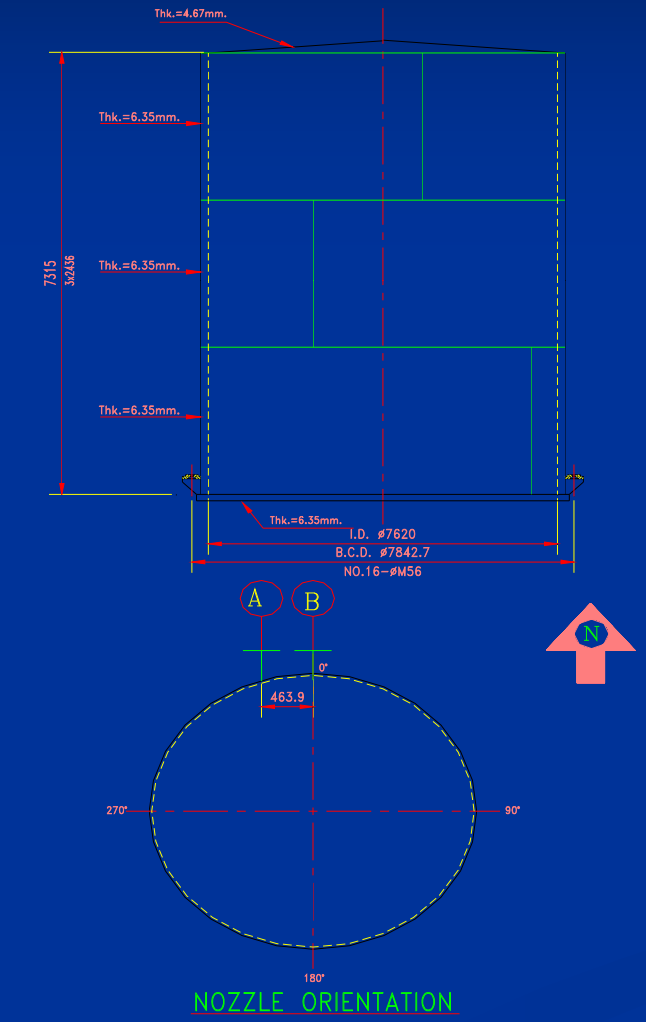
DRAWING NO. EQ-S-M-D-TK2034-01-00

SHEET NO. 1 OF 1

REV. 0

Self Supported Fixed Roof

Storage Tank Data Sheet



NOZZLE ORIENTATION

NOZZLES					
NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A	4	#150-W.N.R.F.	1	279	INLET
B	6	#150-W.N.R.F.	1	220	OUTLET

MATERIALS	
SHELL	SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	–	
DESIGN PRESSURE	ATM.	1	–	
DESIGN TEMPERATURE	°C	50	–	
FLUID SPECIFIC GRAVITY	Kg/dm³	1	–	
TANK SURFACE	m²	–	–	
HEAT TREATMENT		NO	–	
X-RAY TEST		SPOT	–	
JOINT EFFICIENCY	(%)	100	–	
CORROSION ALLOWANCE	mm	1.27	–	
GEOMETRIC CAPACITY	m³	343	–	
INSPECTION INSTITUTE		–	–	
		–	–	
		–	–	

DESIGN CODE : API – 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY ..... 15653 .....Kg

WATER FILLED ..... 334906 .....Kg

LOADS AT SUPPORT BASE

M Q	ERECTION	OPERATION	HYDR. TEST
M Kg.m	16683.7	316540.8	316540.8
Q Kg	3750	96426.5	96426.5

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF 2TK-2301

LOCATION:
NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

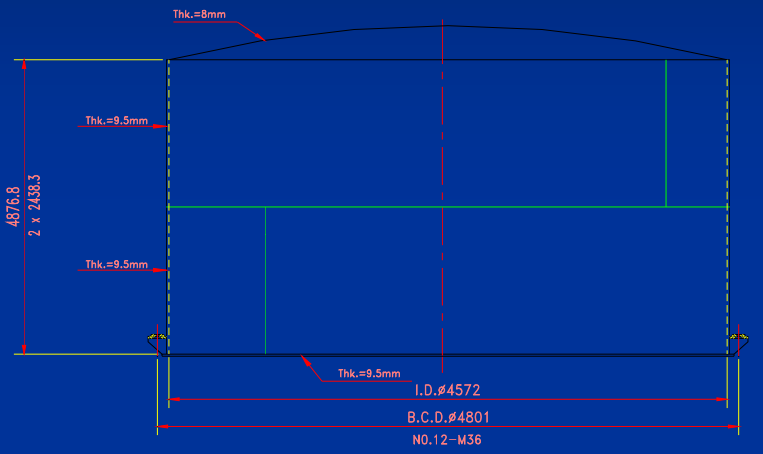
DRAWING NO. EQ-N-M-D-2TK2301-01-00

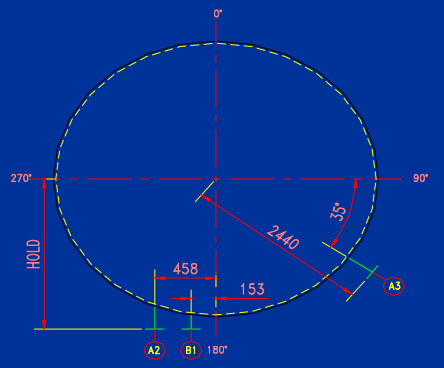
SHEET NO. 1 OF 1

REV. 0

Self Supported Fixed Roof

Storage Tank Data Sheet





NOZZLE ORIENTATION

NOZZLES					
NOZZLE	SIZE	RATING/TYPE	QTY.	H. ELE.	SERVICE
A2	2"	#150-W.N.R.F.	1	230	INLET
A3	2"	#150-W.N.R.F.	1	4246	INLET
B1	2"	#150-W.N.R.F.	1	246	OUTLET

MATERIALS	
SHELL	SA283-Gr.C
ROOF PLATE	SA283-Gr.C
NOZZLE FLANGES	SA181-Gr.I
NOZZLESNECKS & PIPES	SA106-Gr.A
STUD BOLTS/EX. NUTS	SA193-Gr.B7 / SA194-Gr.2H
ANCHOR BOLTS	SA36
BASE PLATE	SA283-Gr.C
BOTTOM PLATE	SA283-Gr.C

DESIGN DATA		SHELL	TUBE	JACKET
EARTHQUAKE ZONE		4	–	–
DESIGN PRESSURE	ATM.	1	–	–
DESIGN TEMPERATURE	°C	65.5	–	–
FLUID SPECIFIC GRAVITY	Kg/dm³	1.03	–	–
TANK SURFACE	m²	–	–	–
HEAT TREATMENT		NO	–	–
X-RAY TEST		SPOT	–	–
JOINT EFFICIENCY	(%)	100	–	–
CORROSION ALLOWANCE	mm	3	–	–
GEOMETRIC CAPACITY	m³	64	–	–
INSPECTION INSTITUTE		–	–	–
		–	–	–
		–	–	–

DESIGN CODE : API – 650

EARTH QUAKE CODE : UBC 1997

WEIGHTS

EMPTY .....15938.....Kg

WATER FILLED .....80773.5.....Kg

LOADS AT SUPPORT BASE			
	ERECTION	OPERATION	HYDR. TEST
M Kg.m	10239.8	49145	48011.2
Q Kg	4282	24839.8	24241

EARTHQUAKE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.14	FIRST ISSUED	A.P.	M.B.	P.M.	H.A.

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE
FOR
TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FAP
FANN AZMAYAN POOYANDEH CO.

DOC. TITLE:
DATA SHEET FOR SEISMIC ANALYSIS OF
2TK-621

LOCATION:
NORTH REFINERY

SCALE: N.T.S.

UNIT NAME : TANKAGE AREA

DRAWING NO.
EQ-N-M-D-2TK621-01-00

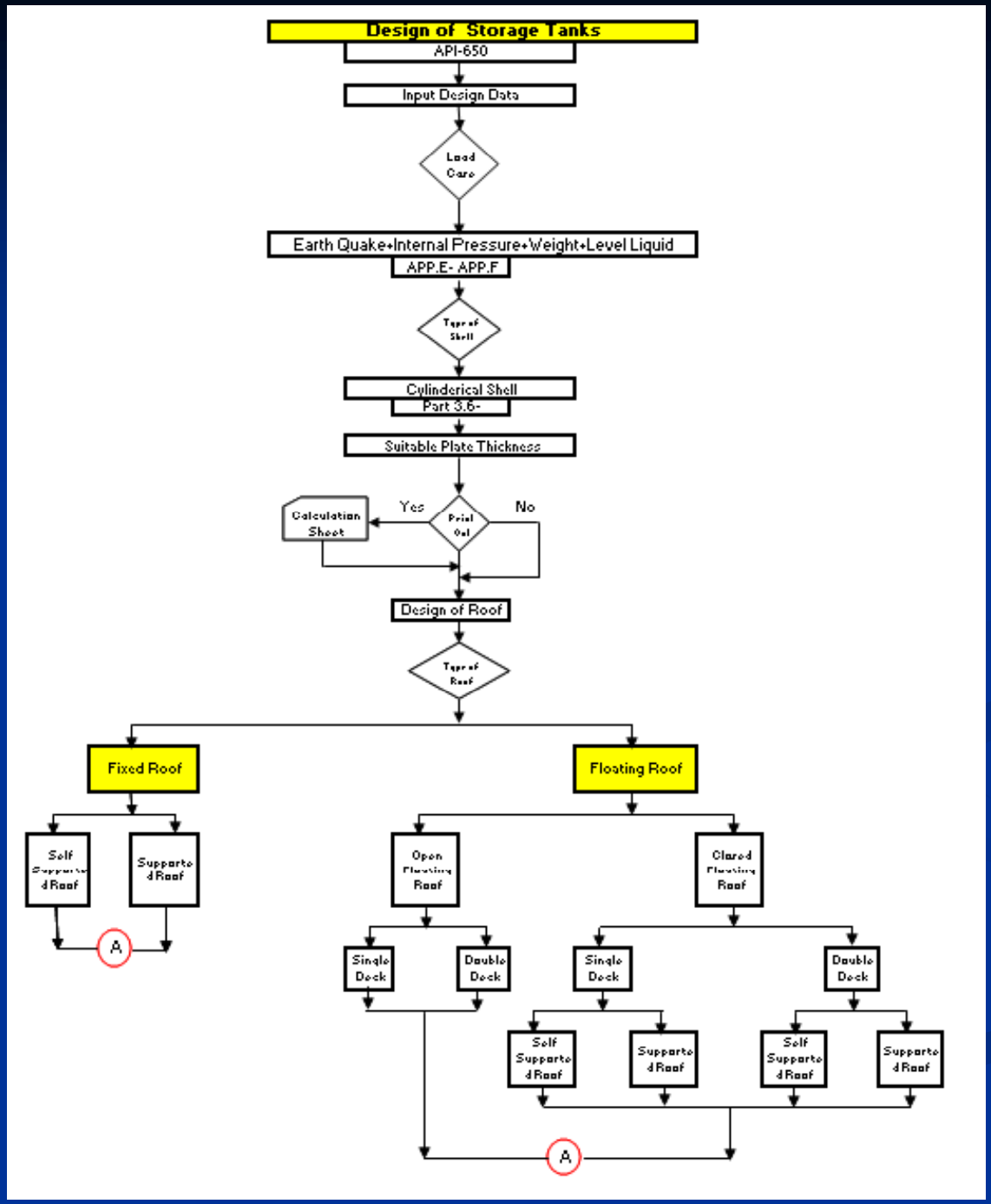
SHEET NO.
1 OF 1

REV.
0

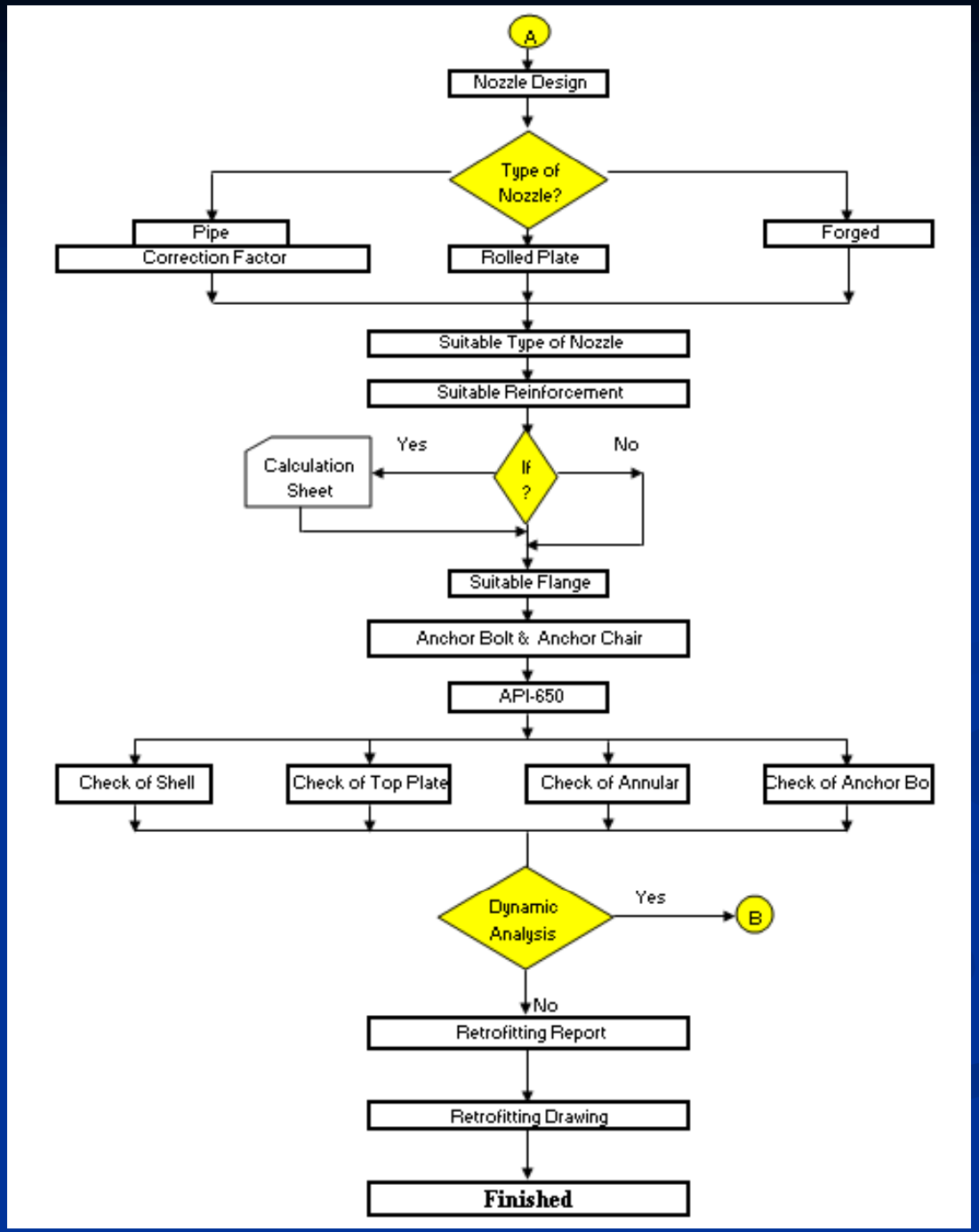
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

4- DESIGN FLOWCHART OF STORAGE TANK

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



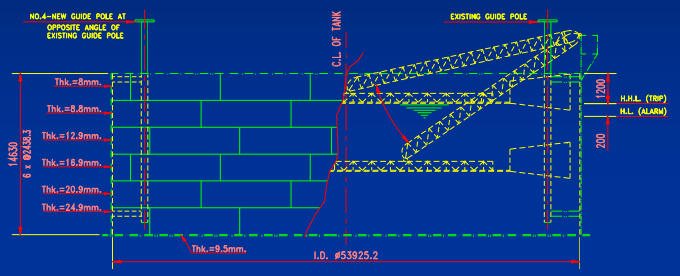
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



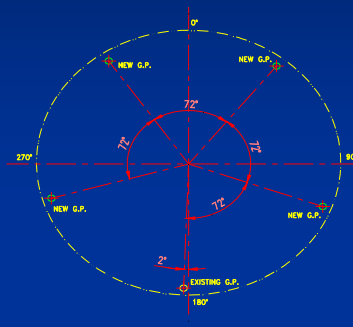
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

5- DIFFERENT TYPE OF RETROFITTING OF STORAGE TANK.

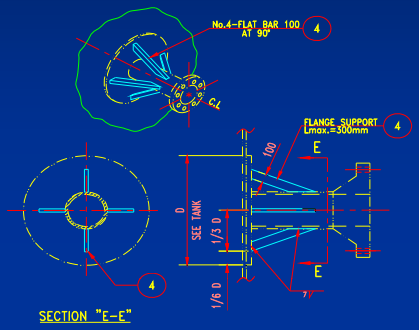
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



GENERAL VIEW OF TANK
TK-2002



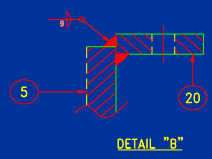
TOP VIEW OF TANK

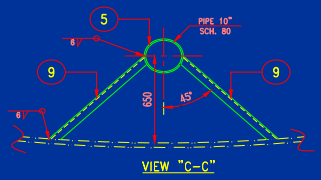


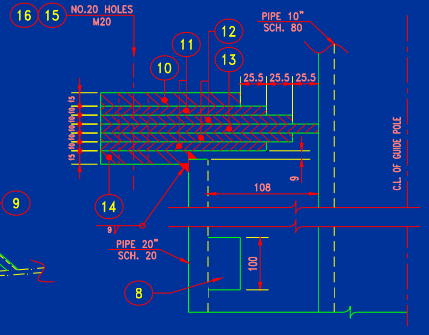
SECTION "E-E"

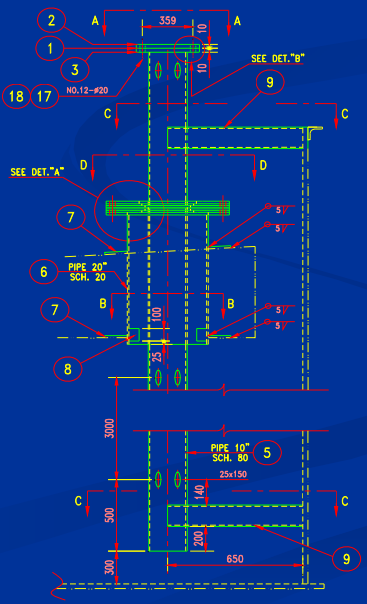
INLET & OUTLET NOZZLE REINFORCING

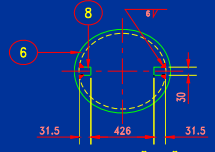
NOTE :
1- ALL DIMENSIONS ARE IN mm.
2- DOUBLE SEALS ARE RECOMENDED , THE PRIMARY SEAL MUST BE FOAM SEAL AND PREFERLY KISS TYPE.

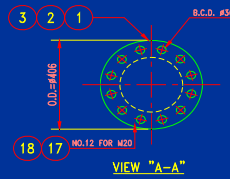


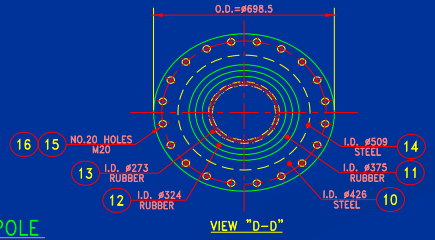












GUIDE POLE
NO.4

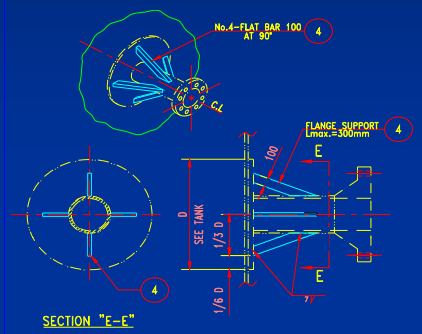
TOTAL WEIGHT=7355.8 (Kg)

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
18	HEX. NUT. M20	96	0.1	9.6	SA194-Gr.2H	
17	STUD BOLT M20, L=110	48	0.2	9.6	SA193-Gr.B7	
16	HEX. NUT. M20	160	0.1	16	SA194-Gr.2H	
15	STUD BOLT M20, L=180	80	0.3	24	SA193-Gr.B7	
14	PLATE t10xO.D.⌀698.5xI.D.⌀509	4	14	56	ST-37	
13	RUBBER t10xO.D.⌀698.5xI.D.⌀273	4	0.5	2	RUBBER	
12	RUBBER t10xO.D.⌀698.5xI.D.⌀324	8	0.4	3.2	RUBBER	
11	RUBBER t10xO.D.⌀698.5xI.D.⌀375	8	0.4	3.2	RUBBER	
10	PLATE t10xO.D.⌀698.5xI.D.⌀426	4	19	76	ST-37	
9	[160, L=1300	16	24	384	ST-37	BRACING
8	FLAT t30x31.5x100	8	0.74	5.92	ST-37	
7	REINF. t8xO.D.=⌀750xI.D.=⌀513	8	14.76	118.08	ST-37	
6	PIPE 20", SCH.20, L=1200	4	140	560	SA106-Gr.B	
5	PIPE 10", SCH.80, L=15230	4	1500	6000	SA106-Gr.B	GUIDE POLE
4	FLAT BAR100-110, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE t10xO.D.⌀406	4	10.16	40.64	ST-37	
2	PLATE t10xO.D.⌀406xI.D.⌀274	4	5.53	22.12	ST-37	
1	t3xO.D.⌀406xI.D.⌀274	4	1.66	6.64	JACKETED ASBESTOS	

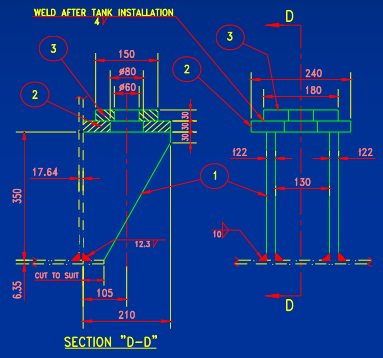
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: PAP PANN AZMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF TK-2002
LOCATION: SOUTH REFINERY
SCALE: N.T.S.
UNIT NAME : TANKAGE AREA
DRAWING NO. EQ-S-M-D-TK2002-02-00
SHEET NO. 1 OF 1
REV. 0

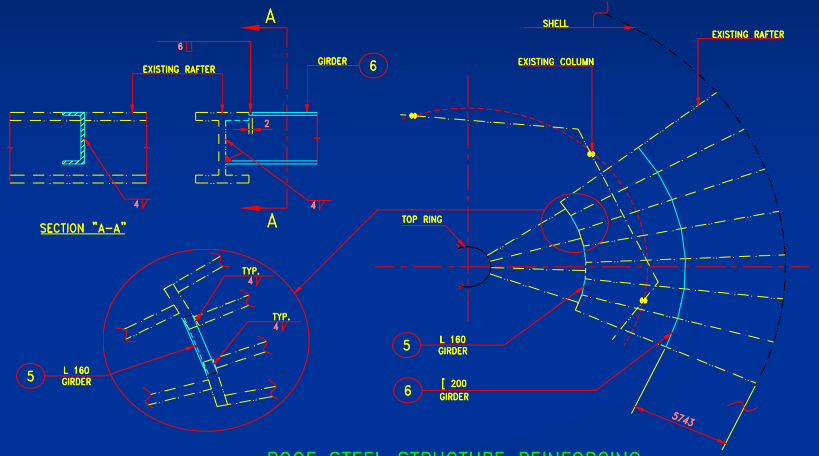
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



INLET & OUTLET NOZZLE REINFORCING

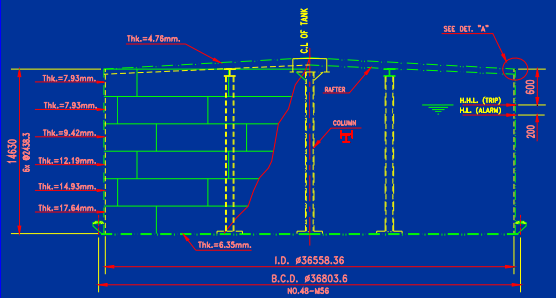


ANCHOR BOLT

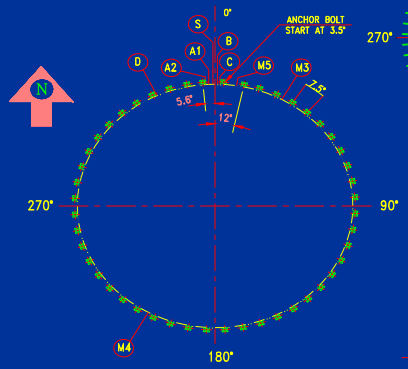


ROOF STEEL STRUCTURE REINFORCING

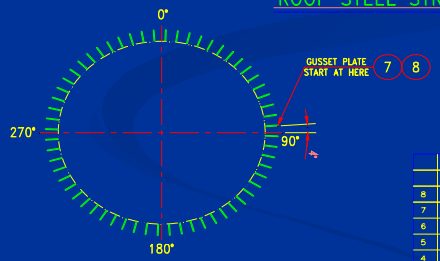
NOTE :
1- ALL DIMENSIONS ARE IN mm.



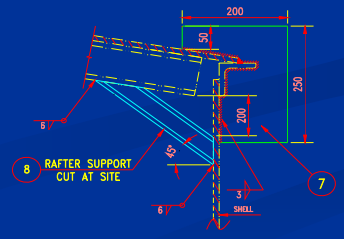
GENERAL VIEW OF TANK
TK-2009



TOP VIEW OF TANK



TOP VIEW OF TANK
GUSSET PLATE



DETAIL "A"

TOTAL WEIGHT=6954.8 (Kg)

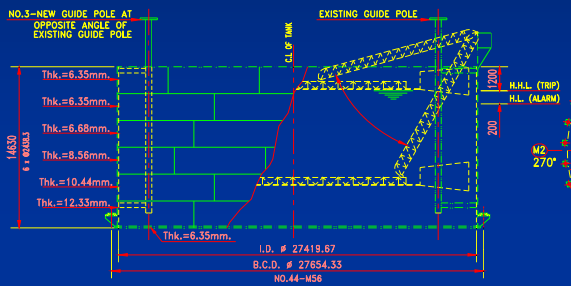
No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
8	IPB 200 . L=FIT AT SITE	60	30	1800	ST-37	RAFTER SUPPORT
7	PLATE 110x200x250	60	4	240	ST-37	GUSSET PLATE
6	[200, L=FIT AT SITE	60	33.9	2034	ST-37	GIRDER
5	L 160, L=FIT AT SITE	30	25.8	774	ST-37	GIRDER
4	FLAT BAR100-110, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE 130x150x180	48	6.3	302.4	ST-37	WASHER
2	PLATE 150x210x240	48	11.8	566.4	ST-37	TOP PLATE
1	PLATE 122x350x210	96	12.7	1219.2	ST-37	GUSSET PLATE

BILL OF MATERIAL

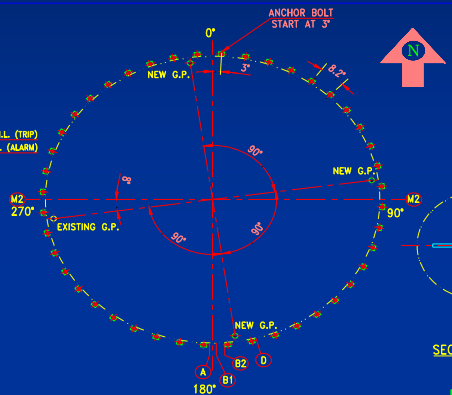
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: FAP PANN AZMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF TK-2009
LOCATION: SOUTH REFINERY
SCALE: N.T.S.
UNIT NAME: TANKAGE AREA
DRAWING NO.: EQ-S-M-D-TK2009-02-00
SHEET NO.: 1 OF 1
REV.: 0

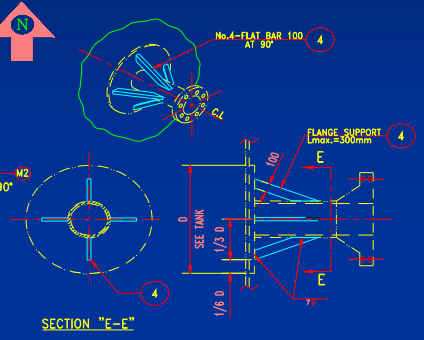
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



GENERAL VIEW OF TANK
TK-2016

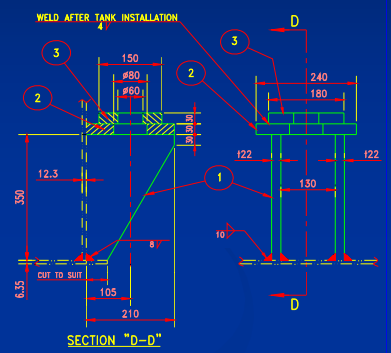


TOP VIEW OF TANK



SECTION "E-E"

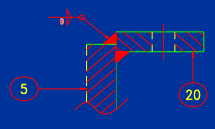
INLET & OUTLET NOZZLE REINFORCING



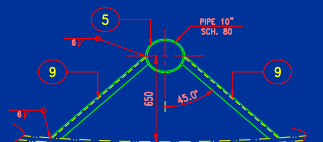
SECTION "D-D"

ANCHOR BOLT

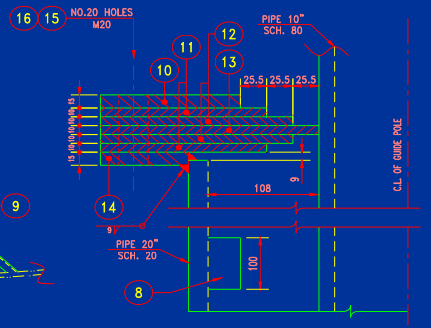
NOTE :
1- ALL DIMENSIONS ARE IN mm.
2- DOUBLE SEALS ARE RECOMENDED , THE PRIMARY SEAL MUST BE FOAM SEAL AND PREFERLY KISS TYPE.



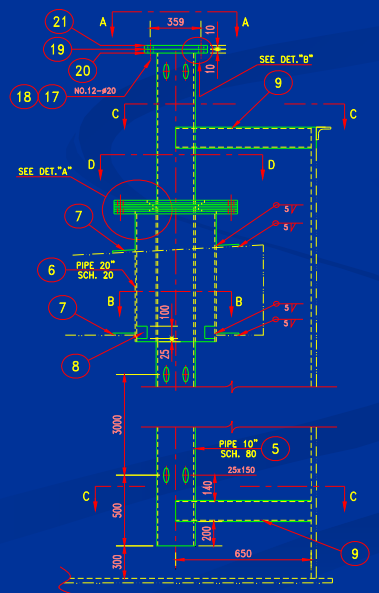
DETAIL "B"

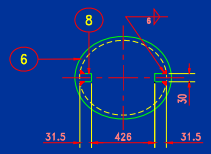


VIEW "C-C"

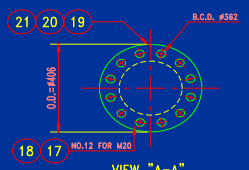


DETAIL "A"



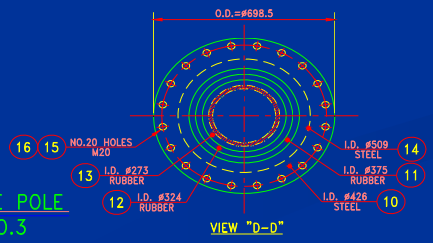


VIEW "B-B"



VIEW "A-A"

GUIDE POLE
NO.3



VIEW "D-D"

TOTAL WEIGHT=7444.9 (Kg)

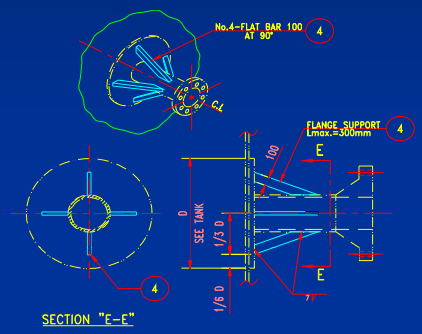
No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
21	PLATE 110xO.D.ϕ406	3	10.2	30.6	ST-37	
20	PLATE 110xO.D.ϕ406xI.D.ϕ274	3	5.5	16.5	ST-37	
19	13xO.D.ϕ406xI.D.ϕ274	3	1.6	4.8	JACKETED ASBESTOS	
18	HEX. NUT. M20	72	0.1	7.2	SA194-Gr.2H	
17	STUD BOLT M20, L=110	36	0.2	7.2	SA193-Gr.B7	
16	HEX. NUT. M20	120	0.1	12	SA194-Gr.2H	
15	STUD BOLT M20, L=160	60	0.3	18	SA193-Gr.B7	
14	PLATE 110xO.D.ϕ698.5xI.D.ϕ509	3	14	42	ST-37	
13	RUBBER 110xO.D.ϕ696.5xI.D.ϕ273	3	0.5	1.5	RUBBER	
12	RUBBER 110xO.D.ϕ698.5xI.D.ϕ324	6	0.4	2.4	RUBBER	
11	RUBBER 110xO.D.ϕ698.5xI.D.ϕ375	6	0.4	2.4	RUBBER	
10	PLATE 110xO.D.ϕ698.5xI.D.ϕ426	3	19	57	ST-37	
9	[180, L=1300	12	24	288	ST-37	BRACING
8	FLAT 130x31.5x100	6	0.7	4.2	ST-37	
7	REINF. 18xO.D.=ϕ750xI.D.=ϕ513	6	14.7	88.2	ST-37	
6	PIPE 20", SCH.20, L=1200	3	140	420	SA106-Gr.B	
5	PIPE 10", SCH.80, L=15230	3	1500	4500	SA106-Gr.B	GUIDE POLE
4	FLAT BAR100-110, L=FIT AT SITE	12	2.35	28.2	ST-37	FLANGE SUPPORT
3	PLATE 130x150x180	44	6.3	277.2	ST-37	WASHER
2	PLATE 130x210x240	44	11.8	519.9	ST-37	TOP PLATE
1	PLATE 122x350x210	88	12.7	1117.6	ST-37	GUSSET PLATE

BILL OF MATERIAL

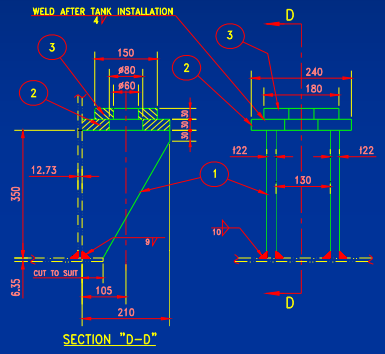
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	85.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: PAP PANN AZMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF TK-2016
LOCATION: SOUTH REFINERY
SCALE: N.T.S. UNIT NAME: TANKAGE AREA
DRAWING NO. EQ-S-M-D-TK2016-02-00 SHEET NO. 1 OF 1 REV. 0

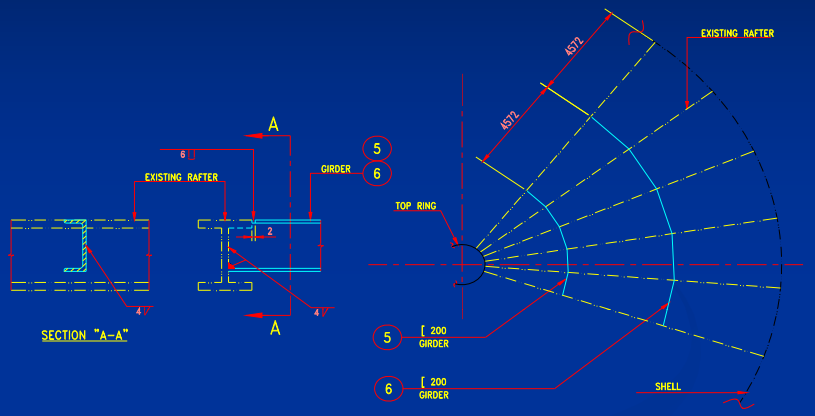
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



INLET & OUTLET NOZZLE REINFORCING

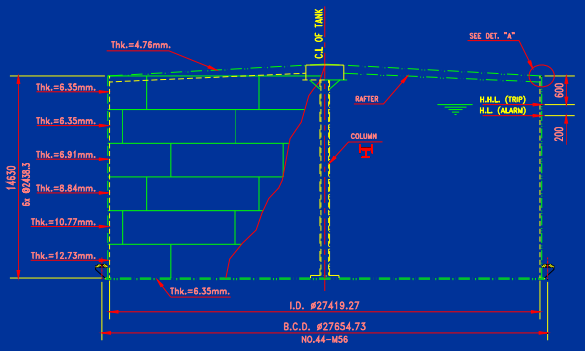


ANCHOR BOLT

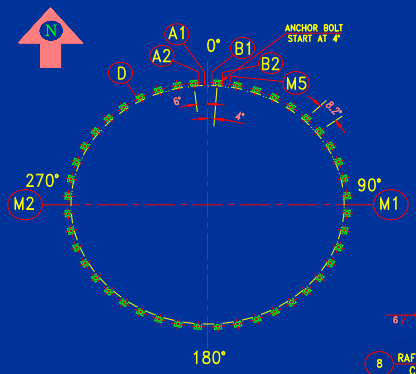


ROOF STEEL STRUCTURE REINFORCING

NOTE :
1- ALL DIMENSIONS ARE IN mm.

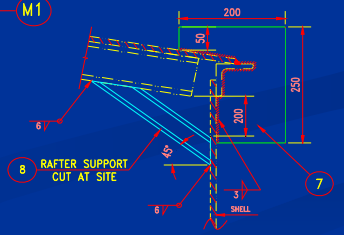


GENERAL VIEW OF TANK
TK-2035



TOP VIEW OF TANK

TOP VIEW OF TANK
GUSSET PLATE



DETAIL "A"

TOTAL WEIGHT=6337.1 (Kg)

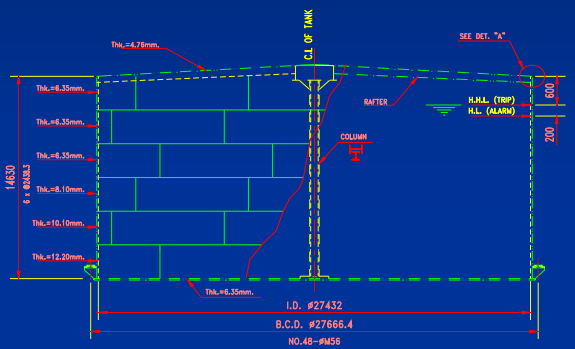
BILL OF MATERIAL

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL WEIGHT /Kg	MATERIAL	REMARK
8	IPB 200, L=FIT AT SITE	49	30	1470	ST-37	RAFTER SUPPORT
7	PLATE 110×200×250	49	4	196	ST-37	GUSSET PLATE
6	[200, L=FIT AT SITE	49	37	1813	ST-37	GIRDER
5	[200, L=FIT AT SITE	49	18.5	906.5	ST-37	GIRDER
4	FLAT BAR100-110, L=FIT AT SITE	16	2.35	37.6	ST-37	FLANGE SUPPORT
3	PLATE 130×150×180	44	6.3	277.2	ST-37	WASHER
2	PLATE 130×210×240	44	11.8	519.2	ST-37	TOP PLATE
1	PLATE 122×350×210	88	12.7	1117.6	ST-37	GUSSET PLATE

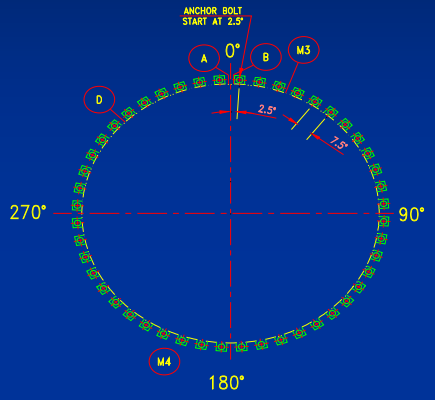
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: PAP PANN AZMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF TK-2035
LOCATION: SOUTH REFINERY
SCALE: N.T.S.
UNIT NAME: TANKAGE AREA
DRAWING NO.: EQ-S-M-D-TK2035-02-00
SHEET NO.: 1 OF 1
REV.: 0

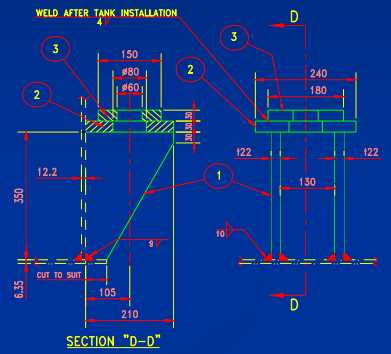
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



GENERAL VIEW OF TANK
2TK-2005



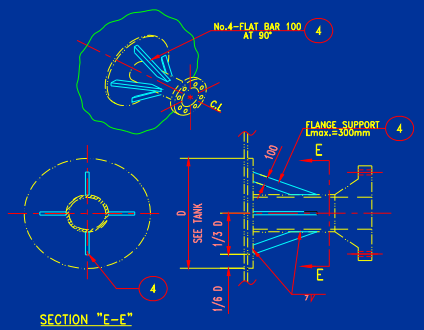
TOP VIEW OF TANK



SECTION "D-D"

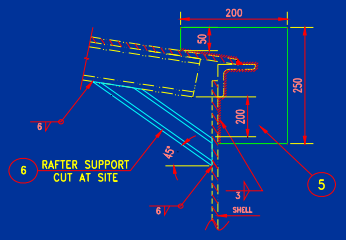
ANCHOR BOLT

NOTE :
1- ALL DIMENSIONS ARE IN mm.

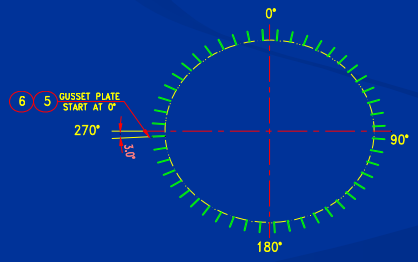


SECTION "E-E"

INLET & OUTLET NOZZLE REINFORCING



DETAIL "A"



TOP VIEW OF TANK
GUSSET PLATE

TOTAL WEIGHT=3738.8 (Kg)

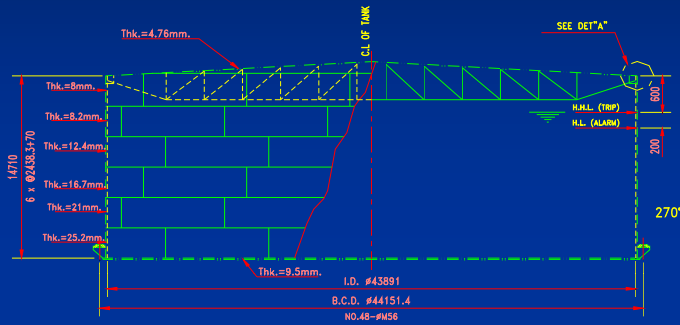
No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL WEIGHT /Kg	MATERIAL	REMARK
6	IPB 200,L=FIT AT SITE	48	30	1440	ST-37	RAFTER SUPPORT
5	PLATE t10×200×250	48	4	192	ST-37	GUSSET PLATE
4	FLAT BAR100-t10, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE t30×150×180	48	6.3	302.4	ST-37	WASHER
2	PLATE t30×210×240	48	11.8	566.4	ST-37	TOP PLATE GUSSET PLATE
1	PLATE t22×350×210	96	12.7	1219.2	ST-37	

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

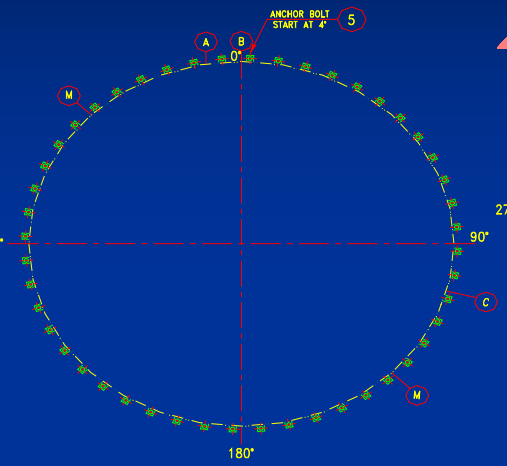
PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF 2TK-2005
LOCATION: NORTH REFINERY
SCALE: N.T.S.
UNIT NAME: TANKAGE AREA
DRAWING NO: EQ-N-M-D-2TK2005-02-00
SHEET NO: 1 OF 1
REV: 0

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

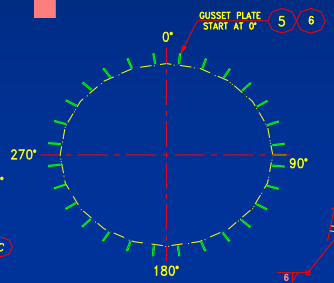


GENERAL VIEW OF TANK
2TK-2010

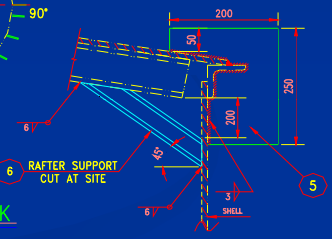
NOTE :
1- ALL DIMENSIONS ARE IN mm.



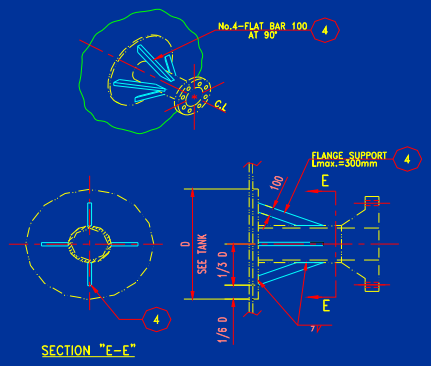
TOP VIEW OF TANK



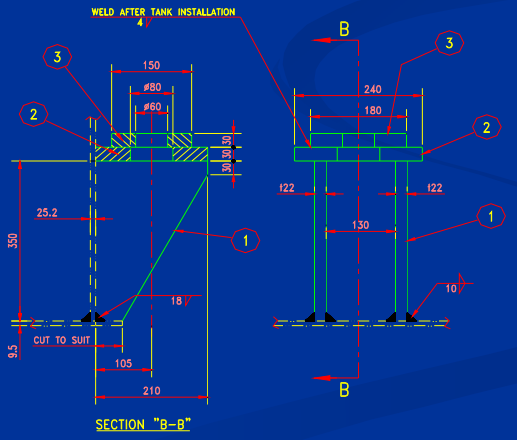
TOP VIEW OF TANK
GUSSET PLATE



DETAIL "A"



INLET & OUTLET NOZZLE REINFORCING



ANCHOR BOLT

TOTAL WEIGHT=3058.8 (Kg)

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
6	IPB 200 . L=FIT AT SITE	28	30	840	ST-37	RAFTER SUPPORT
5	PLATE t10x200x250	28	4	112	ST-37	GUSSET PLATE
4	FLAT BAR100-t10, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE t30x150x180	48	6.3	302.4	ST-37	WASHER
2	PLATE t30x210x240	48	11.8	566.4	ST-37	TOP PLATE
1	PLATE t22x350x210	98	12.7	1219.2	ST-37	GUSSET PLATE

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

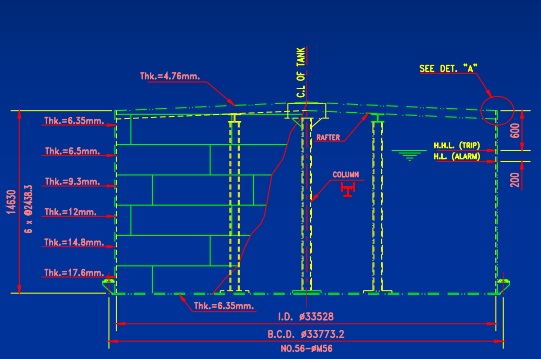
DWG. TITLE:
RETROFITTING DWG. OF 2TK-2010

LOCATION: NORTH REFINERY

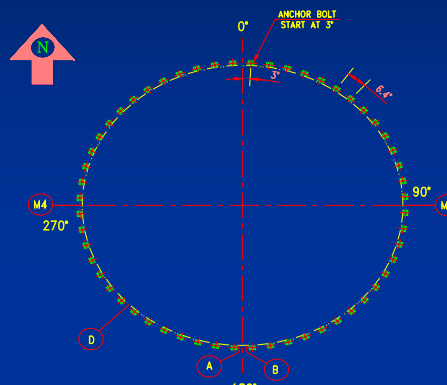
SCALE: N.T.S. UNIT NAME : TANKAGE AREA

DRAWING NO: EQ-N-M-D-2TK2010-02-00 SHEET NO: 1 OF 1 REV. 0

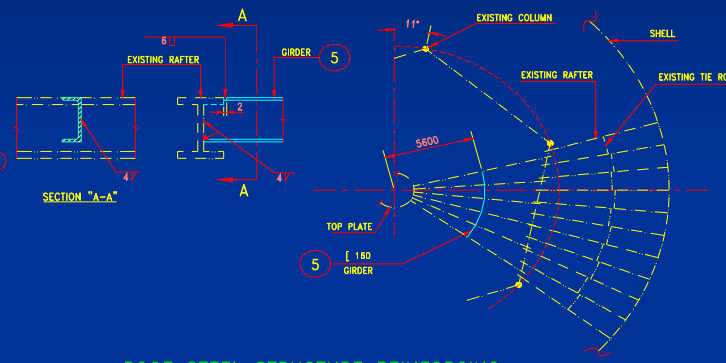
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



GENERAL VIEW OF TANK
2TK-2011

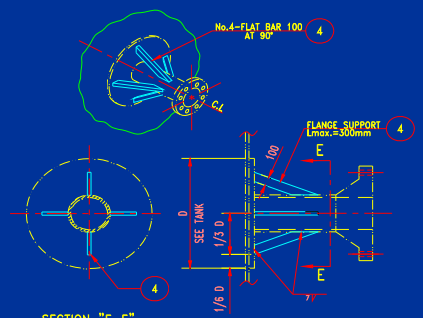


TOP VIEW OF TANK

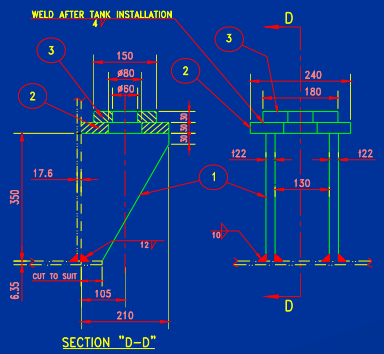


ROOF STEEL STRUCTURE REINFORCING

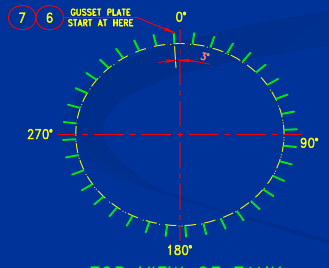
NOTE :
1- ALL DIMENSIONS ARE IN mm.



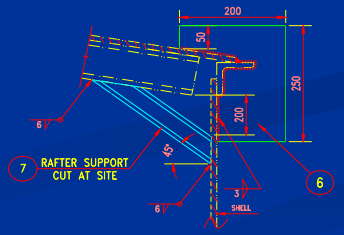
INLET & OUTLET NOZZLE REINFORCING



ANCHOR BOLT



TOP VIEW OF TANK
GUSSET PLATE



DETAIL "A"

TOTAL WEIGHT=4398.8 (Kg)

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
7	IPB 200,L=FIT AT SITE	36	30	1080	ST-37	RAFTER SUPPORT GUSSET PLATE
6	PLATE 110x200x250	36	4	144	ST-37	
5	[180, L=FIT AT SITE	36	20	720	ST-37	GIRDER
4	FLAT BAR1000-110, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE t30x150x180	56	6.3	352.8	ST-37	WASHER
2	PLATE t30x210x240	56	11.8	660.8	ST-37	TOP PLATE
1	PLATE t22x350x210	112	12.7	1422.4	ST-37	GUSSET PLATE

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C.
TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
PAP
PANN AZMAYAN POOYANDEH CO.

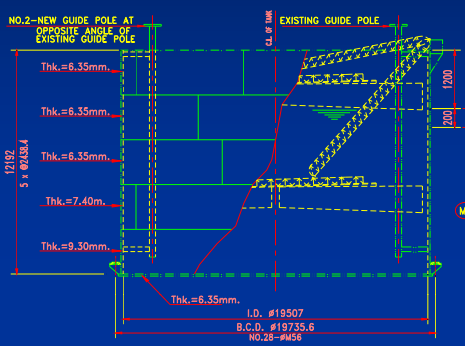
DWG. TITLE:
RETROFITTING DWG. OF 2TK-2011

LOCATION:
NORTH REFINERY

SCALE: N.T.S. UNIT NAME: TANKAGE AREA

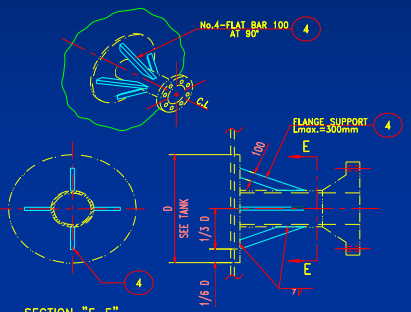
DRAWING NO. EQ-N-M-0-2TK2011-02-00 SHEET NO. 1 OF 1 REV. 0

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

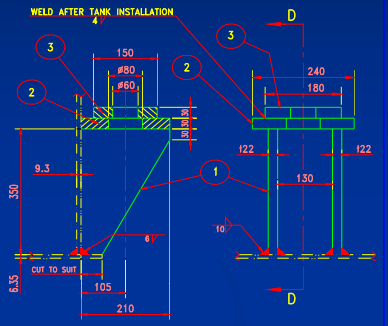


GENERAL VIEW OF TANK
2TK-2024

TOP VIEW OF TANK

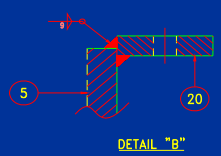


SECTION "E-E"

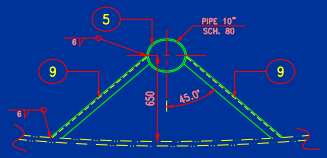


SECTION "D-D"

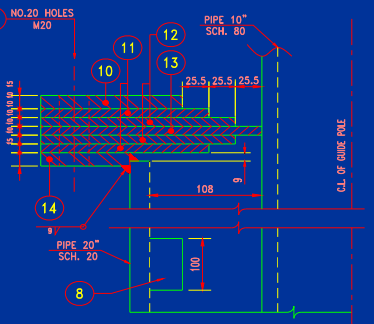
NOTE :
1- ALL DIMENSIONS ARE IN mm.
2- DOUBLE SEALS ARE RECOMENDED , THE PRIMARY SEAL MUST BE FOAM SEAL AND PREFERLY KISS TYPE.



DETAIL "B"



VIEW "C-C"



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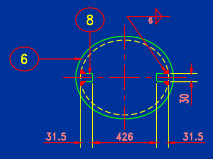
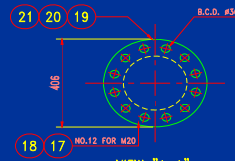
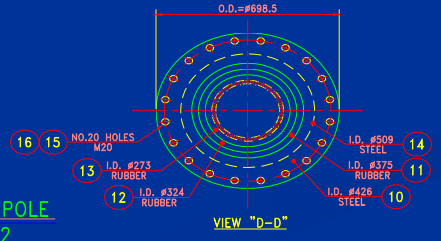


VIEW "B-B"



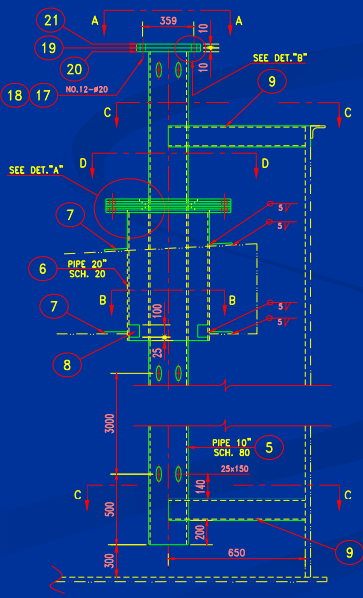
VIEW "A-A"



VIEW "D-D"

GUIDE POLE
NO.2

INLET & OUTLET NOZZLE REINFORCING



ANCHOR BOLT

TOTAL WEIGHT=4923.6 (Kg)

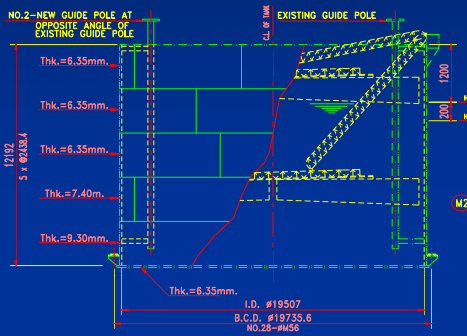
No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL WEIGHT /Kg	MATERIAL	REMARK
21	PLATE t10xO.D.⌀406	2	10.2	20.4	ST-37	
20	PLATE t10xO.D.⌀406xI.D.⌀274	2	5.5	11	ST-37	
19	t3xO.D.⌀406xI.D.⌀274	2	1.6	3.2	JACKETED ASBESTOS	
18	HEX. NUT. M20	48	0.1	4.8	SA194-Gr.2H	
17	STUD BOLT M20, L=110	24	0.2	4.8	SA193-Gr.B7	
16	HEX. NUT. M20	80	0.1	8	SA194-Gr.2H	
15	STUD BOLT M20, L=160	40	0.3	12	SA193-Gr.B7	
14	PLATE t10xO.D.⌀698.5xI.D.⌀509	2	14	28	ST-37	
13	RUBBER t10xO.D.⌀698.5xI.D.⌀273	2	0.5	1	RUBBER	
12	RUBBER t10xO.D.⌀698.5xI.D.⌀324	4	0.4	1.6	RUBBER	
11	RUBBER t10xO.D.⌀698.5xI.D.⌀375	4	0.4	1.6	RUBBER	
10	PLATE t10xO.D.⌀698.5xI.D.⌀426	2	19	38	ST-37	
9	[160, L=1300	8	24	192	ST-37	BRACING
8	FLAT 130x31.5x100	4	0.7	2.8	ST-37	
7	REINF. t8xO.D.=⌀750xI.D.=⌀513	4	14.7	58.8	ST-37	
6	PIPE 20", SCH.20, L=1200	2	140	280	SA106-Gr.B	
5	PIPE 10", SCH.80, L=15250	2	1500	3000	SA106-Gr.B	GUIDE POLE
4	FLAT BAR100-t10, L=FIT AT SITE	16	2.35	37.6	ST-37	FLANGE SUPPORT
3	PLATE t30x150x180	28	6.3	176.4	ST-37	WASHER
2	PLATE t30x210x240	28	11.8	330.4	ST-37	TOP PLATE GUSSET PLATE
1	PLATE t22x350x210	56	12.7	711.2	ST-37	

BILL OF MATERIAL

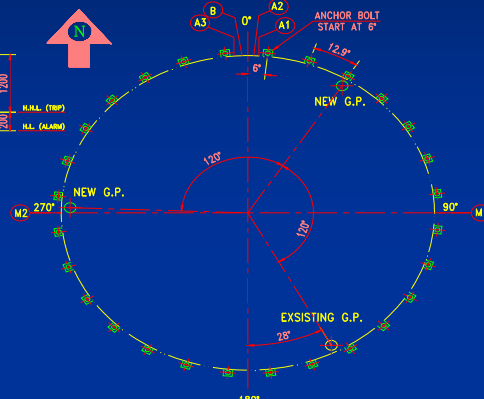
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHKD	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.N.	H.A

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: PAP PANN ARMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF 2TK-2024
LOCATION: NORTH REFINERY
SCALE: N.T.S.
UNIT NAME: TANKAGE AREA
DRAWING NO. EQ-N-M-D-2TK2024-02-00
SHEET NO. 1 OF 1
REV. 0

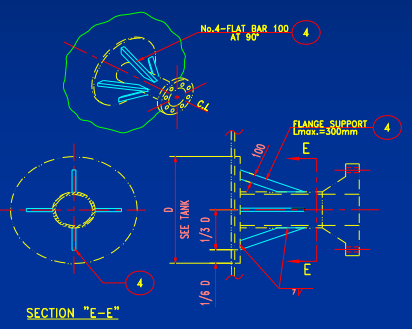
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



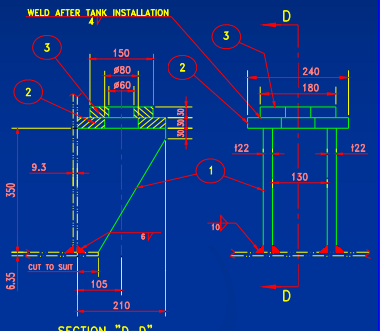
GENERAL VIEW OF TANK
2TK-2024



TOP VIEW OF TANK

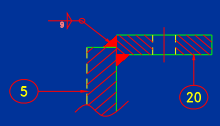


SECTION "E-E"

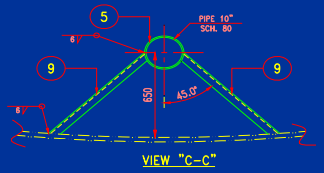


SECTION "D-D"

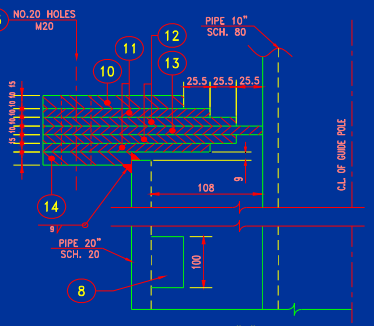
NOTE :
1- ALL DIMENSIONS ARE IN mm.
2- DOUBLE SEALS ARE RECOMENDED , THE PRIMARY SEAL MUST BE FOAM SEAL AND PREFERLY KISS TYPE.



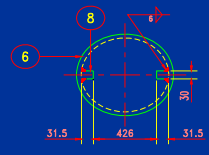
DETAIL "B"



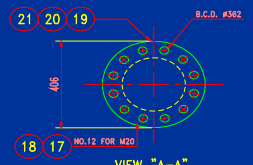
VIEW "C-C"



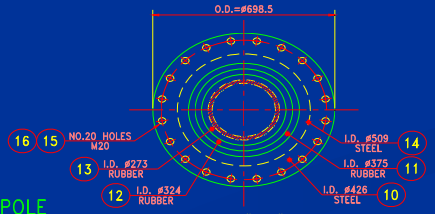
DETAIL "A"



VIEW "B-B"



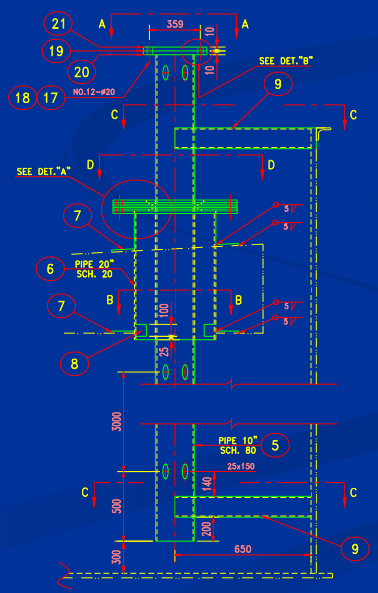
VIEW "A-A"



VIEW "D-D"

GUIDE POLE
NO.2

INLET & OUTLET NOZZLE REINFORCING



ANCHOR BOLT

TOTAL WEIGHT=4923.6 (Kg)

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
21	PLATE 110xO.D.#406	2	10.2	20.4	ST-37	
20	PLATE 110xO.D.#406xI.D.#274	2	5.5	11	ST-37	
19	t3xO.D.#406xI.D.#274	2	1.6	3.2	JACKETED ASBESTOS	
18	HEX. NUT. M20	48	0.1	4.8	SA194-Gr.2H	
17	STUD BOLT M20, L=110	24	0.2	4.8	SA193-Gr.B7	
16	HEX. NUT. M20	80	0.1	8	SA194-Gr.2H	
15	STUD BOLT M20, L=180	40	0.3	12	SA193-Gr.B7	
14	PLATE 110xO.D.#698.5xI.D.#509	2	14	28	ST-37	
13	RUBBER 110xO.D.#698.5xI.D.#273	2	0.5	1	RUBBER	
12	RUBBER 110xO.D.#698.5xI.D.#324	4	0.4	1.6	RUBBER	
11	RUBBER 110xO.D.#698.5xI.D.#375	4	0.4	1.6	RUBBER	
10	PLATE 110xO.D.#698.5xI.D.#426	2	19	38	ST-37	
9	[160, L=1300	8	24	192	ST-37	BRACING
8	FLAT t30x31.5x100	4	0.7	2.8	ST-37	
7	REINF. 18xO.D.=#750xI.D.=#513	4	14.7	58.8	ST-37	
6	PIPE 20", SCH.20, L=1200	2	140	280	SA106-Gr.B	
5	PIPE 10", SCH.80, L=15230	2	1500	3000	SA106-Gr.B	GUIDE POLE
4	FLAT BAR100-110, L=FIT AT SITE	16	2.35	37.6	ST-37	FLANGE SUPPORT
3	PLATE 130x150x180	28	6.3	176.4	ST-37	WASHER
2	PLATE 130x210x240	28	11.8	330.4	ST-37	TOP PLATE GUSSET PLATE
1	PLATE 122x350x210	56	12.7	711.2	ST-37	

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: PAP PANN AZMAYAN POOYANDEH CO.

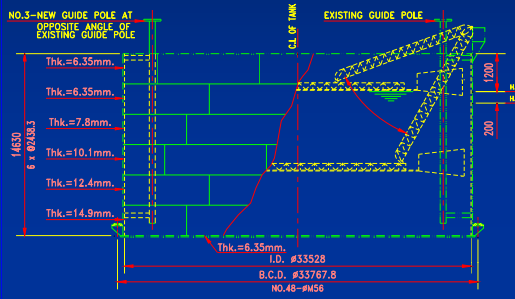
DWG. TITLE:
RETROFITTING DWG. OF 2TK-2024

LOCATION: NORTH REFINERY

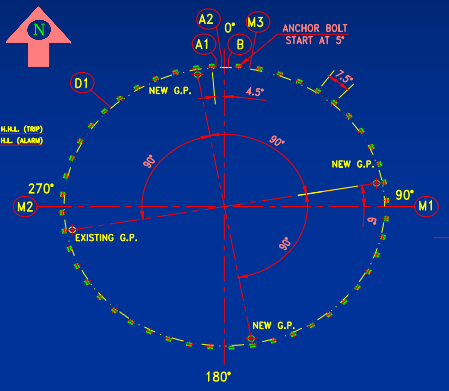
SCALE: N.T.S. UNIT NAME : TANKAGE AREA

DRAWING NO. EQ-N-M-D-2TK2024-02-00 SHEET NO. 1 OF 1 REV. 0

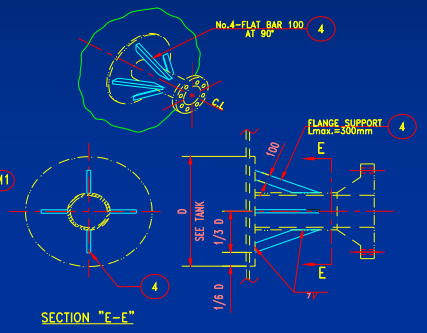
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



GENERAL VIEW OF TANK
2TK-2031

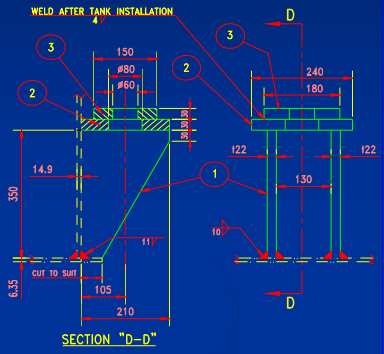


TOP VIEW OF TANK



SECTION "E-E"

INLET & OUTLET NOZZLE REINFORCING

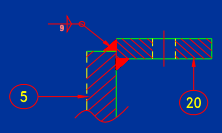


SECTION "D-D"

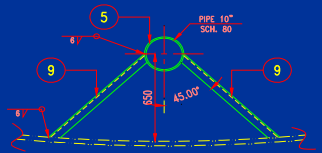
ANCHOR BOLT

NOTE :

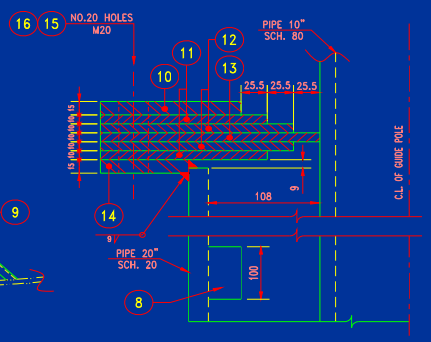
1- ALL DIMENSIONS ARE IN mm.
2- DOUBLE SEALS ARE RECOMENDED , THE PRIMARY SEAL MUST BE FOAM SEAL AND PREFERLY KISS TYPE.



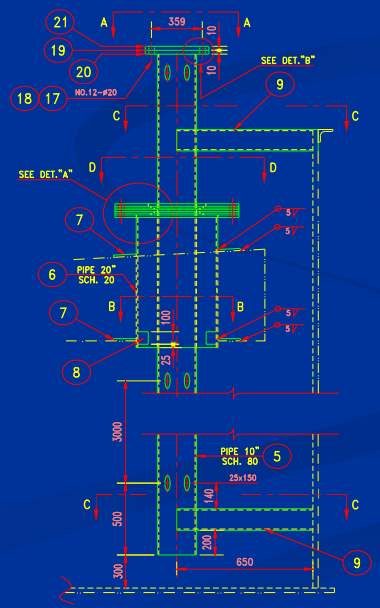
DETAIL "B"

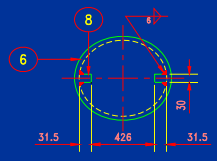


VIEW "C-C"

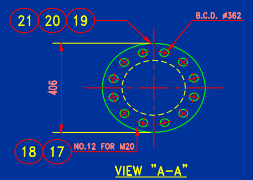


DETAIL "A"

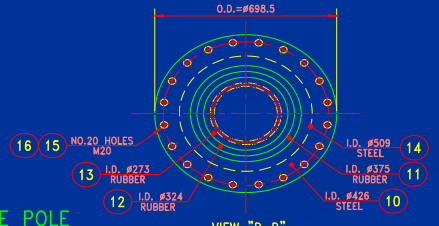




VIEW "B-B"



VIEW "A-A"



VIEW "D-D"

GUIDE POLE
NO.3

TOTAL WEIGHT=7618.2 (Kg)

BILL OF MATERIAL

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
21	PLATE 110xO.D.⌀406	3	10.2	30.6	ST-37	
20	PLATE 110xO.D.⌀406xI.D.⌀274	3	5.5	16.5	ST-37	
19	13xO.D.⌀406xI.D.⌀274	3	1.6	4.8	JACKETED ASBS3103	
18	HEX. NUT. M20	72	0.1	7.2	SA194-Gr.2H	
17	STUD BOLT M20, L=110	36	0.2	7.2	SA193-Gr.B7	
16	HEX. NUT. M20	120	0.1	12	SA194-Gr.2H	
15	STUD BOLT M20, L=180	60	0.3	18	SA193-Gr.B7	
14	PLATE 110xO.D.⌀698.5xI.D.⌀509	3	14	42	ST-37	
13	RUBBER 110xO.D.⌀698.5xI.D.⌀273	3	0.5	1.5	RUBBER	
12	RUBBER 110xO.D.⌀698.5xI.D.⌀324	6	0.4	2.4	RUBBER	
11	RUBBER 110xO.D.⌀698.5xI.D.⌀375	6	0.4	2.4	RUBBER	
10	PLATE 110xO.D.⌀698.5xI.D.⌀426	3	19	57	ST-37	
9	[160, L=1300	12	24	288	ST-37	BRACING
8	FLAT 130x31.5x100	6	0.7	4.2	ST-37	
7	REINF. 18xO.D.⌀750xI.D.⌀513	6	14.7	88.2	ST-37	
6	PIPE 20", SCH.20, L=1200	3	140	420	SA106-Gr.B	
5	PIPE 10", SCH.80, L=15230	3	1500	4500	SA106-Gr.B	GUIDE POLE
4	FLAT BAR100-110, L=FIT AT SITE	12	2.35	28.2	ST-37	FLANGE SUPPORT
3	PLATE 130x150x180	48	6.3	302.4	ST-37	WASHER
2	PLATE 130x210x240	48	11.8	566.4	ST-37	TOP PLATE
1	PLATE 122x350x210	96	12.7	1219.2	ST-37	GUSSET PLATE

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1						
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONSULTANTS: PAP PANN AZMAYAN POOYANDEH CO.

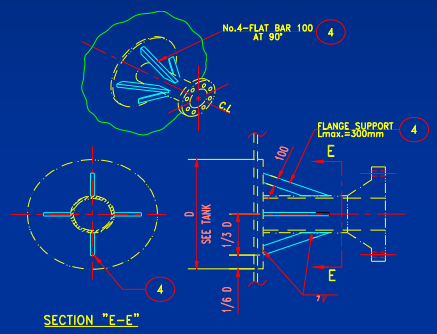
DWG. TITLE:
RETROFITTING DWG. OF 2TK-2031

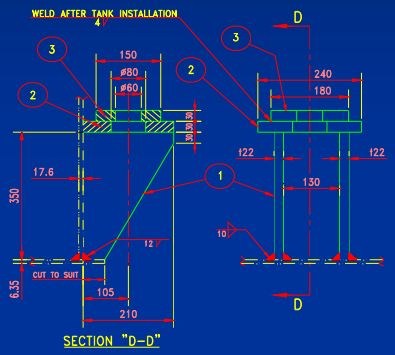
LOCATION: NORTH REFINERY

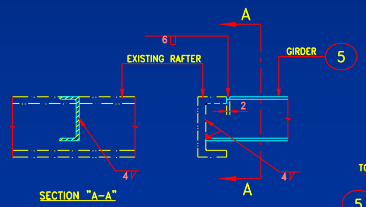
SCALE: N.T.S. UNIT NAME: TANKAGE AREA

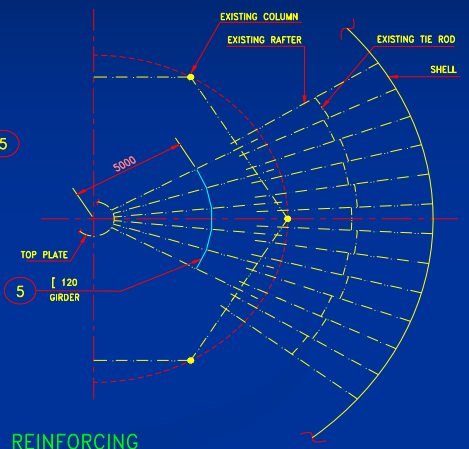
DRAWING NO. EQ-N-M-D-2TK2031-02-00 SHEET NO. 1 OF 1 REV. 0

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)







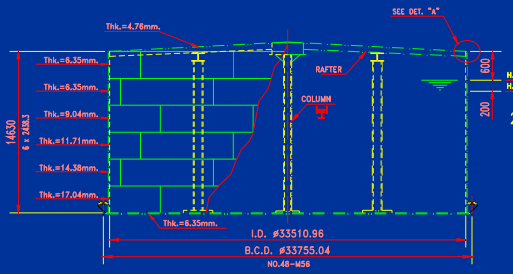


INLET & OUTLET NOZZLE REINFORCING

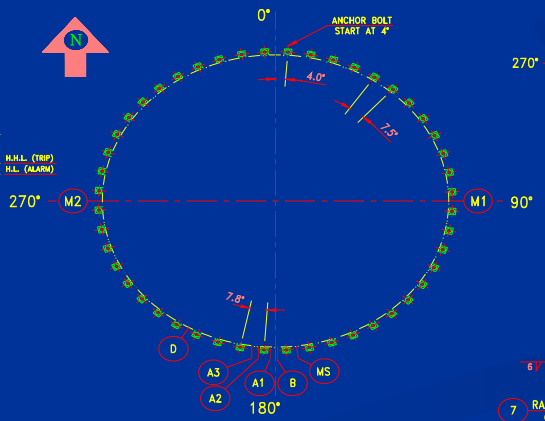
ANCHOR BOLT

ROOF STEEL STRUCTURE REINFORCING

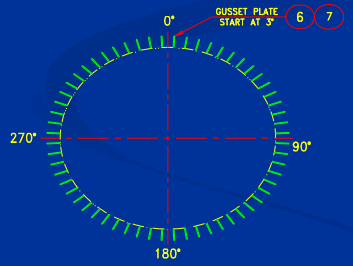
NOTE :
1- ALL DIMENSIONS ARE IN mm.



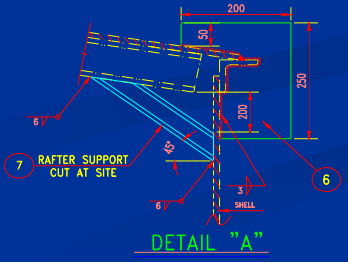
GENERAL VIEW OF TANK
2TK-2037



TOP VIEW OF TANK
ANCHOR BOLT



TOP VIEW OF TANK
GUSSET PLATE



DETAIL "A"

TOTAL WEIGHT=5082.8 (Kg)

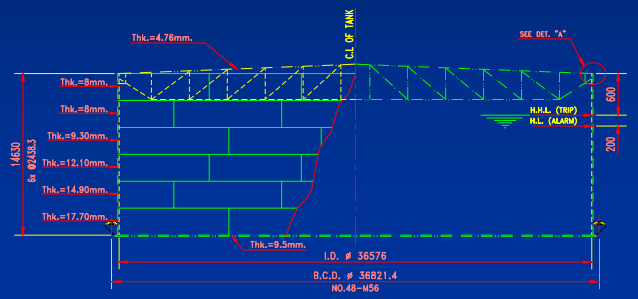
No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL WEIGHT /Kg	MATERIAL	REMARK
7	IPB 200,L=FIT AT SITE	60	30	1800	ST-37	RAFTER SUPPORT
6	PLATE t10×200×250	60	4	240	ST-37	GUSSET PLATE
5	[120, L=FIT AT SITE	30	19.6	588	ST-37	GIRDER
4	FLAT BAR100-t10, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE t30×150×180	56	6.3	352.8	ST-37	WASHER
2	PLATE t30×210×240	56	11.8	660.8	ST-37	TOP PLATE
1	PLATE t22×330×210	112	12.7	1422.4	ST-37	GUSSET PLATE

BILL OF MATERIAL

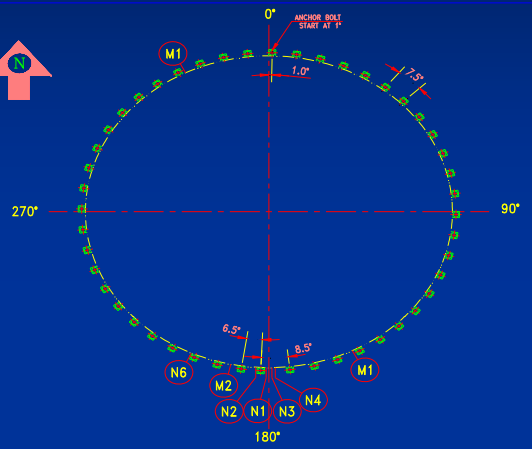
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0		FIRST ISSUED	A.P	A.A	M.B	H.A

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: PAYP PAYA PAYVAND PAYVANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF 2TK-2037
LOCATION: NORTH REFINERY
SCALE: N.T.S.
UNIT NAME : TANKAGE AREA
DRAWING NO. EQ-N-M-D-2TK2037-02-00
SHEET NO. 1 OF 1
REV. 0

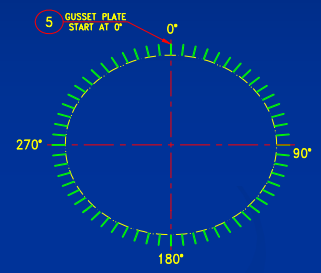
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



GENERAL VIEW OF TANK
TK-2044

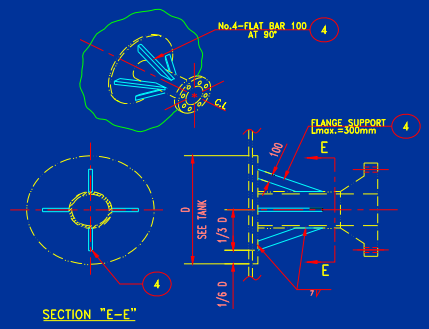


TOP VIEW OF TANK



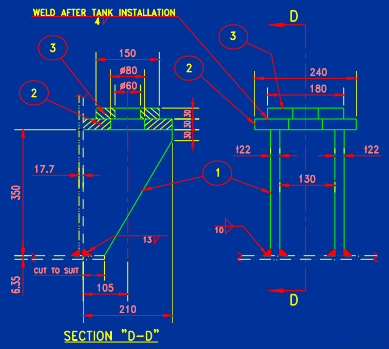
TOP VIEW OF TANK
GUSSET PLATE

NOTE :
1- ALL DIMENSIONS ARE IN mm.



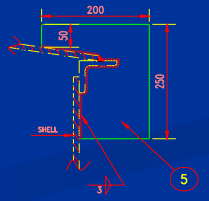
SECTION "E-E"

INLET & OUTLET NOZZLE REINFORCING



SECTION "D-D"

ANCHOR BOLT



DETAIL "A"

TOTAL WEIGHT=2356.2 (Kg)

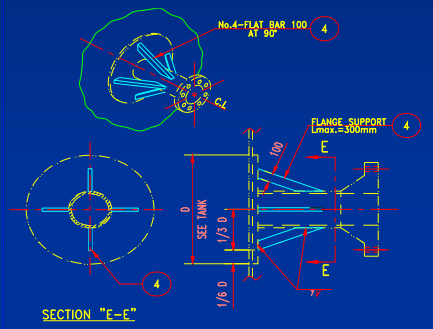
No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
5	PLATE 110×200×250	60	4	240	ST-37	GUSSET PLATE
4	FLAT BAR100-110, L=FIT AT SITE	12	2.35	28.2	ST-37	FLANGE SUPPORT
3	PLATE 130×150×180	48	6.3	302.4	ST-37	WASHER
2	PLATE 130×210×240	48	11.8	566.4	ST-37	TOP PLATE
1	PLATE 122×350×210	96	12.7	1219.2	ST-37	GUSSET PLATE

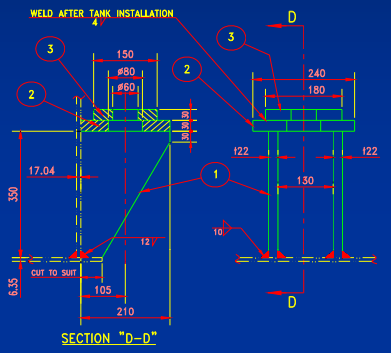
BILL OF MATERIAL

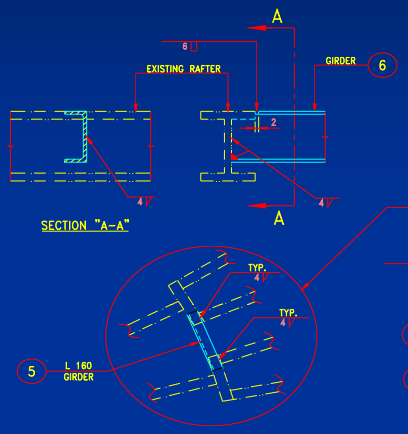
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

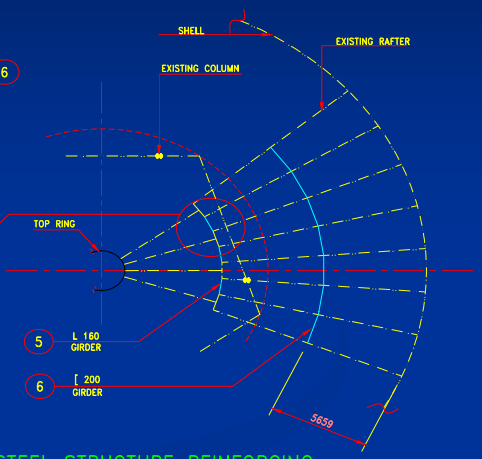
PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: PAP PANN AZMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF TK-2044
LOCATION: SOUTH REFINERY
SCALE: N.T.S.
UNIT NAME : TANKAGE AREA
DRAWING NO. EQ-S-M-D-TK2044-02-00
SHEET NO. 1 OF 1
REV 0

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)









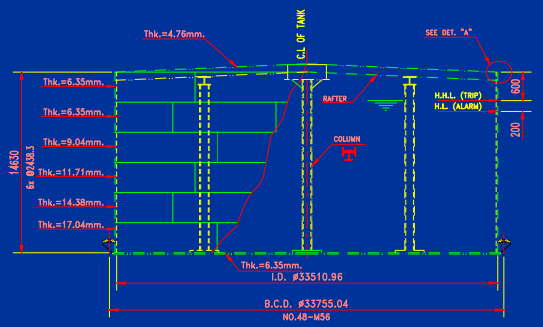
INLET & OUTLET NOZZLE REINFORCING

ANCHOR BOLT

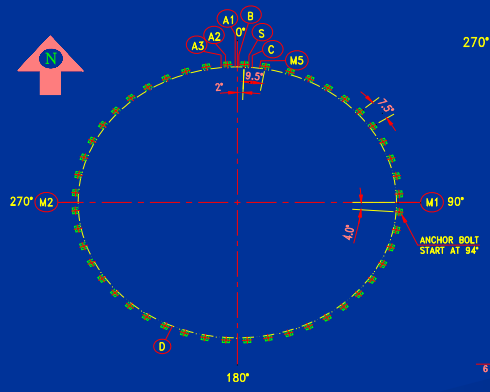
ROOF STEEL STRUCTURE REINFORCING

NOTE :

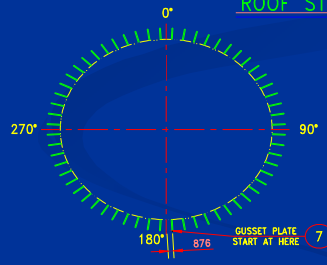
1- ALL DIMENSIONS ARE IN mm.



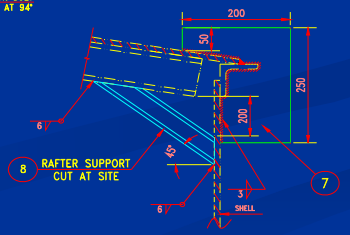
GENERAL VIEW OF TANK TK-2039



TOP VIEW OF TANK



TOP VIEW OF TANK GUSSET PLATE



DETAIL "A"

TOTAL WEIGHT=6549 (Kg)

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL WEIGHT /Kg	MATERIAL	REMARK
8	IPB 200 , L=FIT AT SITE	60	30	1800	ST-37	RAFTER SUPPORT GUSSET PLATE
7	PLATE 110x200x250	60	4	240	ST-37	
6	[200, L=FIT AT SITE	60	30	1800	ST-37	GIRDER
5	L 160, L=FIT AT SITE	30	20.7	621	ST-37	GIRDER
4	FLAT BAR100-t10, L=FIT AT SITE	16	2.35	37.6	ST-37	FLANGE SUPPORT
3	PLATE t30x150x180	48	6.3	302.4	ST-37	WASHER
2	PLATE t30x210x240	48	11.8	566.4	ST-37	TOP PLATE
1	PLATE t22x350x210	96	12.7	1219.2	ST-37	GUSSET PLATE

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
FANN AZMAYAN POOYANDEH CO.

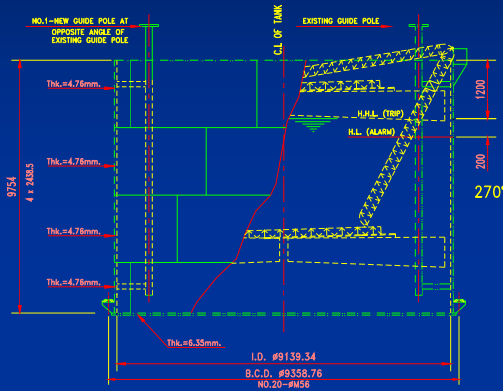
DWG. TITLE:
RETROFITTING DWG. OF TK-2039

LOCATION:
SOUTH REFINERY

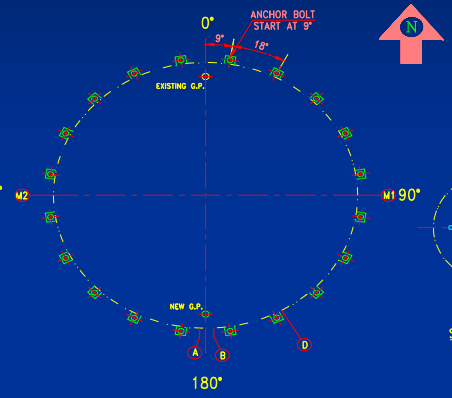
SCALE: N.T.S. UNIT NAME : TANKAGE AREA

DRAWING NO. EQ-S-M-D-TK2039-02-00 SHEET NO. 1 OF 1 REV. 0

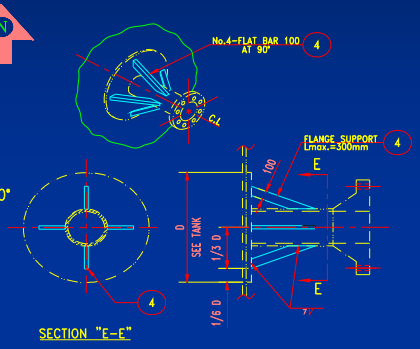
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



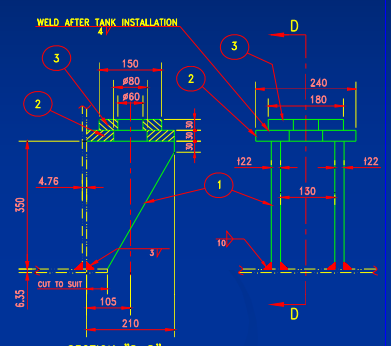
GENERAL VIEW OF TANK
TK-2034



TOP VIEW OF TANK

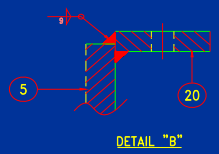


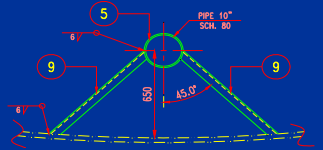
INLET & OUTLET NOZZLE REINFORCING

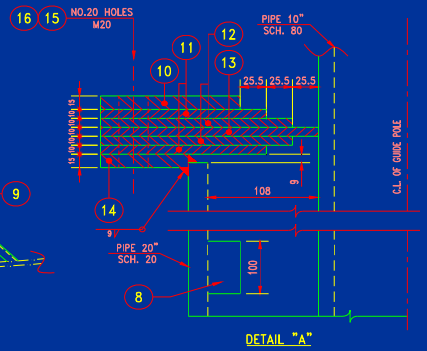


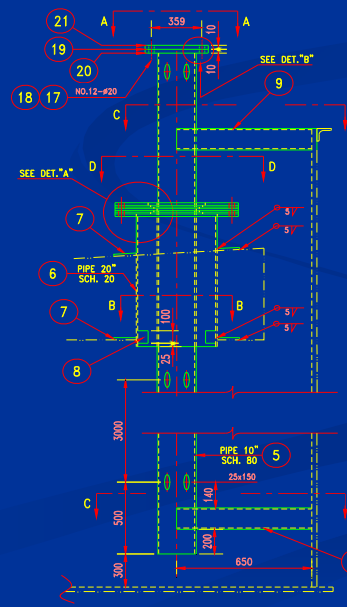
ANCHOR BOLT

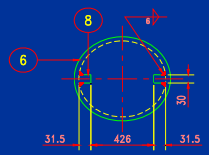
NOTE :
1- ALL DIMENSIONS ARE IN mm.
2- DOUBLE SEALS ARE RECOMENDED , THE PRIMARY SEAL MUST BE FOAM SEAL AND PREFERLY KISS TYPE.

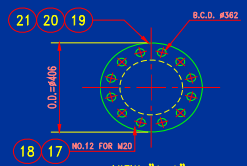


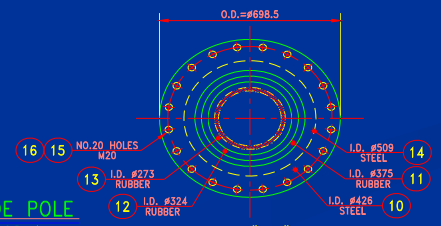












GUIDE POLE
NO.1

TOTAL WEIGHT=2722.8 (Kg)

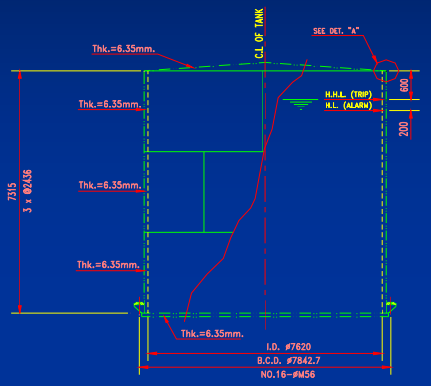
No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL WEIGHT /Kg	MATERIAL	REMARK
21	PLATE t10xO.D.ø406	1	10.2	10.2	ST-37	
20	PLATE t10xO.D.ø406xI.D.ø274	1	5.5	5.5	ST-37	
19	t3xO.D.ø406xI.D.ø274	1	1.6	1.6	JACKETED ASBESTOS	
18	HEX. NUT. M20	24	0.1	2.4	SA194-Gr.2H	
17	STUD BOLT M20, L=110	12	0.2	2.4	SA193-Gr.B7	
16	HEX. NUT. M20	40	0.1	4	SA194-Gr.2H	
15	STUD BOLT M20, L=160	20	0.3	6	SA193-Gr.B7	
14	PLATE t10xO.D.ø698.5xI.D.ø509	1	14	14	ST-37	
13	RUBBER t10xO.D.ø698.5xI.D.ø273	1	0.5	0.5	RUBBER	
12	RUBBER t10xO.D.ø698.5xI.D.ø324	2	0.4	0.8	RUBBER	
11	RUBBER t10xO.D.ø688.5xI.D.ø375	2	0.4	0.8	RUBBER	
10	PLATE t10xO.D.ø698.5xI.D.ø426	1	19	19	ST-37	
9	[160, L=1300	4	24	96	ST-37	BRACING
8	FLAT t30x31.5x100	2	0.7	1.4	ST-37	
7	REINF. t8xO.D.=ø750xI.D.=ø513	2	14.7	29.4	ST-37	
6	PIPE 20", SCH.20, L=1200	1	140	140	SA106-Gr.B	
5	PIPE 10", SCH.80, L=15230	1	1500	1500	SA106-Gr.B	GUIDE POLE
4	FLAT BAR100-t10, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE t30x150x180	20	6.3	126	ST-37	WASHER
2	PLATE t30x210x240	20	11.8	236	ST-37	TOP PLATE
1	PLATE t22x350x210	40	12.7	508	ST-37	GUSSET PLATE

BILL OF MATERIAL

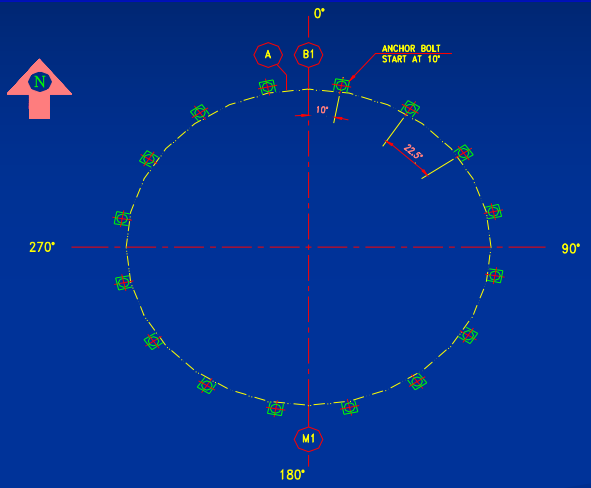
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTORS: IPAP PANN AZMAYAN POOYANDEH CO.
DWG. TITLE: RETROFITTING DWG. OF TK-2034
LOCATION: SOUTH REFINERY
SCALE: N.T.S.
UNIT NAME: TANKAGE AREA
DRAWING NO.: EQ-S-M-D-TK2034-02-00
SHEET NO.: 1 OF 1
REV.: 0

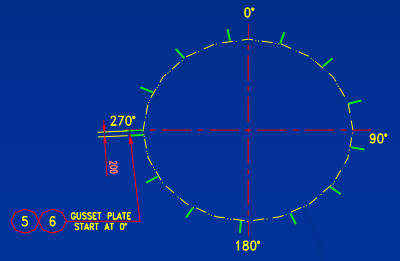
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



GENERAL VIEW OF TANK
2TK-2301

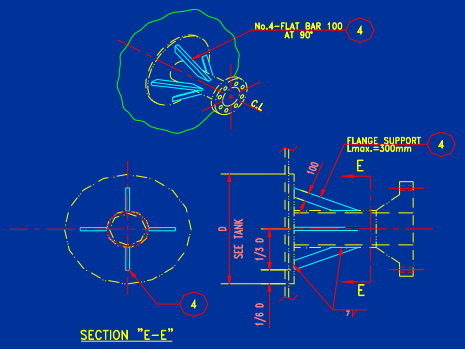


TOP VIEW OF TANK

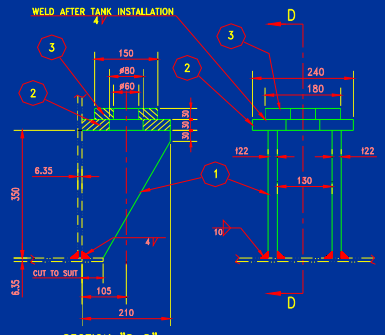


TOP VIEW OF TANK
GUSSET PLATE

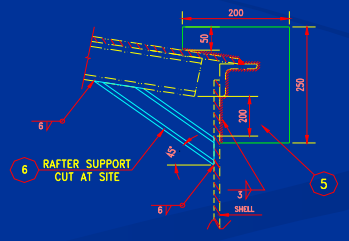
NOTE :
1- ALL DIMENSIONS ARE IN mm.



SECTION "E-E"



SECTION "D-D"



INLET & OUTLET NOZZLE REINFORCING

ANCHOR BOLT

DETAIL "A"

TOTAL WEIGHT=1156.8 (Kg)

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
6	IPB 200,L=FIT AT SITE	13	30	390	ST-37	RAFTER SUPPORT
5	PLATE 110x200x250	13	4	52	ST-37	GUSSET PLATE
4	FLAT BAR100-110, L=FIT AT SITE	8	2.35	18.8	ST-37	FLANGE SUPPORT
3	PLATE t30x150x180	16	6.3	100.8	ST-37	WASHER
2	PLATE t30x210x240	16	11.8	188.8	ST-37	TOP PLATE
1	PLATE t22x350x210	32	12.7	406.4	ST-37	GUSSET PLATE

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.A	M.B	P.M.	H.A

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE
FOR
TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FANN AZMAYAN POOYANDEH CO.

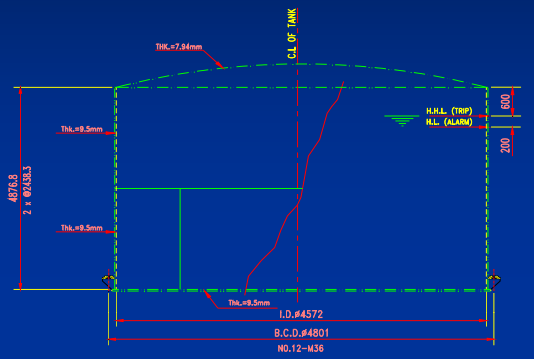
DWG. TITLE:
RETROFITTING DWG. OF
2TK-2301

LOCATION: NORTH REFINERY

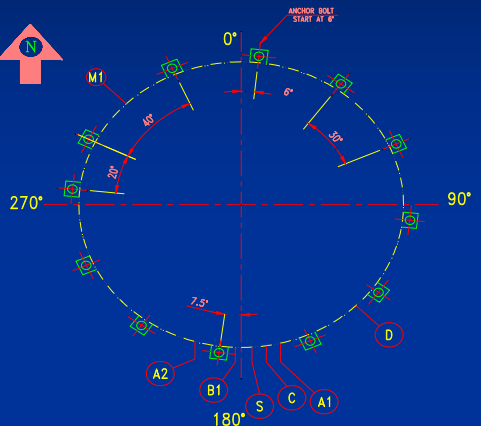
SCALE: N.T.S. UNIT NAME : TANKAGE AREA

DRAWING NO. EQ-N-M-D-2TK2301-02-00 SHEET NO. 1 OF 1 REV. 0

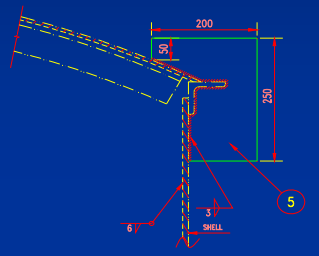
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)



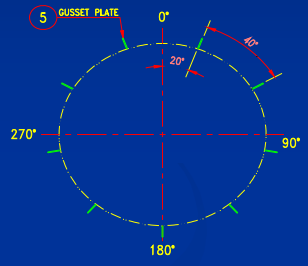
GENERAL VIEW OF TANK
2TK-621



TOP VIEW OF TANK

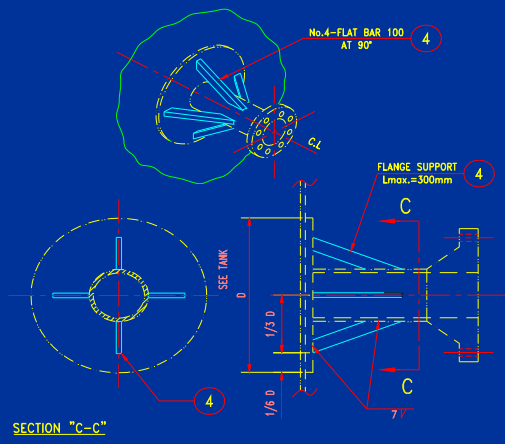


DETAIL "A"



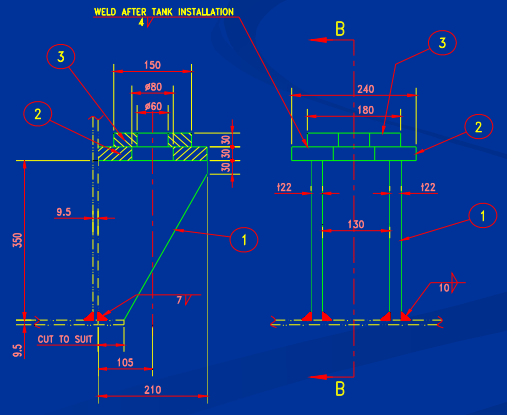
TOP VIEW OF TANK
GUSSET PLATE

NOTE :
1- ALL DIMENSIONS ARE IN mm.



SECTION "C-C"

INLET & OUTLET NOZZLE REINFORCING



SECTION "B-B"

ANCHOR BOLT

TOTAL WEIGHT=586.2 (Kg)

No.	DESCRIPTION	QTY.	UNIT WEIGHT /Kg	TOTAL	MATERIAL	REMARK
5	PLATE 110x200x250	8	4	36	ST-37	GUSSET PLATE
4	FLAT BAR100-110, L=FIT AT SITE	12	2.35	28.2	ST-37	FLANGE SUPPORT
3	PLATE 130x150x180	12	6.3	75.6	ST-37	WASHER
2	PLATE 130x210x240	12	11.8	141.6	ST-37	TOP PLATE
1	PLATE 122x350x210	24	12.7	304.8	ST-37	GUSSET PLATE

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	83.7.29	FIRST ISSUED	A.P	A.A	M.B	H.A

PROJECT NAME:
SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT:
N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR:
PAYA PAYANDEH CO.
PAYA AZMAYAN PAYANDEH CO.

DWG. TITLE:
RETROFITTING DWG. OF 2TK-621

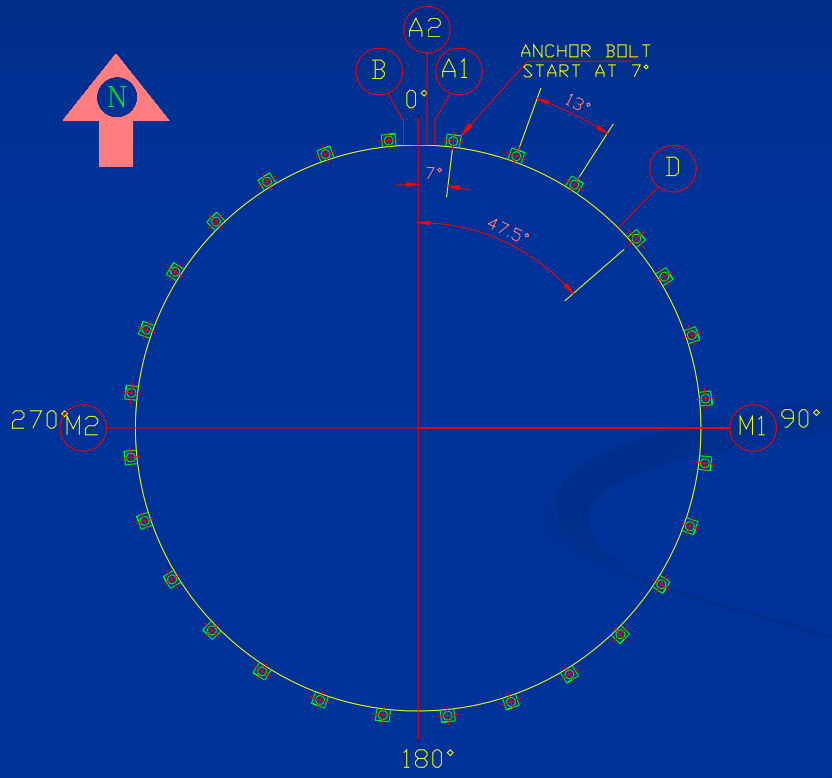
LOCATION:
NORTH REFINERY

SCALE: N.T.S.
UNIT NAME: TANKAGE AREA

DRAWING NO: EQ-N-M-D-2TK621-02-00
SHEET NO: 1 OF 1
REV. 0

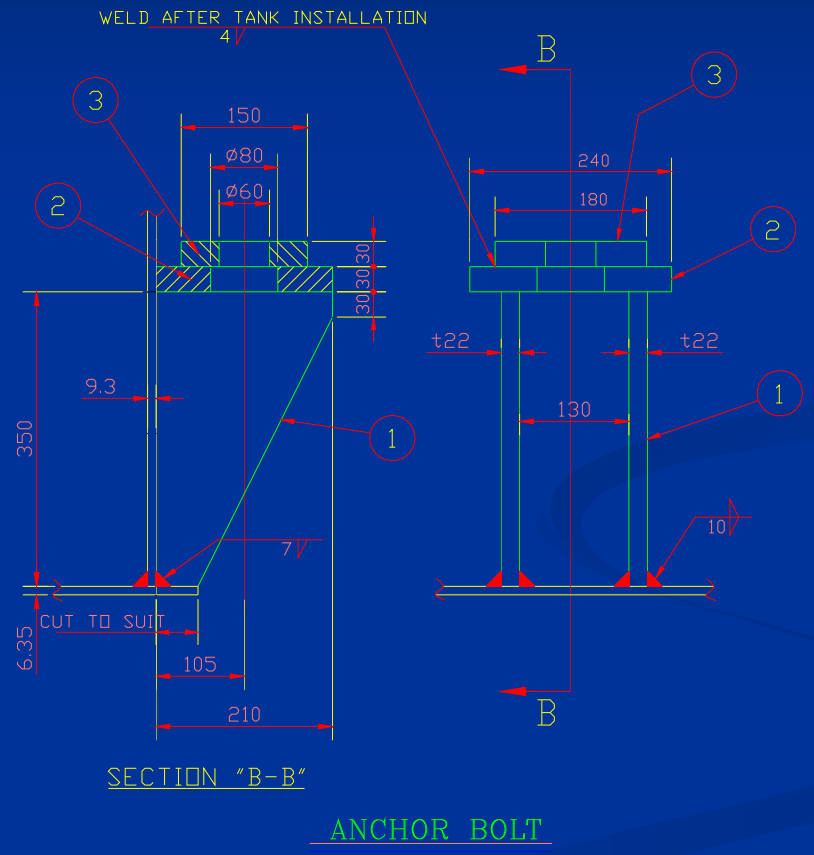
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Anchor Bolts Orientation For Storage Tank



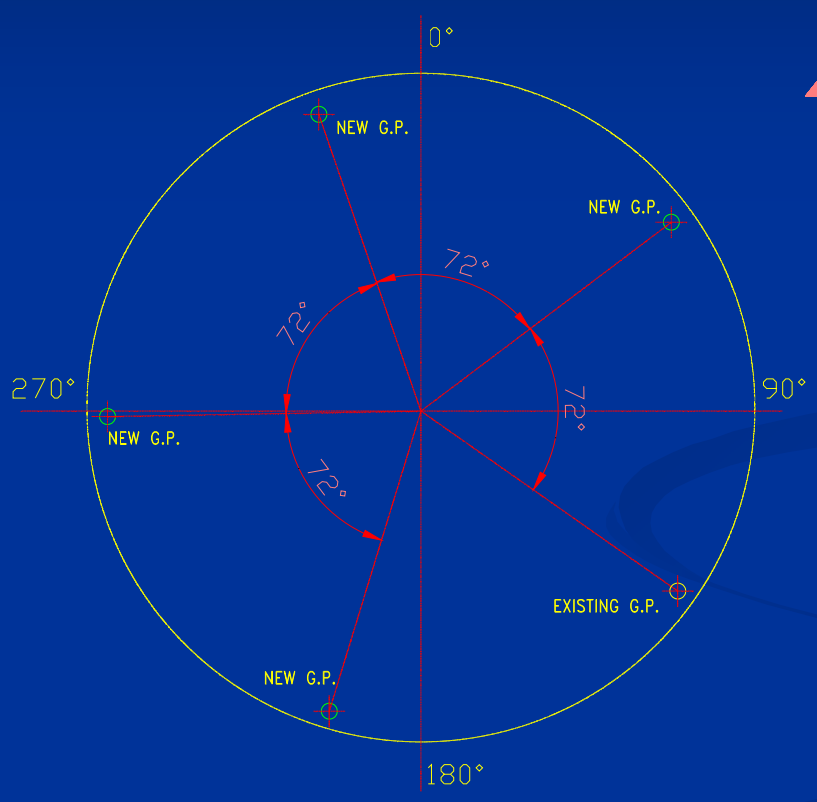
TOP VIEW OF TANK

Anchor Bolts Detail of Storage Tank



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

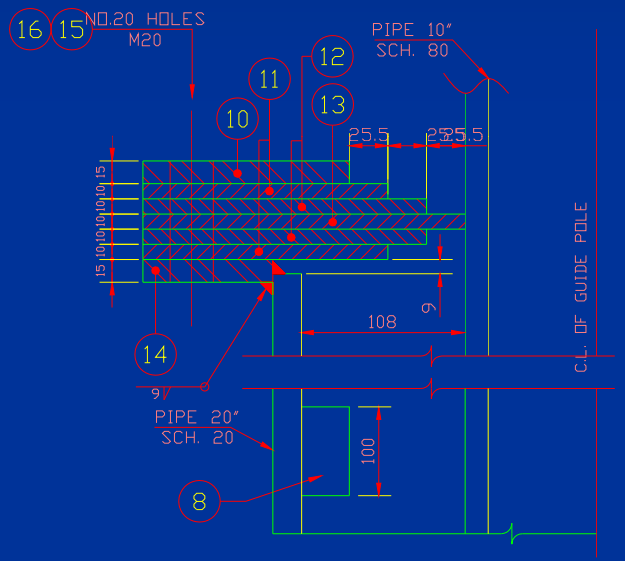
Guide Pole Orientation For Floating Roof Storage Tank

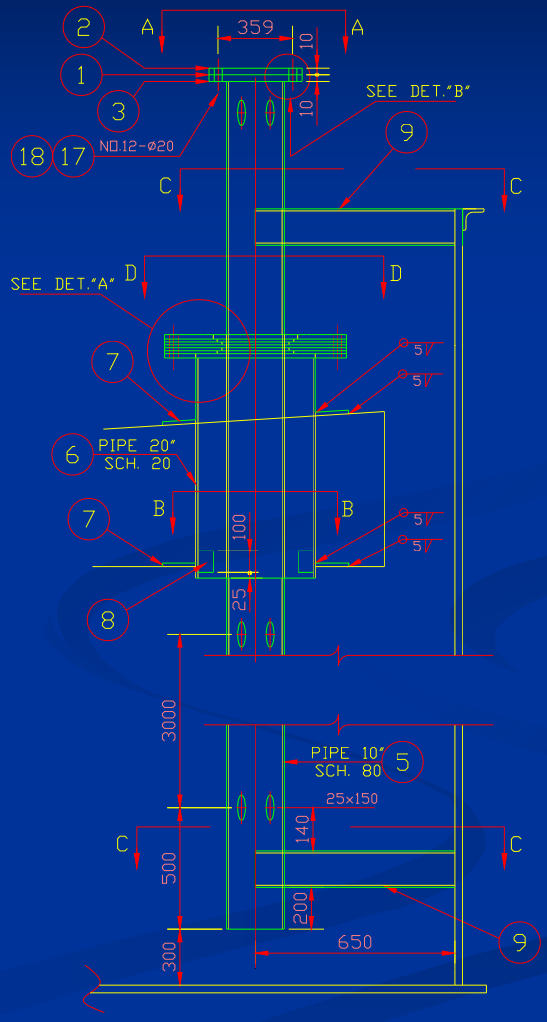


TOP VIEW OF TANK

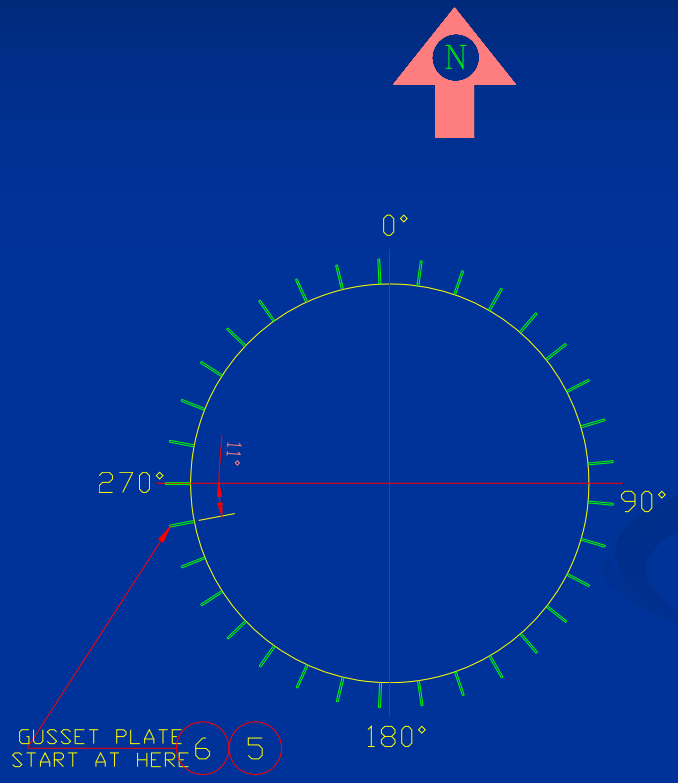
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Guide Pole Detail For Floating Roof Storage Tank





Gusset Plate & Gusset Beam Orientation For Storage Tank



TOP VIEW OF TANK

GUSSET PLATE

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

یادداشت

FRANGIBLE

A_f $A_f < A^*$

$$A^* = \frac{(0.153)(W)}{(30800)\,tg\theta}$$

A_f

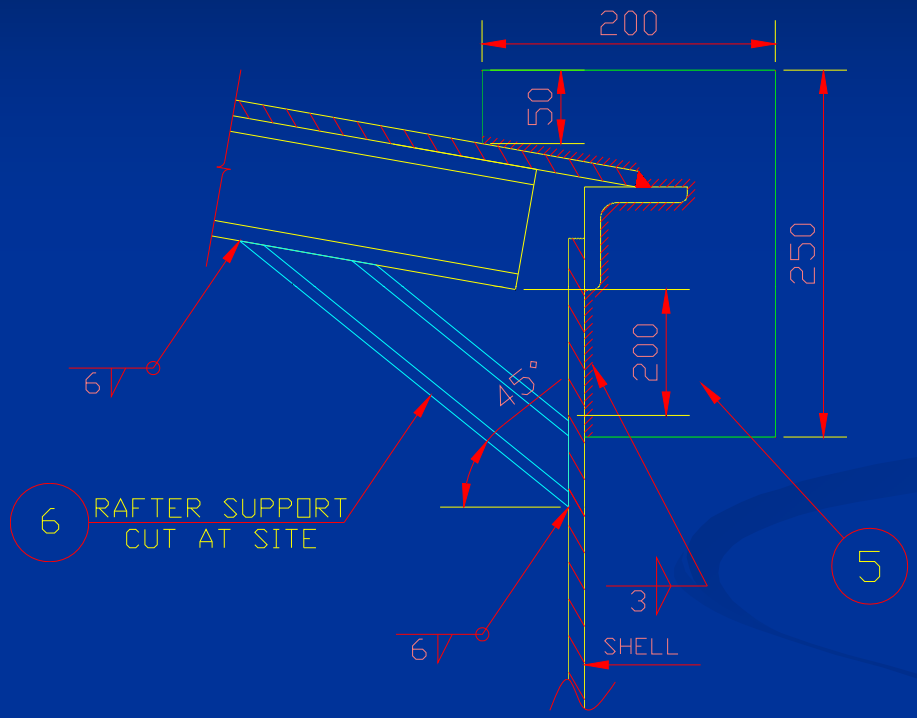
$$A^* = \frac{D^2(P - 8t_h)}{30800\,(tg\theta)}$$

t_h: internal, In

$$A^{**} = \frac{D^2}{3000\,\sin\theta}$$ Cone Self Support

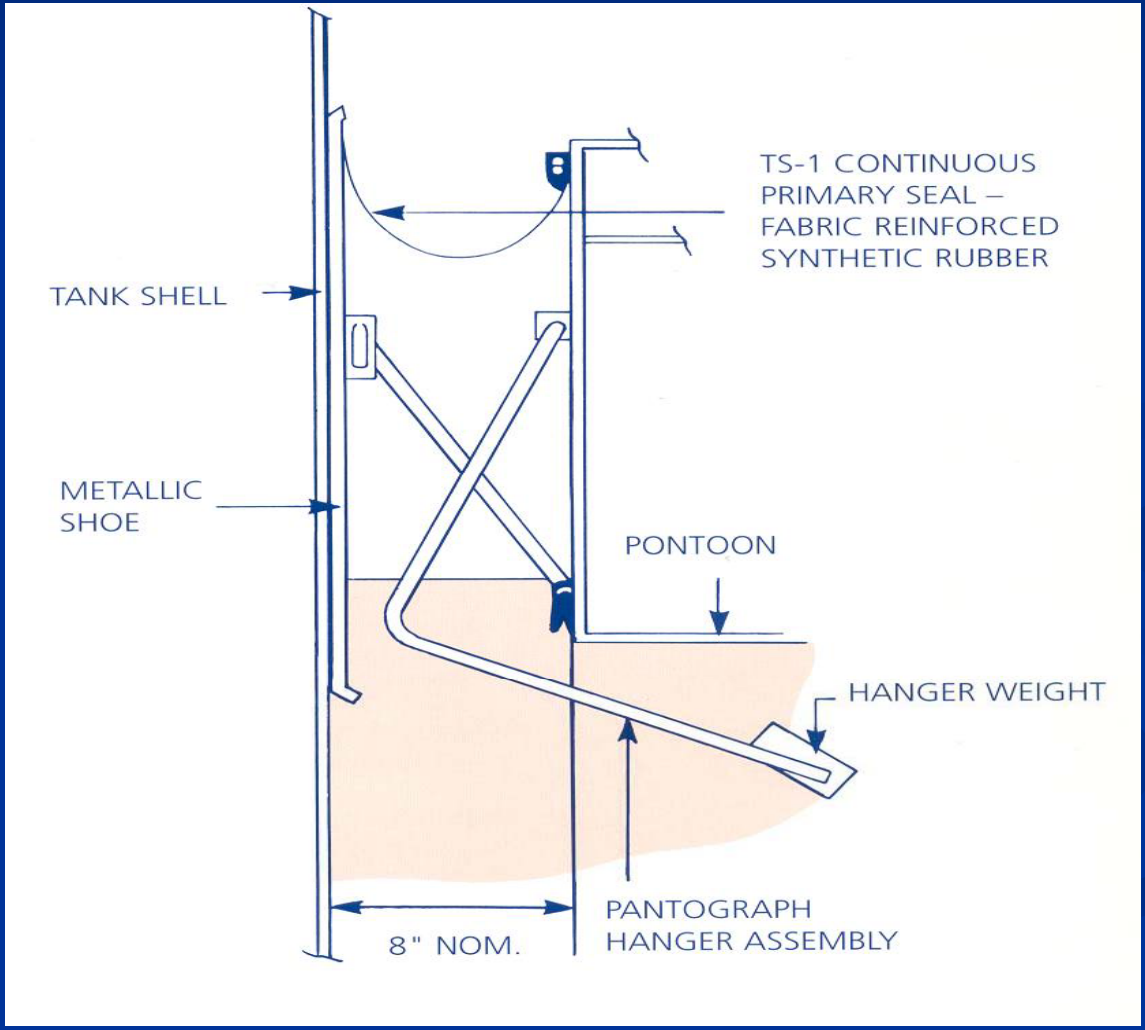
$$A^{**}{}_{Shell} = \frac{(D)(r)^{1/2}}{1500}$$ Dome Self Support

Gusset Plate & Gusset Beam Detail For Storage Tank



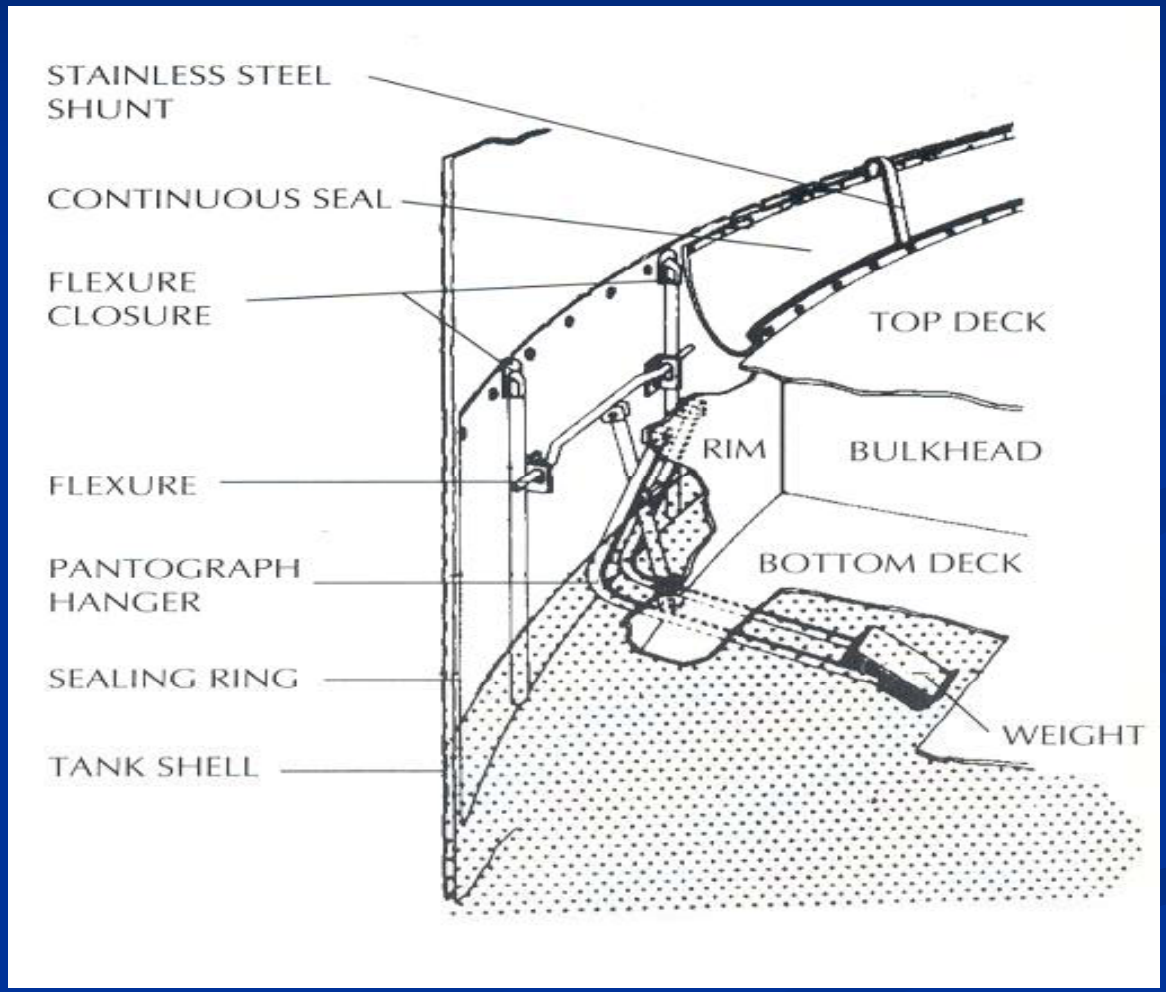
DETAIL "A"

Pantograph Sealing for Storage Tanks



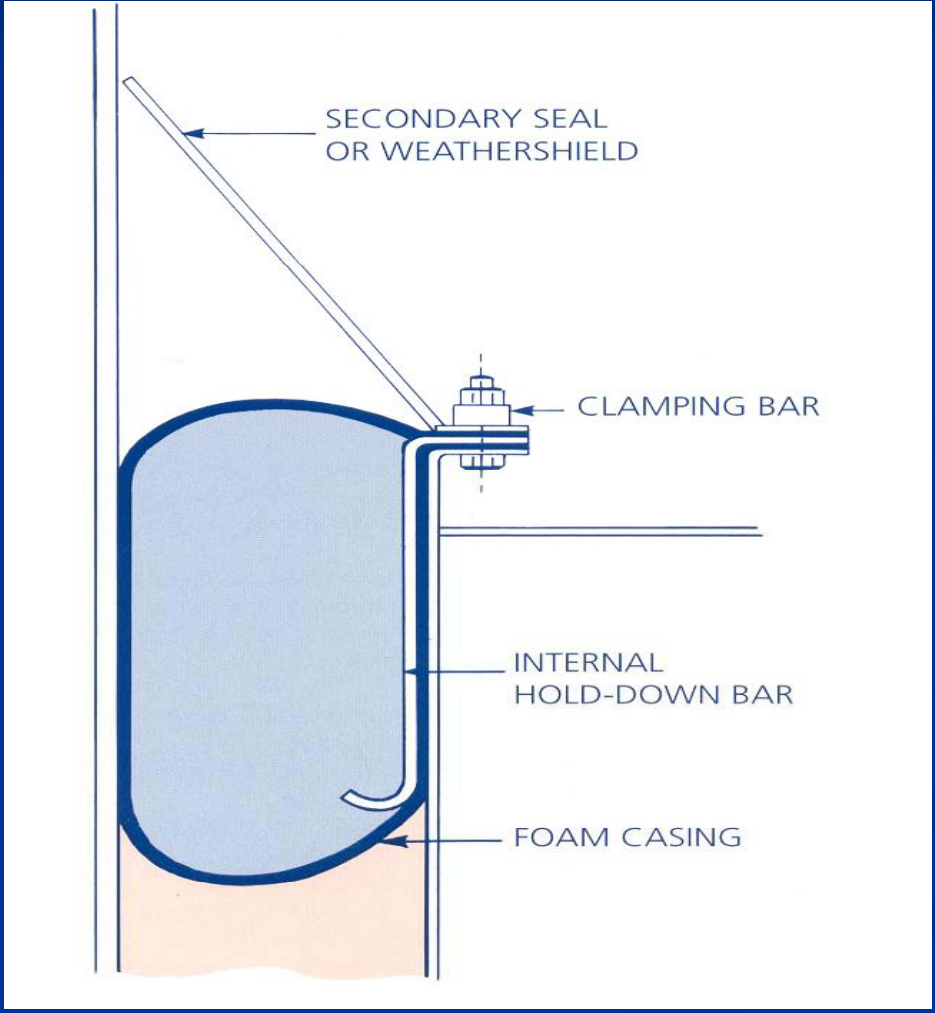
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Pantograph Sealing for Storage Tanks



Firing Due to Lateral Movement of Floating Roof Storage Tank

Foam Seal
For
Floating Roof Storage Tank



TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

RESULT :

1- DECREASING THE OVERTURNING MOMENT FOR STORAGE TANKS BY REDUCING OF LEVEL LIQUIDE, IF IT IS POSSIBLE.

2- USE ANCHOR BOLTS FOR DECREASING LATERAL & VERTICAL MOVEMENT OF STORAGE TANKS.

3- USE DOUBLE SEAL FOR FLOATING ROOF STORAGE TANKS.

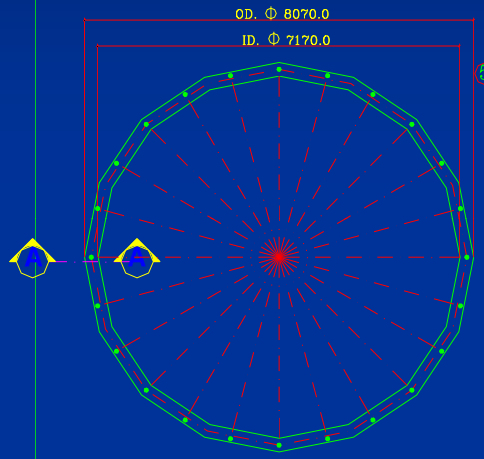
4- CHANGE CONNECTION FROM SIMPLE SUPPORT TO FIXED SUPPORT IN STEEL STRUCTURE OF FIXED ROOF STORAGE TANKS.

5- USE EXTRA GUIDE POLES FOR FLOATING ROOF STORAGE TANKS.

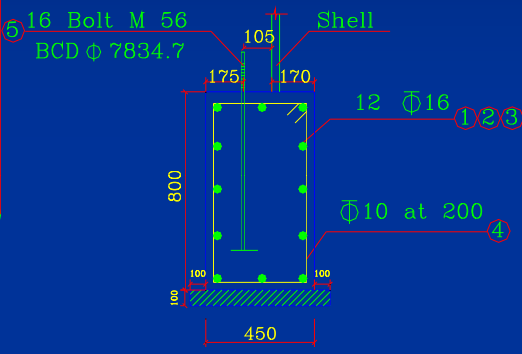
TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

Foundation Retrofitting Drawing

Tank Foundation Retrofitting



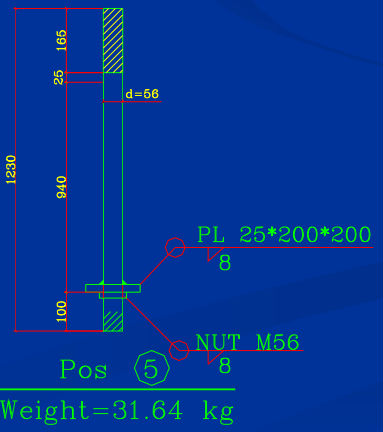
Plan Of Ring-Wall



Section Of Ring-Wall A-A

TK-2301-Round Bar Scheduale

POS	Φ	NO	Shape (mm)	L (m)	T.L (m)	U.W (kg)	W (kg)	T.W (kg)
1	16	12	3000	3.00	36.00	1.58	56.88	
2	16	6x12	4000	4.00	288.00	1.58	455.04	
3	16	12	4619	4.62	59.64	1.58	87.58	
4	10	120	680 / 100 / 310	2.14	256.80	0.617	158.45	
5	56	16				31.64	506.24	
								1264.16



یادآوریهای عمومی

۱- پیمانکار باید قبل از شروع عملیات اجرایی کلیه اندازه های مندرج در نقشه ها را کنترل و تایید نماید.

۲- بتن مگر مصرفی دارای عیار حداقل ۲۰۰ کیلو سیمان در هر متر مکعب بتن میباشد.

۳- کلیه میلگرد های مصرفی از نوع آجدار AIII میباشند که حد جاری شدن آن ۴۰۰۰ کیلوگرم بر سانتیمتر مربع میباشد

۴- بتن مصرفی از نوع B-300 با عیار سیمان حداقل ۳۵۰ کیلو سیمان در هر متر مکعب بتن وبا مقاومت Fc=240 kg/cm^2 روی نمونه ۲۸ روزه استوانه ای میباشد.

۵-تنش مجاز خاک در طراحی پی ۲ کیلوگرم بر سانتیمتر مربع بر اساس بند ۳-۳ گزارش مکانیک خاک در نظر گرفته شده است

۶- پوشش بتن روی میلگرد پی ها ۷ سانتیمتر در نظر گرفته شود

۷- سفره زیرین میلگردها باید به کمک قطعات ماسه سیمان یا زیر سریهای پلاستیکی از کف پی بالاتر نگه داشته شوند.

۸- کلیه نقشه ها باید در ارتباط با هم خوانده شوند.

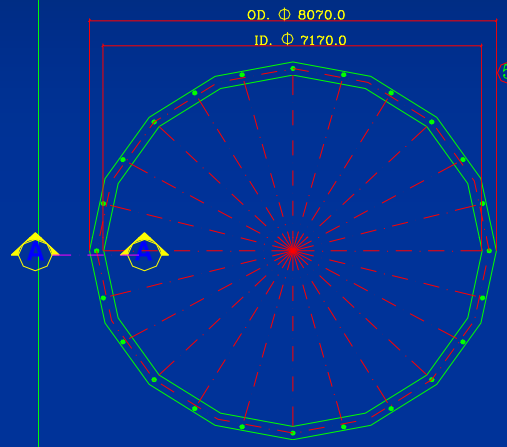
۹- کلیه اندازه ها به میلیمتر میباشند

NOTE:
FOR DETAIL OF LEAK DETECTION PIPE
SEE DRAWING HSE-SN-M-TANKS-01-00.

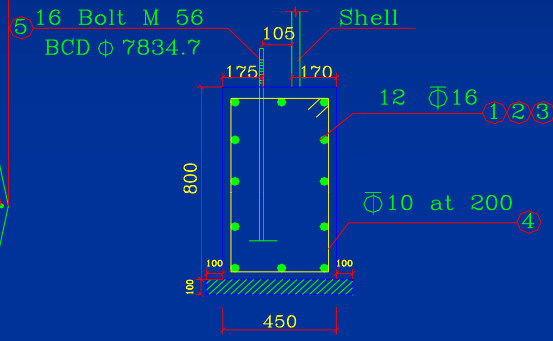
REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	11/05	FIRST ISSUED	S.A	S.A	A.M	

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: FAP PANN AZMAYAN POOYANDEH CO.
DWG. TITLE: Retrofitting Drawing
TANK (TK.2301) foundation plan & section
LOCATION: SOUTH REFINERY
SCALE: N.T.S. UNIT NAME : SOUTH TANKAGE AREA
DRAWING NO. BQ-S-S-D-TK2301-01-01 SHEET NO. 1 REV. 1

Tank Foundation Retrofitting



Plan Of Ring-Wall



Section Of Ring-Wall A-A

یادآوریهای عمومی

۱- پیمانکار باید قبل از شروع عملیات اجرایی کلیه اندازه های مندرج در نقشه ها را کنترل و تایید نماید.

۲- بتن مگر مصرفی دارای عیار حداقل ۳۰۰ کیلو سیمان در هر متر مکعب بتن میباشد.

۳- کلیه میلگرد های مصرفی از نوع آجدار AIII میباشند که حد جاری شدن آن ۴۰۰۰ کیلوگرم بر سانتیمتر مربع میباشد

۴- بتن مصرفی از نوع B-300 با عیار سیمان حداقل ۳۵۰ کیلو سیمان در هر متر مکعب بتن وبا مقاومت Fc=240 kg/cm^2 روی نمونه ۲۸ روزه استوانه ای میباشد.

۵-تنش مجاز خاک در طراحی پی ۲ کیلوگرم بر سانتیمتر مربع بر اساس بند ۳-۳ گزارش مکانیک خاک در نظر گرفته شده است

۶- پوشش بتن روی میلگرد پی ها ۷ سانتیمتر در نظر گرفته شود

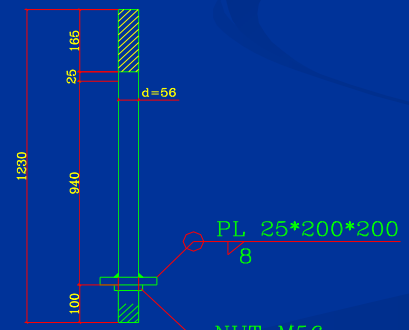
۷- سفره زیرین میلگردها باید به کمک قطعات ماسه سیمان یا زیر سریهای پلا ستیکی از کف پی بالاتر نگه داشته شوند.

۸- کلیه نقشه ها باید در ارتباط با هم خوانده شوند.

۹- کلیه اندازه ها به میلیمتر میباشند

TK-2302-Round Bar Scheduale

POS	Φ	NO	Shape (mm)	L (m)	T.L (m)	U.W (kg)	W (kg)	T.W (kg)
1	16	12	3000	3.00	36.00	1.58	56.88	
2	16	6x12	4000	4.00	288.00	1.58	455.04	
3	16	12	4619	4.62	59.64	1.58	87.58	
4	10	120	660, 100, 310	2.14	256.80	0.617	158.45	
5	56	16				31.64	506.24	
								1264.18



Pos 5

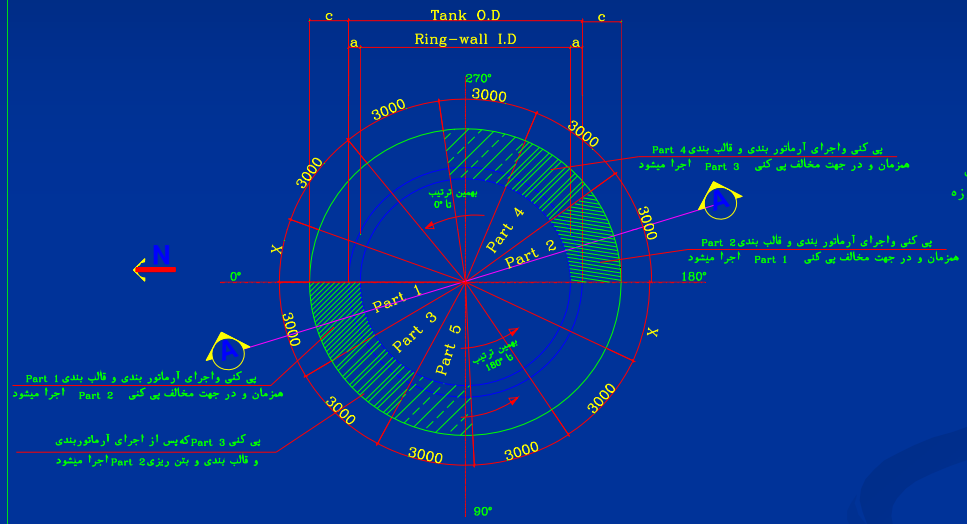
Weight=31.64 kg

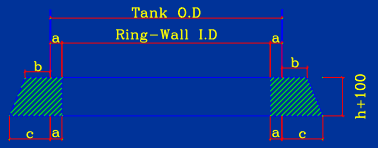
NOTE:
FOR DETAIL OF LEAK DETECTION PIPE
SEE DRAWING HSE-SN-M-TANKS-01-00.

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
0	11/95	FIRST ISSUED	S.A	S.A	A.M	

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY
CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY
CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.
DWG. TITLE: Retrofitting Drawing
TANK (TK.2302) foundation plan & section
LOCATION: SOUTH REFINERY
SCALE: N.T.S.
UNIT NAME : SOUTH TANKAGE AREA
DRAWING NO. EQ-S-S-D-TK2302-01-01
SHEET NO. 1
REV. 1

Tank Foundation Retrofitting Procedure (1)





SECTION A-A

پلان - مقطع و ترتیب پی کنی

یادآوریهای عمومی

۱- پیمانکار باید قبل از شروع عملیات اجرایی کلیه اندازه های مندرج در نقشه ها را کنترل و تایید نماید.

۲- بتن مگر مصرفی دارای عیار حداقل ۲۰۰ کیلو سیمان در هر متر مکعب بتن میباشد.

۳- کلیه میلگرد های مصرفی از نوع آجدار AIII میباشند که حد جاری شدن آن ۴۰۰۰ کیلوگرم بر سانتیمتر مربع میباشد

۴- بتن مصرفی از نوع B-300 با عیار سیمان حداقل ۳۵۰ کیلو سیمان در هر متر مکعب بتن وبا مقاومت Fc=240 kg/cm^2 روی نمونه ۲۸ روزه استوانه ای میباشد.

۵-تنش مجاز خاک در طراحی پی ۲ کیلوگرم بر سانتیمتر مربع بر اساس بند ۳-۳ گزارش مکانیک خاک در نظر گرفته شده است

۶- پوشش بتن روی میلگرد پی ها ۷ سانتیمتر در نظر گرفته شود

۷- سفره زیرین میلگردها باید به کمک قطعات ماسه سیمان یا زیر سریهای پلا ستیکی از کف پی بالاتر نگه داشته شوند.

۸- کلیه نقشه ها باید در ارتباط با هم خوانده شوند.

۹- کلیه اندازه ها به میلیمتر میباشند

۱۰- ابعاد مقاطع پی کنی هر مخزن هنگام اجرا توسط پیمانکار و دستگاه نظارت اندازه گیری و صورتجلسه میشود.

۱۱- در صورت لزوم و با هما هنگی دستگاه نظارت اندازه و تعداد تقسیمات طول قوس پی مخازن قابل تغییر میباشد.

۱۲- میل گرد مصرفی در انکر بولت ها از نوع نرمه AII با FY=2400 kg/cm2

۱۳- موقعیت استقرار اولین انکر بولت با توجه به شرایط محلی هرکدام از مخازن در هنگام اجرا توسط دستگاه نظارت و پیمانکار تعیین و صورتجلسه میشود

۱۴- در صورت تداخل احتمالی هر کدام از انکر بولت ها با موقعیت نازل های مخازن محل انکر بولت ها با نظر دستگاه نظارت تعیین خواهد شد.

n= تعداد تقسیمات نصف محیط پی به طول قوسهای مساوی ۳ متری بر اساس O.D مخزن

X=(n x 3000) - نصف محیط براساس O.D هر مخزن

a,h = طبق اندازه مندرج در نقشه مربوط به هر مخزن

c,b = بر اساس اندازه گیری در محل هنگام اجرا برای هر مخزن

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
2						
1	84.2	DESIGN PROGRESS	S.A	A.M	A.M	
0	83.6	FIRST ISSUED	S.A	A.M	A.M	

PROJECT NAME: SEISMIC DESIGN & RETROFIT PROCEDURE FOR TEHRAN OIL REFINING COMPANY

CLIENT: N.I.O.C. TEHRAN OIL REFINERY COMPANY

CONTRACTOR: FAP FANN AZMAYAN POOYANDEH CO.

DWG. TITLE: Retrofitting Drawing

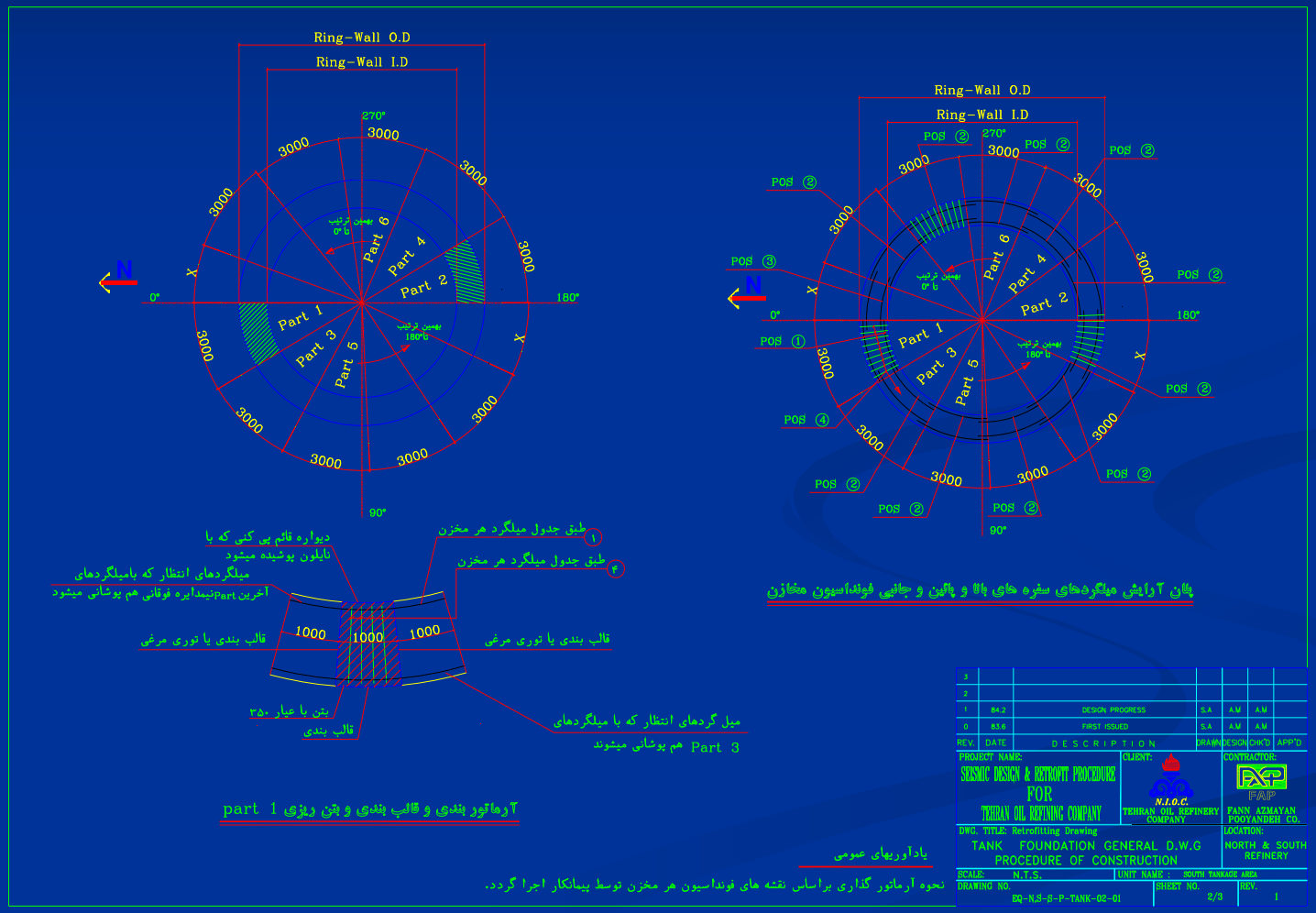
TANK FOUNDATION GENERAL D.W.G PROCEDURE OF CONSTRUCTION

LOCATION: NORTH & SOUTH REFINERY

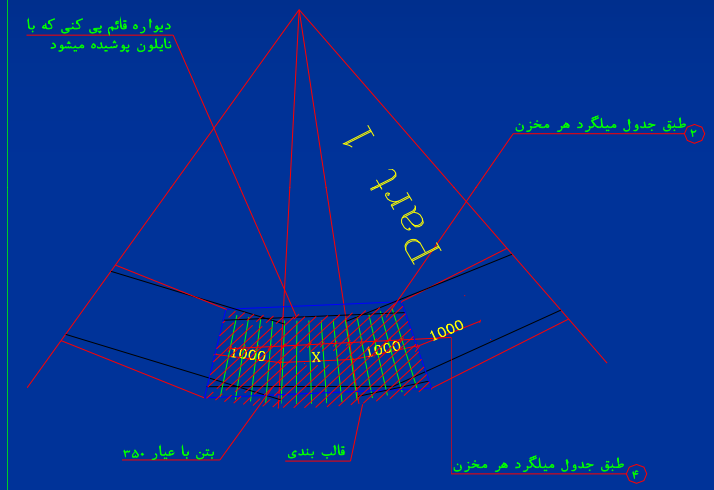
SCALE: N.T.S. UNIT NAME: SOUTH TANKAGE AREA

DRAWING NO. EQ-N,S-S-P-TANK-01-01 SHEET NO. 1/3 REV. 1

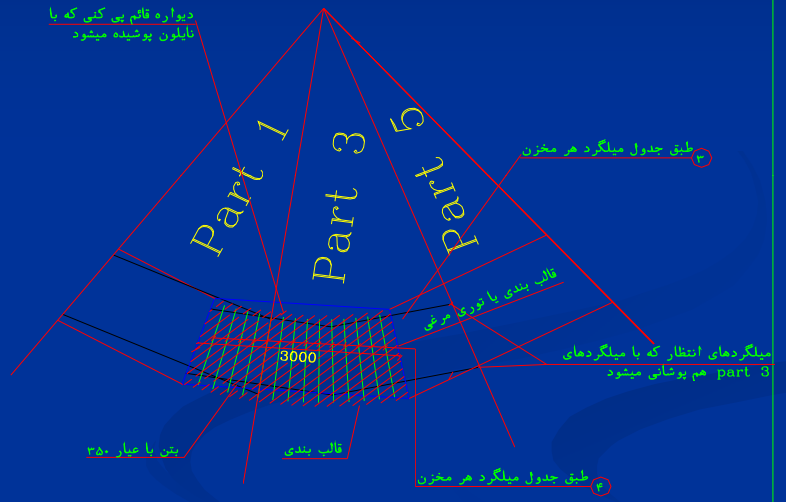
Tank Foundation Retrofitting Procedure (2)



Tank Foundation Retrofitting Procedure (3)



آرماتور بندی و قالب بندی و بتن ریزی آخرین part



آرماتور بندی و قالب بندی و بتن ریزی part2 الیpartماقبل آخر از هر نیمدایره

REV.	DATE	DESCRIPTION	DRAWN	DESIGN	CHK'D	APP'D
3						
2						
1	84.2	DESIGN PROGRESS	S.A	A.M	A.M	
0	83.6	FIRST ISSUED	S.A	A.M	A.M	

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TANK FOUNDATION GENERAL D.W.G
PROCEDURE OF CONSTRUCTION

LOCATION: NORTH & SOUTH REFINERY

SCALE: N.T.S. UNIT NAME : SOUTH TANKAGE AREA

DRAWING NO. EQ-N,S-S-P-TANK-03-01 SHEET NO. 3/3 REV. 1

TARAVOSH JAM
DESIGN &ENG.CO(P.J.S)

THE END