Drillingsoftware
Casing Design User Manual

1. Introduction

   Working Stress Design (WSD) loads are evaluated throughout the entire length of the casing from the Well Head to the Casing Shoe. True Vertical Depth (TVD) is now fully linked to Vertical Well Geometry or Directional Well Geometry. Accurate TVD's are used for precise Burst, Collapse and Tensile load calculations. User defined Custom Casing Specifications can also be incorporated into the design. The program is designed to take the user through a logical sequence to achieve the optimum casing design.

2. Operation

   A. Menu

Fig. 1 Menu

On the Menu page, selecting About This Program and the WSD Parameters buttons explain the program parameters. Selecting Enter Design Survey shows the Directional/Survey page. Selecting Utilities shows the contact details of drillingsoftware. Selecting Exit closes the program.

B. Set-up

To set-up the design program select Enter Design Survey, The Directional/Survey page is shown

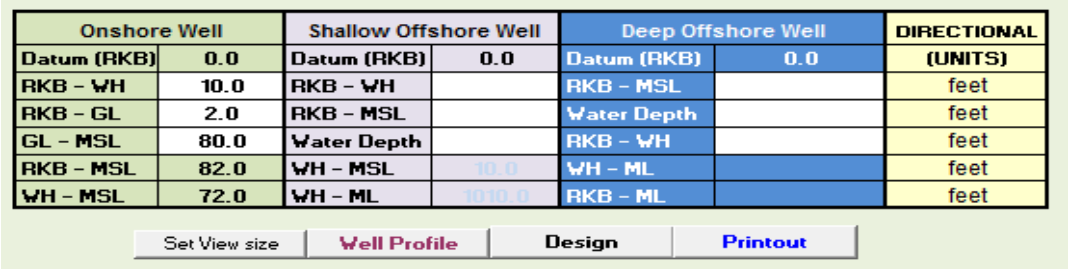


Fig.2 Directional/Survey Page Buttons

On the top of the Directional/Survey page are four buttons (Ref. Fig. 2A). These buttons are:

- Set View size selecting this shows an option to increase or decrease the magnification
- Well Profile selecting this shows the Well Profile data form (Ref. Fig. 3)
- Design selecting this shows the Design page (Ref. Fig. 4)
- Printout prints the Survey page.

(1) Well Data

Before proceeding with the casing design, the Well Profile must be established. On the Directional/Survey page, select Well Profile. The Well Profile data form is shown (Ref. Fig. 3).

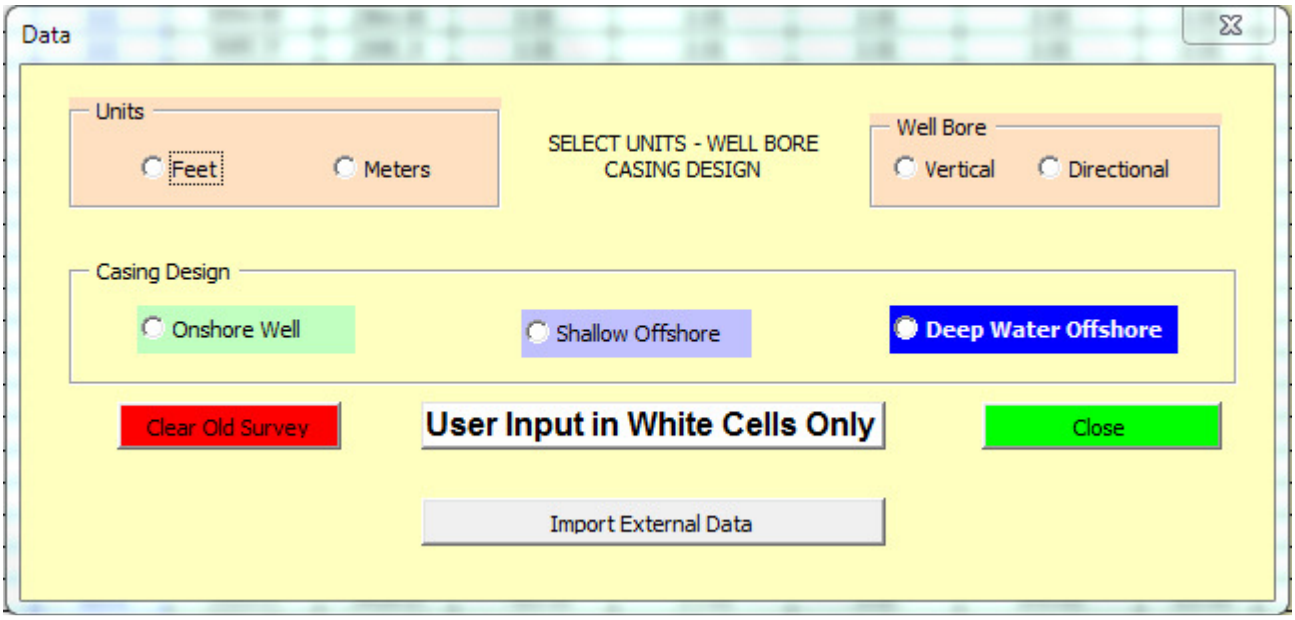


Fig.3 Well Profile Data Form

On the Well Profile data form, these parameters are selected:

- Units (Feet or Meters)
- Well Bore (Vertical or Directional)
- Casing Design (Onshore Well, Shallow Offshore or Deep Water Offshore).

Before entering new data, old data is cleared by using the Clear Old Survey button.

After the Well Profile data is entered, selecting Close shows the Directional/Survey page. On the Directional/Survey page the selected well data is entered.

(a) Vertical Well (Ref. Fig. 3A)

Onshore Well		Shallow Offshore Well		Deep Offshore Well		VERTICAL
Datum (RKB)	0.0	Datum (RKB)	0.0	Datum (RKB)	0.0	(UNITS)
RKB – WH	10.0	RKB – WH		RKB – MSL		feet
RKB – GL	2.0	RKB – MSL		Water Depth		feet
GL – MSL	80.0	Water Depth		RKB – WH		feet
RKB – MSL	82.0	WH – MSL	10.0	WH – ML		feet
WH – MSL	72.0	WH – ML	1010.0	RKB – ML		feet

Set View size | Well Profile | Design | Printout

Vertical Section Azim 0 °

SURVEY #	MD (ft)	INCL °	AZIM °	TVD (ft)	TVD SS (ft)	N/-S (ft)	E/-W (ft)	DLS (100ft)	Closure (ft)	AZIM °	Vert Sect (ft)
RKB	0.00	0.00	0.00	0.00	-82.00	0.00	0.00	0.00	0.00	0.00	0.00
1	10,000.0	0.0	0.0	10000.00	9918.00	0.00	0.00	0.00	0.00	0.00	0.00

Fig.3A Vertical Well

A Vertical Well requires these inputs:

- The Measured Depth (MD)
- The Inclination (0˚)
- The Azimuth (0˚).

External data can also be imported.

(b) Directional Well (Fig. 3B)

Onshore Well		Shallow Offshore Well		Deep Offshore Well		DIRECTIONAL
Datum (RKB)	0.0	Datum (RKB)	0.0	Datum (RKB)	0.0	(UNITS)
RKB - WH	10.0	RKB - WH		RKB - MSL		feet
RKB - GL	2.0	RKB - MSL		Water Depth		feet
GL - MSL	80.0	Water Depth		RKB - WH		feet
RKB - MSL	82.0	WH - MSL	10.0	WH - ML		feet
WH - MSL	72.0	WH - ML	1010.0	RKB - ML		feet

Set View size | Well Profile | Design | Printout

Vertical Section Azim 177.4 °

SURVEY #	MD (ft)	INCL °	AZIM °	TVD (ft)	TVD SS (ft)	N/-S (ft)	E/-W (ft)	DLS (100ft)	Closure (ft)	AZIM °	Vert Sect (ft)
RKB	0.00	0.00	0.00	0.00	-82.00	0.00	0.00	0.00	0.00	0.00	0.00
1	9,821.5	0.0	177.4	9821.50	9739.50	0.00	0.00	0.00	0.00	0.00	0.00
2	9,921.6	3.0	177.4	9921.52	9839.52	-2.62	0.12	3.00	2.62	177.40	2.62
3	10,021.6	6.0	177.4	10021.20	9939.20	-10.45	0.47	3.00	10.46	177.40	10.46
4	10,121.6	9.0	177.4	10120.33	10038.33	-23.49	1.07	3.00	23.52	177.40	23.52
5	10,221.6	12.0	177.4	10218.65	10136.65	-41.69	1.89	3.00	41.74	177.40	41.74
6	10,321.6	15.0	177.4	10315.88	10233.88	-65.01	2.95	3.00	65.08	177.40	65.08
7	10,421.6	18.0	177.4	10411.75	10329.75	-93.38	4.24	3.00	93.48	177.40	93.48
8	10,521.6	21.0	177.4	10506.00	10424.00	-126.72	5.75	3.00	126.85	177.40	126.85
9	10,621.0	24.0	177.4	10597.83	10515.83	-164.72	7.48	3.02	164.89	177.40	164.89
10	10,721.0	27.0	177.4	10688.08	10606.08	-207.72	9.43	3.00	207.94	177.40	207.94
11	10,821.6	30.0	177.4	10776.47	10694.47	-255.67	11.61	2.98	255.93	177.40	255.93
12	10,907.6	32.6	177.4	10849.95	10767.95	-300.28	13.64	3.00	300.59	177.40	300.59
13	10,921.6	33.0	177.4	10861.73	10779.73	-307.86	13.98	3.00	308.17	177.40	308.17
14	10,964.0	34.3	177.4	10897.03	10815.03	-331.32	15.05	3.00	331.66	177.40	331.66
15	11,464.0	34.3	177.4	11310.24	11228.24	-612.58	27.82	0.00	613.21	177.40	613.21
16	11,548.4	34.3	177.4	11379.98	11297.98	-660.05	29.97	0.00	660.73	177.40	660.73
17	11,648.4	31.8	177.4	11463.81	11381.81	-714.48	32.44	2.50	715.21	177.40	715.21
18	11,748.4	29.3	177.4	11549.95	11467.95	-765.21	34.75	2.50	765.99	177.40	765.99

Fig.3B Directional Well

A Directional Well requires these inputs:

- The Survey Depth
- The MD
- The Inclination
- The Azimuth.

When this data is entered, the following is automatically calculated:

- TVD
- Sub Sea TVD (TVD SS)
- N/-S
- E/-W
- DLS
- Closure.

External data can also be imported.

C. Casing Design

The Directional/Survey page is the entry point for the design stage. To start the casing design, on the Directional/Survey page, select **Design**. The Design page is shown (Ref. Fig. 4) with the Menu Bar overlay..

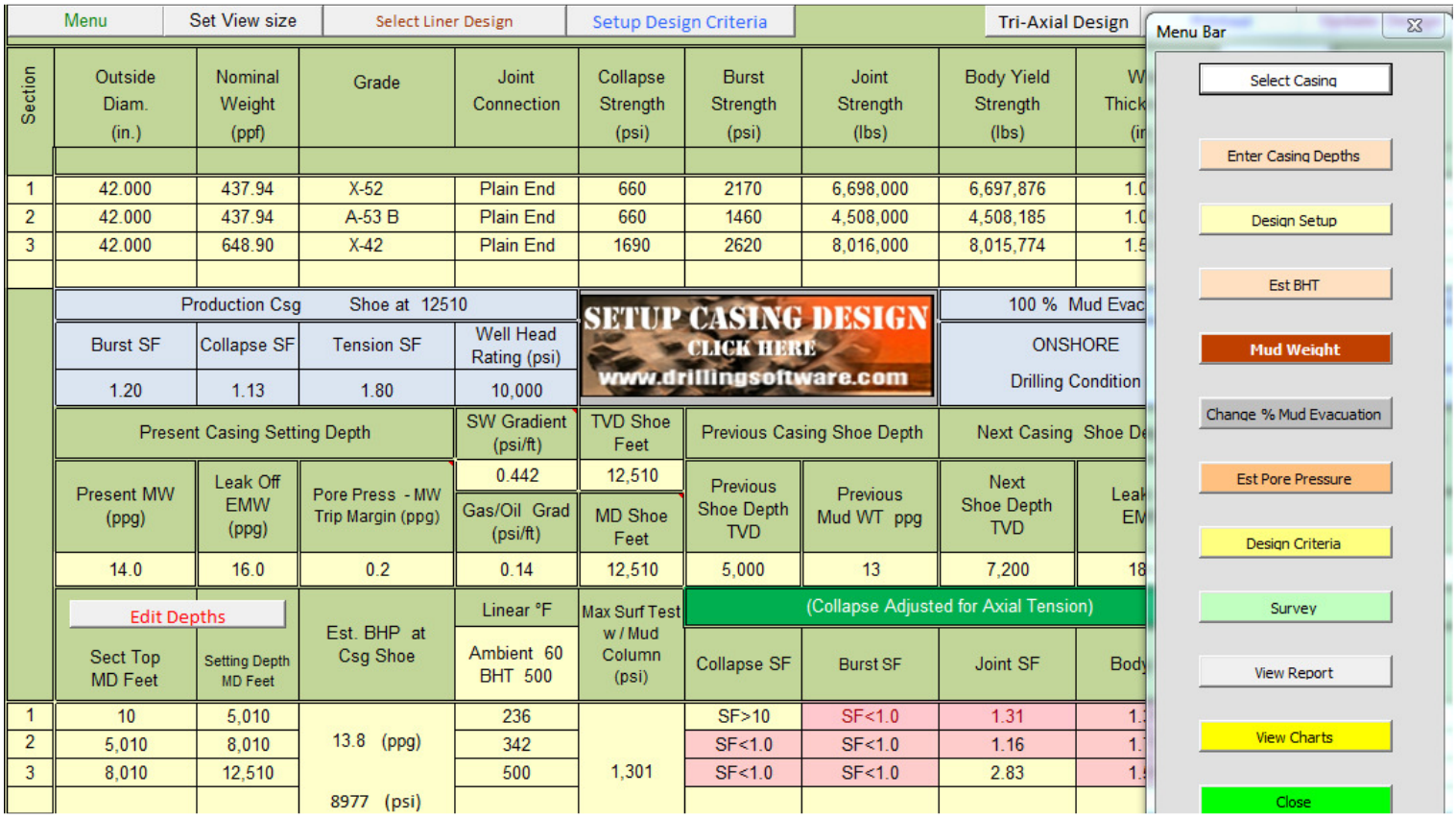


Fig.4 Design Page

NOTE: For the Menu Bar button functions and the Casing Design flow chart, refer to Appendix A.

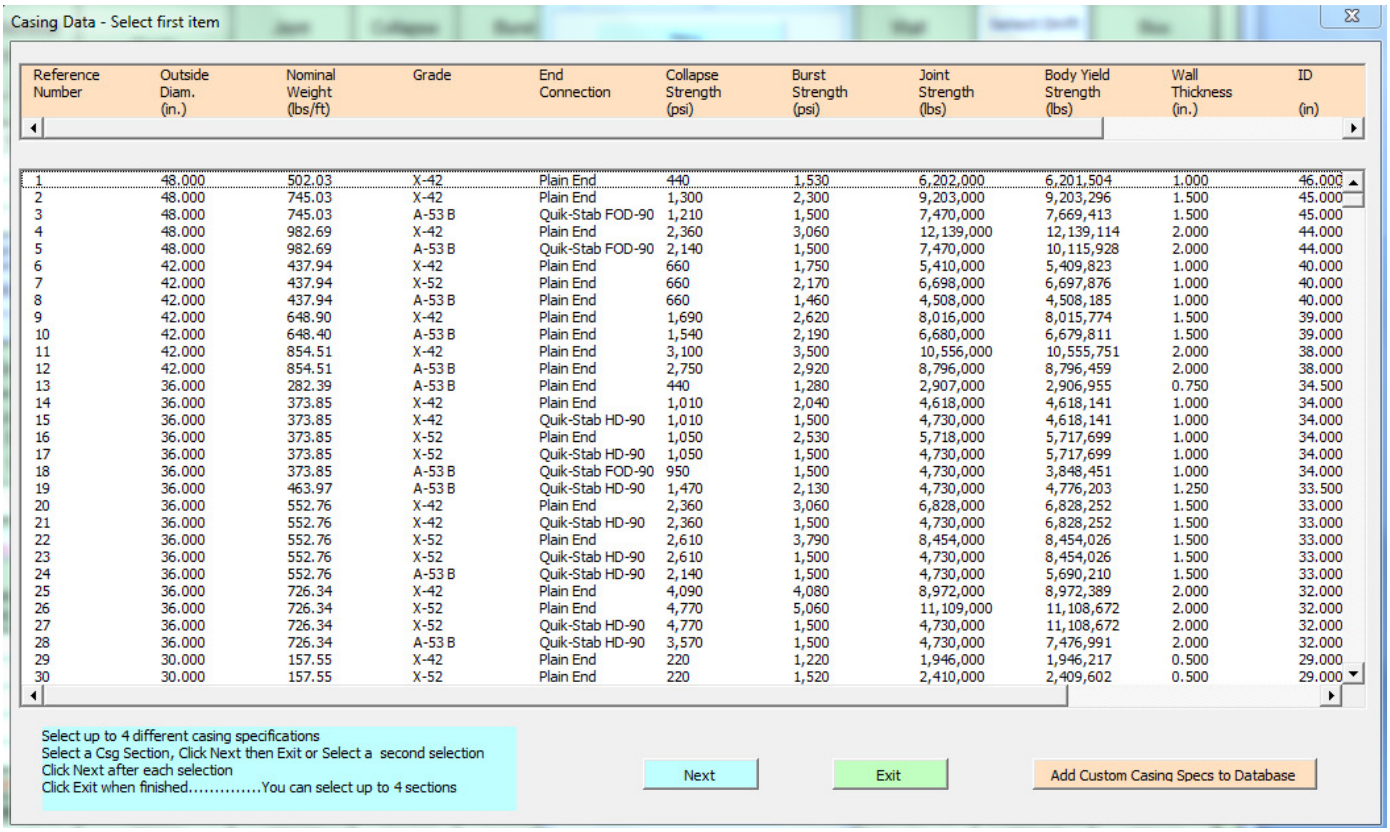
Any existing anomalies in the design will cause a red message to be shown on the Menu Bar. The warning message shown informs the design engineer of the specific design fault.

(1) Casing and Liner Data

(a) Casing Data

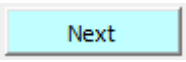
On the Menu Bar, select **Select Casing**. The Casing Data form is shown

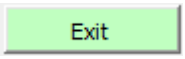
(Ref. Fig. 5). On the Casing Data form, up to 4 different weights and grades of casing can be selected. If a tapered string design is required, different sizes of casing can be selected. The casing database contains over 4000 different joints. Customized casing data can be appended to the database.



Reference Number	Outside Diam. (in.)	Nominal Weight (lbs/ft)	Grade	End Connection	Collapse Strength (psi)	Burst Strength (psi)	Joint Strength (lbs)	Body Yield Strength (lbs)	Wall Thickness (in.)	ID (in)
1	48.000	502.03	X-42	Plain End	440	1,530	6,202,000	6,201,504	1.000	46.000
2	48.000	745.03	X-42	Plain End	1,300	2,300	9,203,000	9,203,296	1.500	45.000
3	48.000	745.03	A-53 B	Quik-Stab FOD-90	1,210	1,500	7,470,000	7,669,413	1.500	45.000
4	48.000	982.69	X-42	Plain End	2,360	3,060	12,139,000	12,139,114	2.000	44.000
5	48.000	982.69	A-53 B	Quik-Stab FOD-90	2,140	1,500	7,470,000	10,115,928	2.000	44.000
6	42.000	437.94	X-42	Plain End	660	1,750	5,410,000	5,409,823	1.000	40.000
7	42.000	437.94	X-52	Plain End	660	2,170	6,698,000	6,697,876	1.000	40.000
8	42.000	437.94	A-53 B	Plain End	660	1,460	4,508,000	4,508,185	1.000	40.000
9	42.000	648.90	X-42	Plain End	1,690	2,620	8,016,000	8,015,774	1.500	39.000
10	42.000	648.40	A-53 B	Plain End	1,540	2,190	6,680,000	6,679,811	1.500	39.000
11	42.000	854.51	X-42	Plain End	3,100	3,500	10,556,000	10,555,751	2.000	38.000
12	42.000	854.51	A-53 B	Plain End	2,750	2,920	8,796,000	8,796,459	2.000	38.000
13	36.000	282.39	A-53 B	Plain End	440	1,280	2,907,000	2,906,955	0.750	34.500
14	36.000	373.85	X-42	Plain End	1,010	2,040	4,618,000	4,618,141	1.000	34.000
15	36.000	373.85	X-42	Quik-Stab HD-90	1,010	1,500	4,730,000	4,618,141	1.000	34.000
16	36.000	373.85	X-52	Plain End	1,050	2,530	5,718,000	5,717,699	1.000	34.000
17	36.000	373.85	X-52	Quik-Stab HD-90	1,050	1,500	4,730,000	5,717,699	1.000	34.000
18	36.000	373.85	A-53 B	Quik-Stab FOD-90	950	1,500	4,730,000	3,848,451	1.000	34.000
19	36.000	463.97	A-53 B	Quik-Stab HD-90	1,470	2,130	4,730,000	4,776,203	1.250	33.500
20	36.000	552.76	X-42	Plain End	2,360	3,060	6,828,000	6,828,252	1.500	33.000
21	36.000	552.76	X-42	Quik-Stab HD-90	2,360	1,500	4,730,000	6,828,252	1.500	33.000
22	36.000	552.76	X-52	Plain End	2,610	3,790	8,454,000	8,454,026	1.500	33.000
23	36.000	552.76	X-52	Quik-Stab HD-90	2,610	1,500	4,730,000	8,454,026	1.500	33.000
24	36.000	552.76	A-53 B	Quik-Stab HD-90	2,140	1,500	4,730,000	5,690,210	1.500	33.000
25	36.000	726.34	X-42	Plain End	4,090	4,080	8,972,000	8,972,389	2.000	32.000
26	36.000	726.34	X-52	Plain End	4,770	5,060	11,109,000	11,108,672	2.000	32.000
27	36.000	726.34	X-52	Quik-Stab HD-90	4,770	1,500	4,730,000	11,108,672	2.000	32.000
28	36.000	726.34	A-53 B	Quik-Stab HD-90	3,570	1,500	4,730,000	7,476,991	2.000	32.000
29	30.000	157.55	X-42	Plain End	220	1,220	1,946,000	1,946,217	0.500	29.000
30	30.000	157.55	X-52	Plain End	220	1,520	2,410,000	2,409,602	0.500	29.000

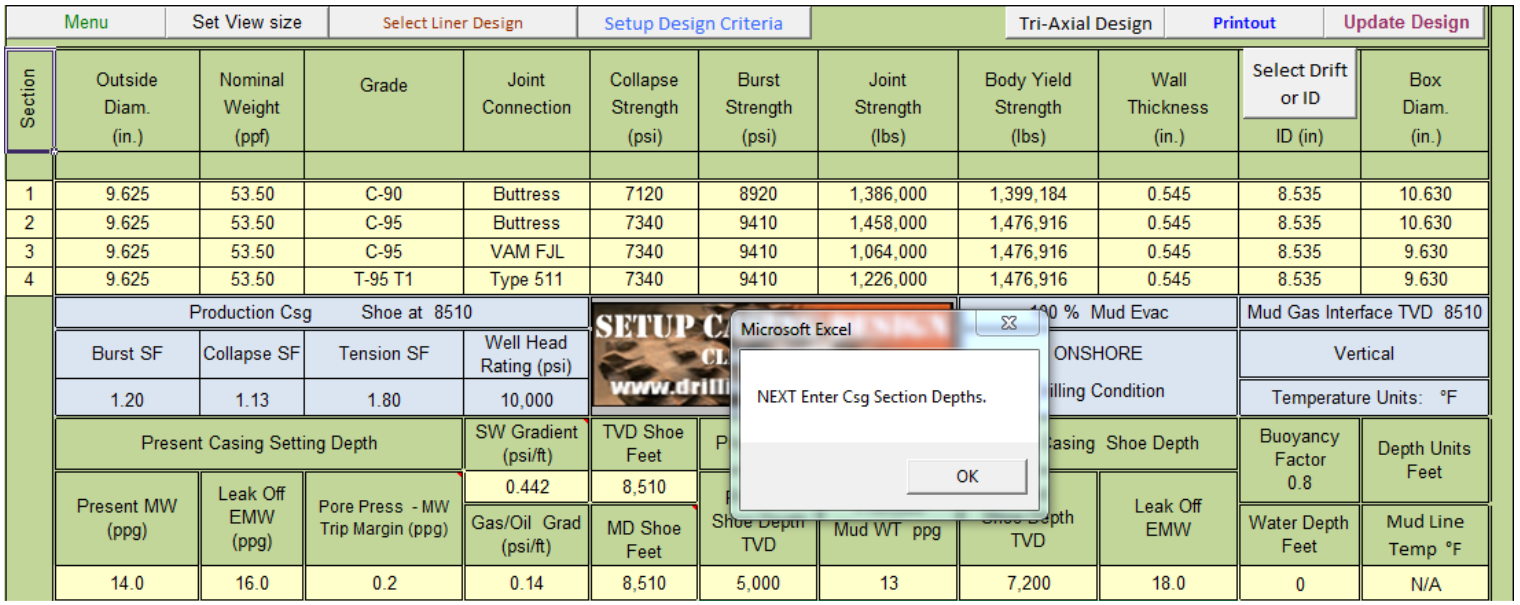
Fig.5 Casing Data Form

To select a casing, highlight the required casing section. Select 

and 

if the design requires only 1, 2, or 3 sections. The program automatically returns to the Design page after 4 sections are selected.

The selected Casing Data is shown at the top of the Design page (Ref. Fig. 6) is then shown.



Section	Outside Diam. (in.)	Nominal Weight (ppf)	Grade	Joint Connection	Collapse Strength (psi)	Burst Strength (psi)	Joint Strength (lbs)	Body Yield Strength (lbs)	Wall Thickness (in.)	Select Drift or ID / ID (in)	Box Diam. (in.)
1	9.625	53.50	C-90	Buttress	7120	8920	1,386,000	1,399,184	0.545	8.535	10.630
2	9.625	53.50	C-95	Buttress	7340	9410	1,458,000	1,476,916	0.545	8.535	10.630
3	9.625	53.50	C-95	VAM FJL	7340	9410	1,064,000	1,476,916	0.545	8.535	9.630
4	9.625	53.50	T-95 T1	Type 511	7340	9410	1,226,000	1,476,916	0.545	8.535	9.630

Production Csg	Shoe at 8510				% Mud Evac	Mud Gas Interface TVD 8510
Burst SF	Collapse SF	Tension SF	Well Head Rating (psi)		ONSHORE	Vertical
1.20	1.13	1.80	10,000		illing Condition	Temperature Units: °F

Present Casing Setting Depth			SW Gradient (psi/ft)	TVD Shoe Feet	asing Shoe Depth		Buoyancy Factor 0.8	Depth Units Feet
			0.442	8,510				
Present MW (ppg)	Leak Off EMW (ppg)	Pore Press - MW Trip Margin (ppg)	Gas/Oil Grad (psi/ft)	MD Shoe Feet	Mud WT ppg	Leak Off EMW	Water Depth Feet	Mud Line Temp °F
14.0	16.0	0.2	0.14	8,510	13	18.0	0	N/A

Fig.6 Casing Data

Select OK on the prompt. The Menu Bar is shown.

On the Menu Bar select Enter Casing Depths. The Section Depths data form is shown (Ref. Fig. 7).

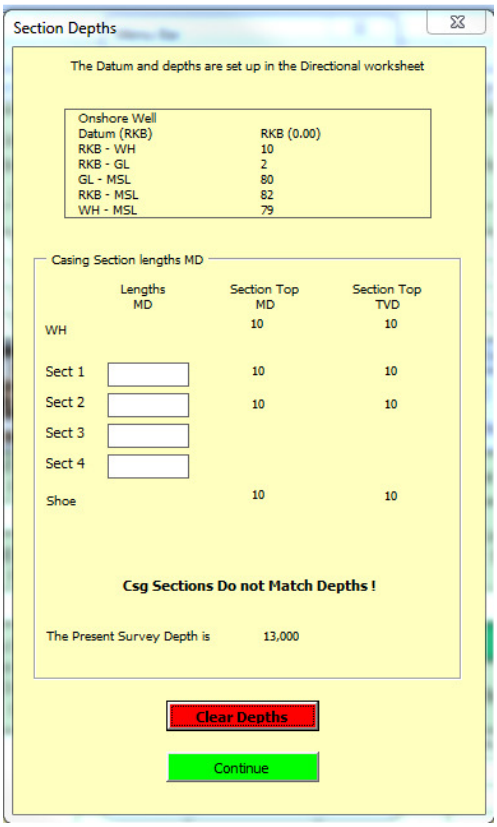


Fig.7 Section Depths

Select Clear Depths to clear any existing data. After entering the depths of each casing section in the section panels, select Continue. The Update Charts prompt is shown (Ref. Fig 8).

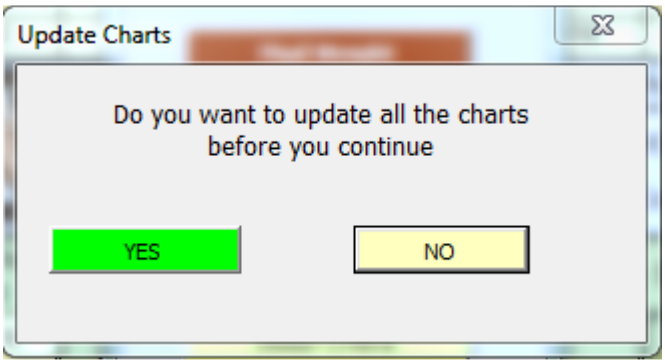


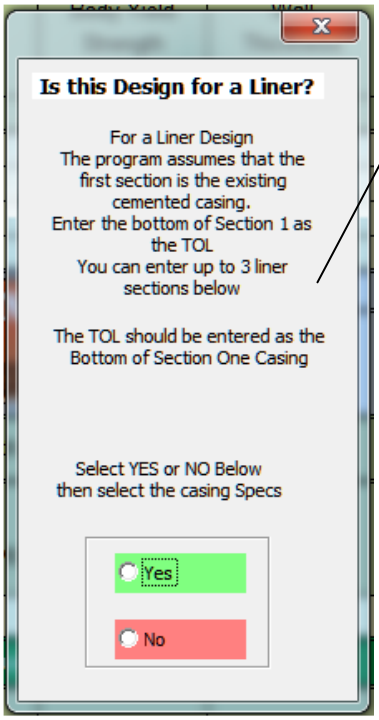
Fig.8 Update Charts

Selecting NO, returns the program to the Design page (Ref. Fig. 4).

If YES is selected, refer to Para. 2. C. (14).

(b) Liner Data

On the Design Page (Ref. Fig. 4), select Select Liner Design. A Design for a Liner panel is shown (Ref Fig. 9).



Use the existing upper section of the casing and enter the TOL as the bottom of section 1.
Enter up to 3 liner sections below the existing cemented casing

Fig.9 Design for a Liner

On the panel, select Yes. The liner(s) can now be selected in the same manner as selecting casing data [Ref. Para. 2. C.(1) (a)]. After selection, the design page is shown with the selected liner data shown at the top of the design page (Ref. Fig. 10).

Previous cemented casing

Menu | Set View size | Select Liner Design | Setup Design Criteria | Tri-Axial Design | Printout | Update Design

Section	Outside Diam. (in.)	Nominal Weight (ppf)	Grade	Joint Connection	Collapse Strength (psi)	Burst Strength (psi)	Joint Strength (lbs)	Body Yield Strength (lbs)	Wall Thickness (in.)	Select Drift or ID: ID (in)	Box Diam. (in.)
			Liner Design Selected								
1	9.625	40.00	T-95 T1	Type 521	3320	6820	847,000	1,088,109	0.395	8.835	9.960
L1	7.000	32.00	C-95	LT&C	9750	10760	768,000	885,144	0.453	6.094	7.660
L2	7.000	32.00	S-95	LT&C	10400	10760	779,000	885,144	0.453	6.094	7.660
L3	7.000	32.00	S-95	VAM FJL	10400	10760	636,000	885,144	0.453	6.094	7.000

Up to 3 liner sections can be used

Fig.10 Liner Data

If the sections for a liner have been selected, and No was selected on the Design for a Liner panel (Ref. Fig. 9), the prompt Csg Dia ? Select Liner Design is shown. Select Select Liner Design, then select Yes on the Liner Design Dialogue. The Liner Data is now shown at the top of the Design page (Ref. Fig. 10).

(2) Design Safety Factors (Fig. 11)

On the Design page, select Design Menu. The Menu Bar is shown. On the Menu Bar, select Design Setup. The Design Factors data form is shown (Ref. Fig. 11).

Fig.11 Design Factors

On the Design Factors data form, the following are selected:

- Burst
- Collapse
- Tension.

An option to enter Custom Safety Factors is also available

Make the required selections and select OK. The Casing Design Condition Setup data form is shown (Ref. Fig. 12).

(3) Casing Design Condition Setup (Fig. 12)

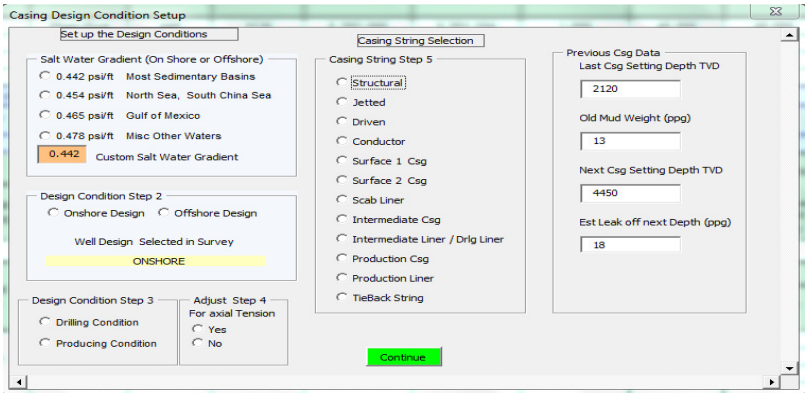


Fig.12 Casing Design Condition Setup

On the Casing Design Condition Setup data form, the following are selected:

- Design Conditions:
  - Salt Water Gradient (Offshore)
  - Onshore or Offshore
  - Drilling or Producing Case
  - Axial Tension.

Note: The updated version of the Casing Design program includes Bi-axial and Tri-axial calculations.

- String Selection:
  - Structural
  - Jetted
  - Driven
  - Conductor
  - Surface 1 Csg
  - Surface 2 Csg
  - Scab Liner
  - Intermediate Csg
  - Intermediate Liner/Drlg Liner
  - Production Csg
  - Production Liner
  - Tieback String.

Make the required selections and select Continue. The Gas/Oil Gradient data form is shown (Ref. Fig. 13).

(4) Gas/Oil Gradient (Fig.13)

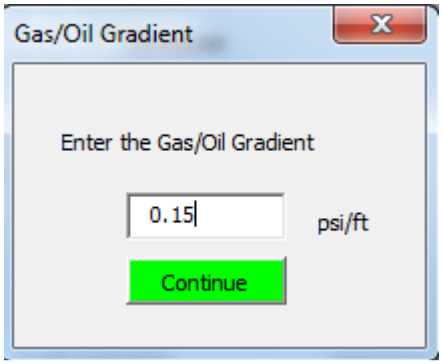


Fig.13 Gas/Oil Gradient

Enter the gas or oil gradient and select Continue. The Mud Weight –Leakoff data form is shown (Ref Fig. 14).

(5) Mud Weight – Leakoff (Fig 14)

Fig.14 Mud Weight – Leakoff

Enter:

- The Present Mud Weight
- Leakoff @ present shoe
- Old Mud Weight.

Select Continue. The Add in any Mud Weight Overbalance data form is shown (Ref. Fig. 15).

(6) Mud Weight Overbalance Option (Fig. 15)

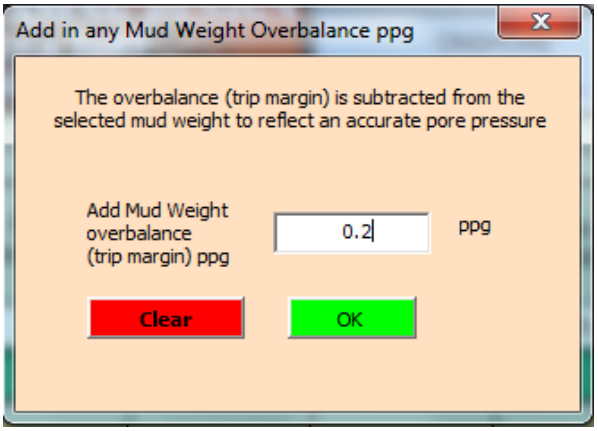


Fig.15 Mud Weight Overbalance

This data form gives an option to enter any overbalance. This is deducted from the mud weight to give a more accurate pore pressure.

Select  if not required for the design.

Select  . The Section Depths data form is shown (Ref. Fig. 16).

(7) Section Depths (Fig. 16)

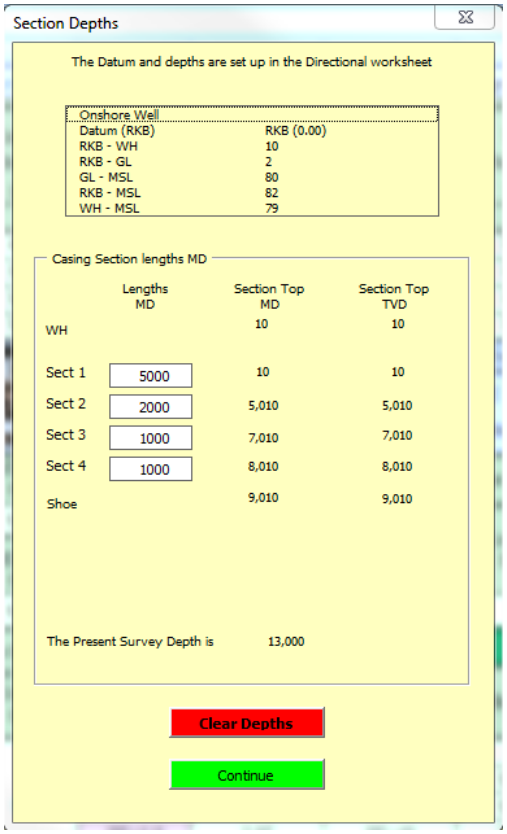


Fig.16 Section Depths

At the top of the Section Depths data form there is a reference to the selected type of well and all the datum depths.
Enter the depths at the bottom of each casing section.

Note: A warning will indicate any errors in the design.

Select Clear Depths and enter the new depths. Select Continue. The estimated BHT data form is shown (Ref. Fig. 13)

(8) Temperatures and Estimated BHT (Fig. 17)

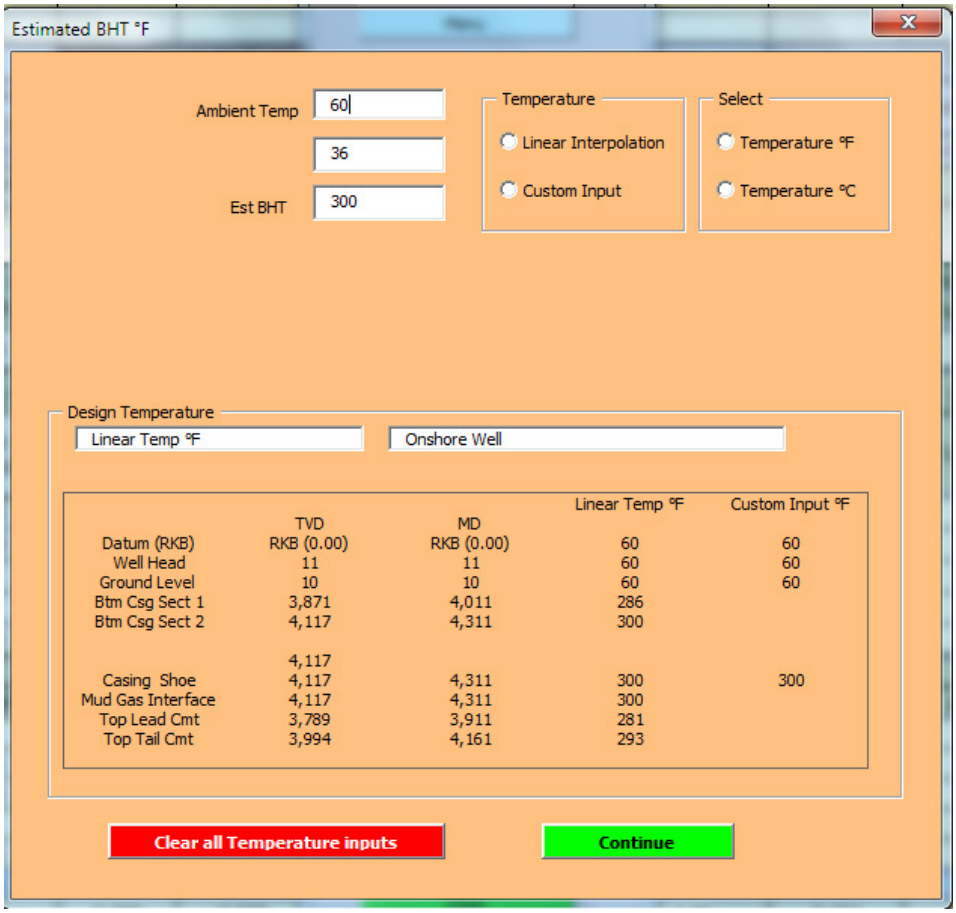


Fig.17 Estimated BHT

Select Clear all Temperature inputs before entering new temperatures.
Enter the known ambient temperature.
Select the Linear Interpolation or Custom Input for the bottom of each casing section.
Select the Temperature units (˚C or ˚F).

A reference to all the datum depths, TVD, MD and the linear and/or custom temperatures is shown in the Design Temperature panel.

Select Continue. The Select Well Head Rating data form is shown (Ref. Fig. 18).

(9) Select Well Head Rating (Fig. 18)

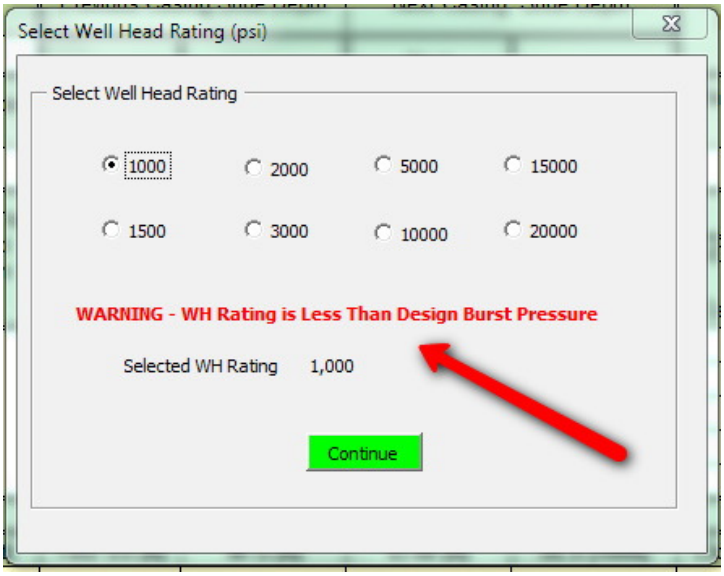


Figure 18 Select Well Head Rating

Select the well head rating design (from 1000psi to 20000psi).

Note: If a rating below the calculated surface pressure is selected, a red warning will be shown.

The maximum design burst pressure and the safety factors have all been calculated in the background.

Select Continue. The Mud Evacuation Selection data form is shown (Ref. Fig. 19).

(10) Mud Evacuation (Fig. 19)

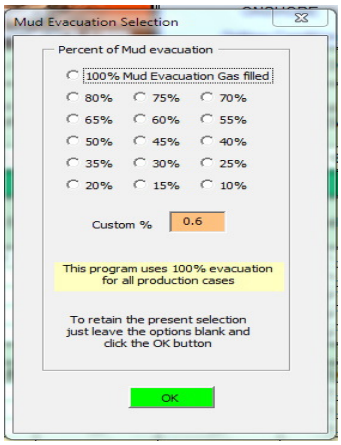


Fig.19 Mud Evacuation

Select the percentage of mud evacuation for the design. 0% to 100% or a custom percentage can be entered.

Note: If a producing well design was previously selected, the program automatically selects 100% mud evacuation.

Select OK. The Update Charts data form is shown (Ref. Fig. 20)

(11) Update Charts (Fig. 20)

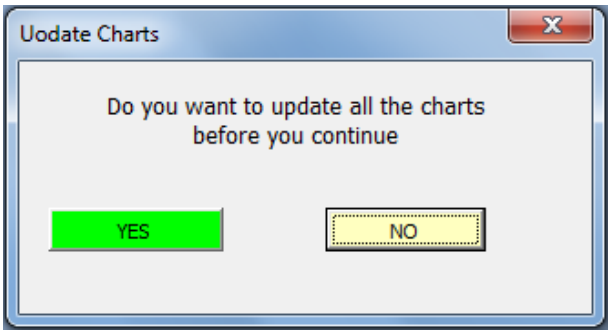


Fig. 20 Update Charts

Select YES to update all the Design Report/ Design Charts (Ref. Figs. 24 and 25).

If YES is selected, the Printout Header Data page is shown. Go to Para. 2. C. (14).

Selecting NO shows the Design Progress page (Ref. Fig. 21)

(12) Design Progress (Fig. 21)

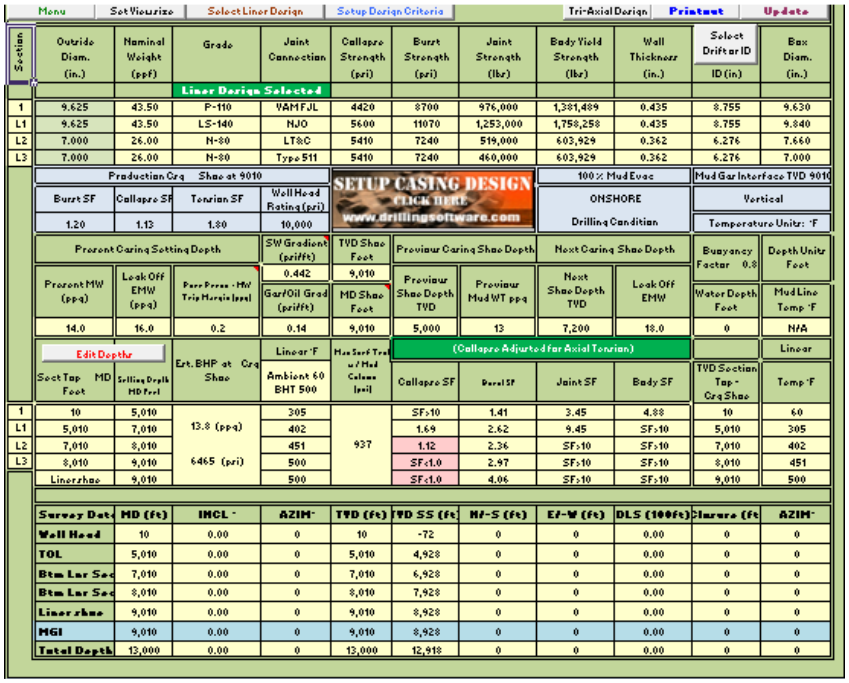


Fig.21 Design Progress

Accessing the Design page at this stage gives a quick, visual check as to how the design is progressing. Any design failures are shown as red cells.

At the top section of the design page selected casing sections parameters are shown. The parameters shown are:

- The Outside Diameter (in.)
- The Nominal Weight (ppf)
- The Grade
- The Joint Connection
- Collapse Strength (psi)
- Joint Strength (psi)
- Body Yield Strength (lbs)
- Wall Thickness (in.)
- Option to select Drift or ID
- Box Diameter (in.).

The light blue section shows all the present and previous mud data and the next setting depths.

Immediately below the light blue section all the design safety factors are shown. Any failed safety factors will show in red.

The Mud Gas Interface (MGI) depth is shown in the light blue section of the survey data.

Note: Any section of the design set-up can be accessed via the Menu Bar. Quick changes to any of the design parameters can be accomplished without going through the complete sequential design set-up.

The Menu Bar is shown when Setup Design Criteria is selected on the Design page.

On the Menu Bar, select Design Criteria. The Design Criteria page is shown (Ref. Fig. 22).

(13) Design Criteria (Fig. 22)

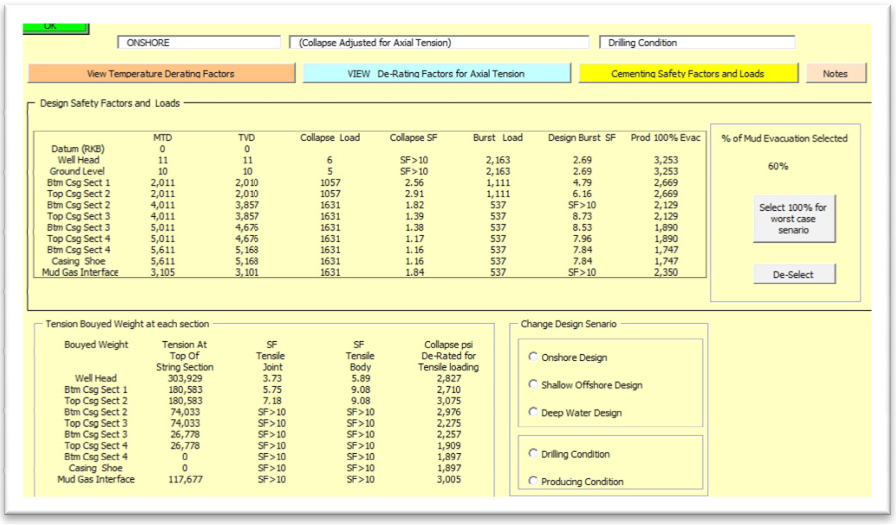


Fig.22 Design Criteria

From the Design Criteria Page the following are reviewed :

- Temperature De-rating Factors
- De-rating Factors due to Axial Loading
- Cementing Safety Factors.

Select View Temperature Derating Factors to access the Temperature De-rating Effect page (Ref. Fig. 22A).

(a) Temperature De-rating Effect (Fig. 22A)

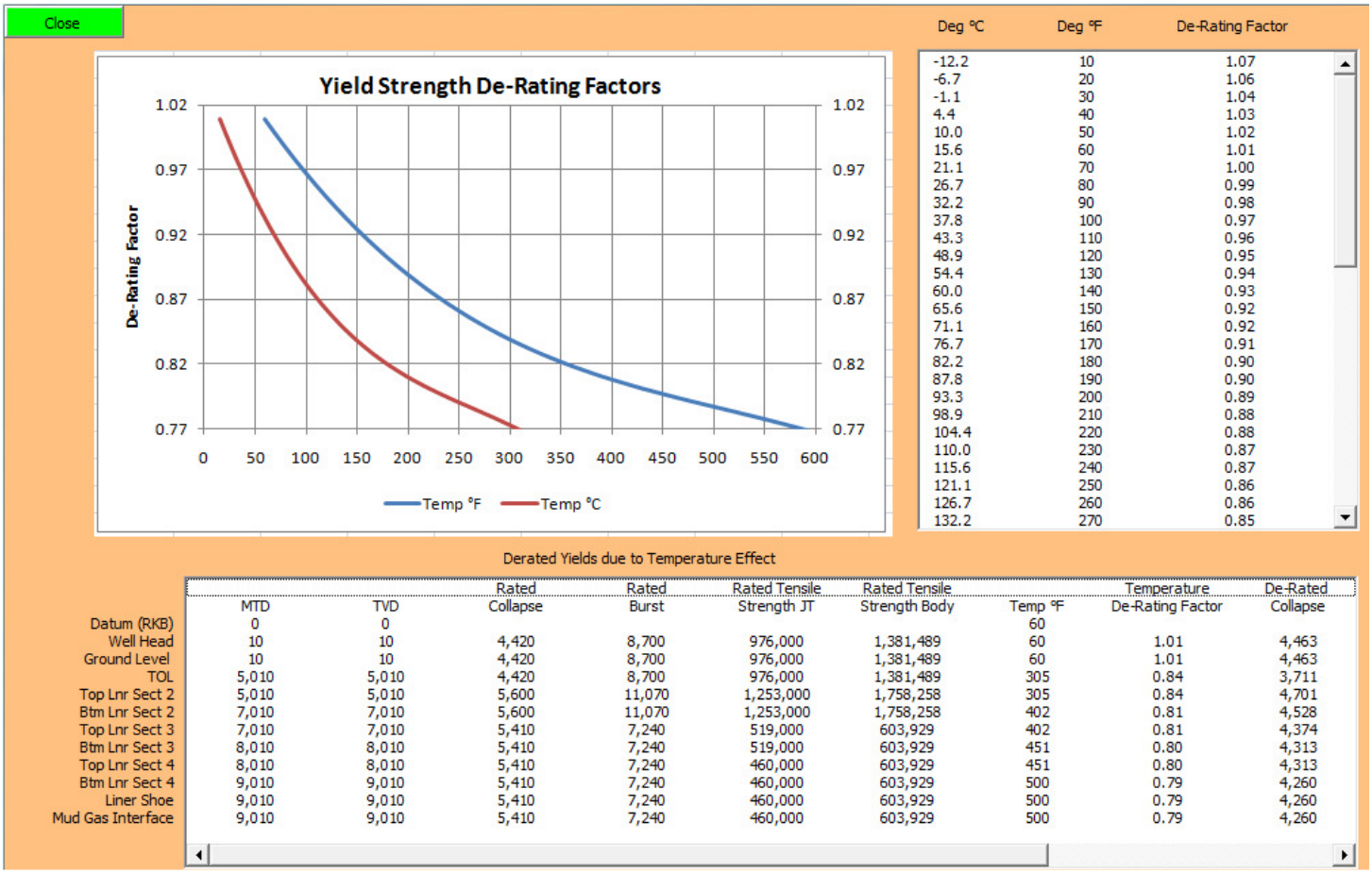
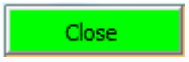
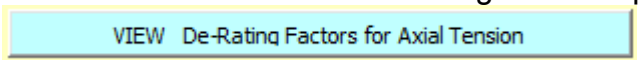


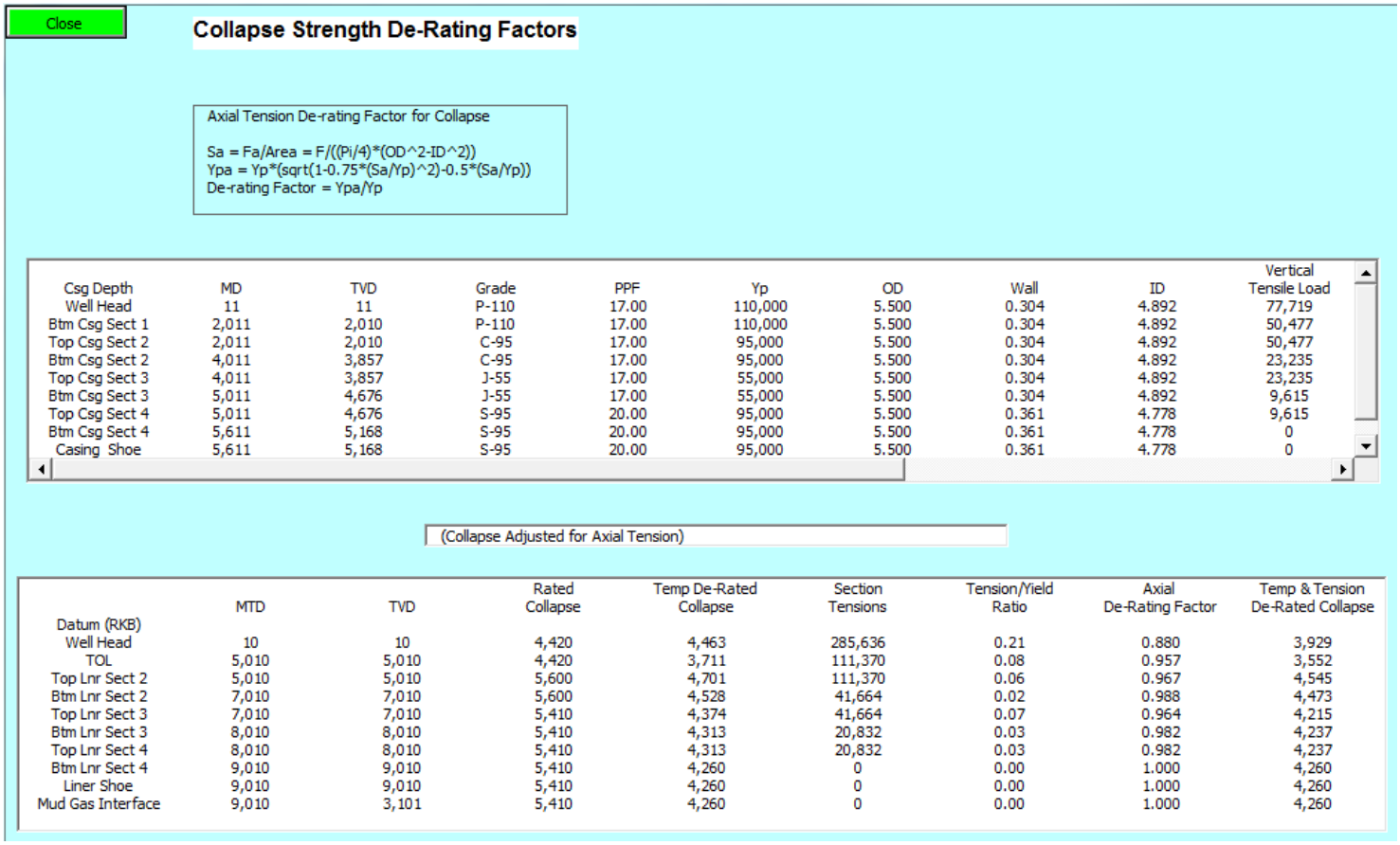
Fig.22A Temperature De-rating Effect

Use the scroll bar to review all data.

Select  to return to the Design Criteria page.

Select  to access the Collapse Strength De-rating Factors (Ref. Fig. 22B).

(b) De-rating Collapse Curve Factors (Fig. 22B)



Csg Depth	MD	TVD	Grade	PPF	Yp	OD	Wall	ID	Vertical Tensile Load
Well Head	11	11	P-110	17.00	110,000	5.500	0.304	4.892	77,719
Btm Csg Sect 1	2,011	2,010	P-110	17.00	110,000	5.500	0.304	4.892	50,477
Top Csg Sect 2	2,011	2,010	C-95	17.00	95,000	5.500	0.304	4.892	50,477
Btm Csg Sect 2	4,011	3,857	C-95	17.00	95,000	5.500	0.304	4.892	23,235
Top Csg Sect 3	4,011	3,857	J-55	17.00	55,000	5.500	0.304	4.892	23,235
Btm Csg Sect 3	5,011	4,676	J-55	17.00	55,000	5.500	0.304	4.892	9,615
Top Csg Sect 4	5,011	4,676	S-95	20.00	95,000	5.500	0.361	4.778	9,615
Btm Csg Sect 4	5,611	5,168	S-95	20.00	95,000	5.500	0.361	4.778	0
Casing Shoe	5,611	5,168	S-95	20.00	95,000	5.500	0.361	4.778	0

Datum (RKB)	MTD	TVD	Rated Collapse	Temp De-Rated Collapse	Section Tensions	Tension/Yield Ratio	Axial De-Rating Factor	Temp & Tension De-Rated Collapse
Well Head	10	10	4,420	4,463	285,636	0.21	0.880	3,929
TOL	5,010	5,010	4,420	3,711	111,370	0.08	0.957	3,552
Top Lnr Sect 2	5,010	5,010	5,600	4,701	111,370	0.06	0.967	4,545
Btm Lnr Sect 2	7,010	7,010	5,600	4,528	41,664	0.02	0.988	4,473
Top Lnr Sect 3	7,010	7,010	5,410	4,374	41,664	0.07	0.964	4,215
Btm Lnr Sect 3	8,010	8,010	5,410	4,313	20,832	0.03	0.982	4,237
Top Lnr Sect 4	8,010	8,010	5,410	4,313	20,832	0.03	0.982	4,237
Btm Lnr Sect 4	9,010	9,010	5,410	4,260	0	0.00	1.000	4,260
Liner Shoe	9,010	9,010	5,410	4,260	0	0.00	1.000	4,260
Mud Gas Interface	9,010	3,101	5,410	4,260	0	0.00	1.000	4,260

Fig.22B De-rating Collapse Curve Factors

Use the scroll bar to review the data.

Select Close to return to the Design Criteria page.

Select Cementing Safety Factors and Loads to access the Cementing Collapse Load page (Ref. Fig. 22C).

(c) Cementing Collapse Load (Fig 22C)

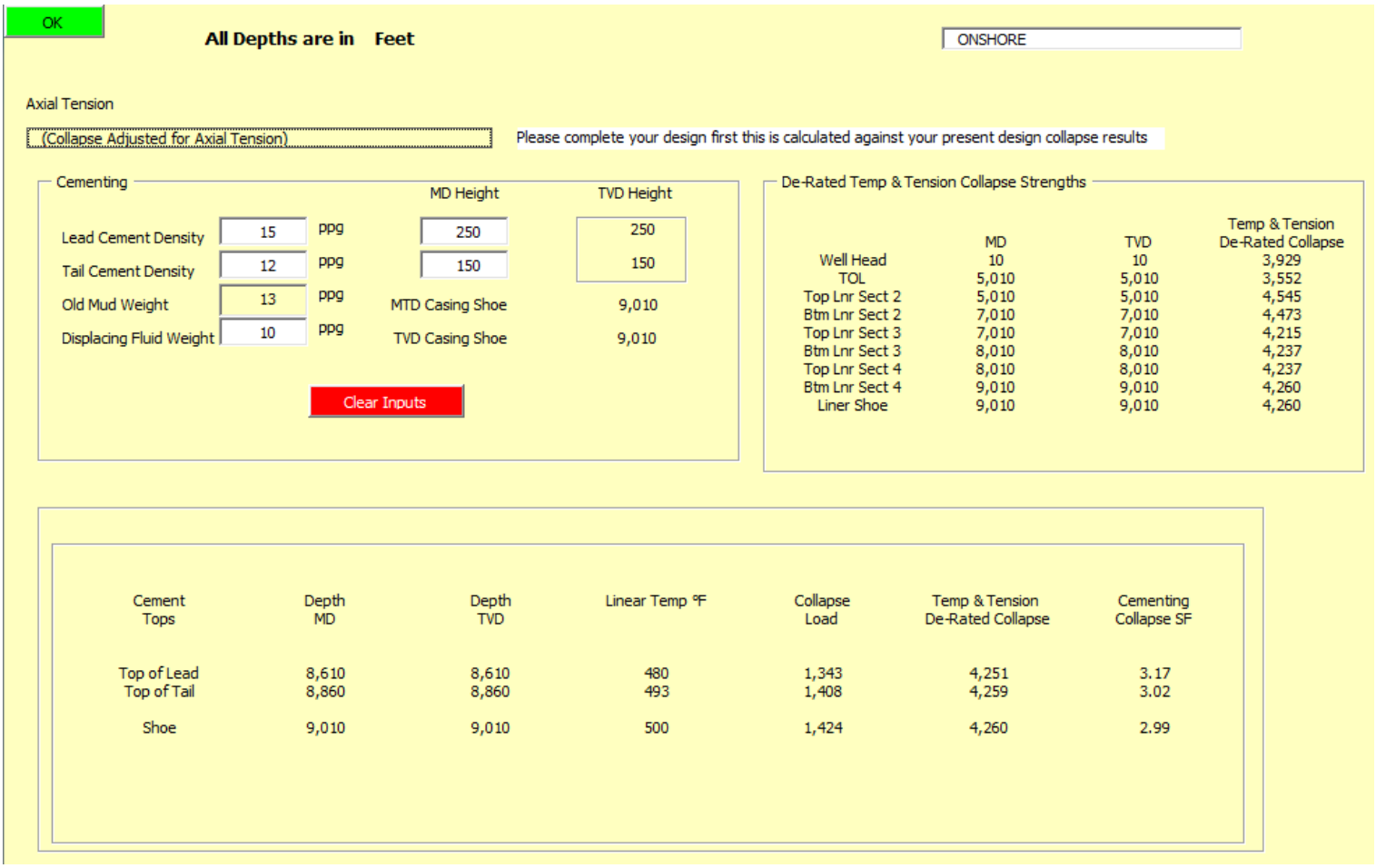


Fig. 22C Cementing Collapse Load

After reviewing the data, select OK to return to the Design Criteria page. Select

Select OK to return to the Design Page. Select Close on the Menu Bar

(14) Printout Header (Fig. 23)

The Printout Header is accessed from either the Update Design button on the Design page (Ref. Fig. 4) or the YES button on the Update Charts prompts (Fig. 8 and Fig. 20).

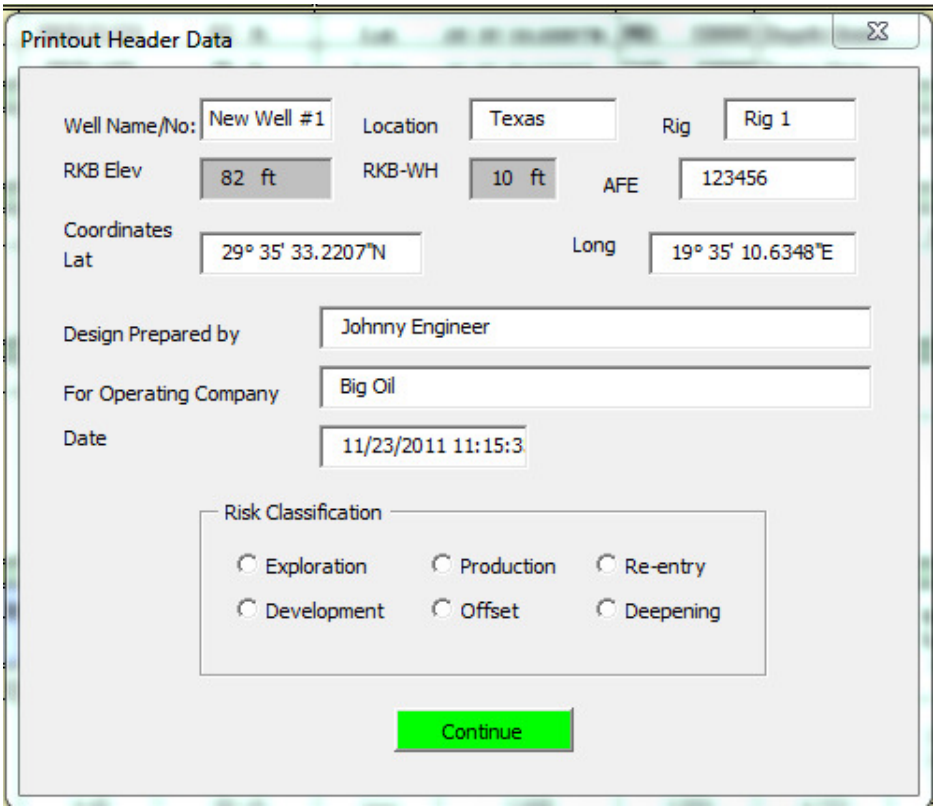


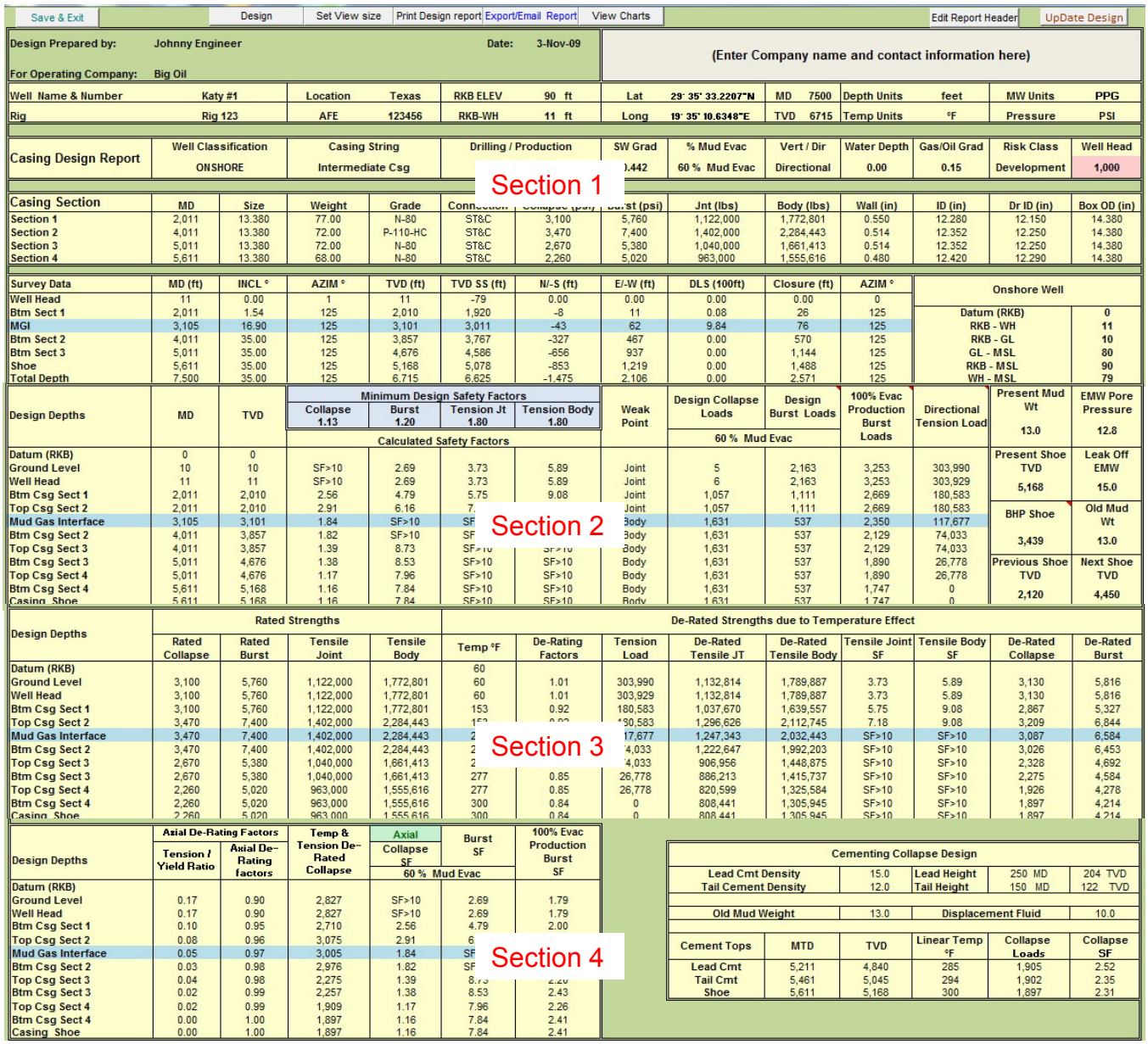
Fig. 23 Printout Header

The Printout Header is used to input the well particulars. These are:

- Well Name/No.
- Location
- Rig
- RKB Elev
- RKB-WH
- AFE
- Coordinates (Lat/Long)
- Design Prepared By
- Operating Company
- Date
- Risk Classification.

Enter the data. Select Continue. The Design Report is shown (Ref. Fig. 24).

(15) Design Report (Fig. 24)



Save & Exit | Design | Set View size | Print Design report | Export/Email Report | View Charts | Edit Report Header | UpDate Design

Design Prepared by: Johnny Engineer — Date: 3-Nov-09 — For Operating Company: Big Oil — (Enter Company name and contact information here)

Well Name & Number	Katy #1	Location	Texas	RKB ELEV	90 ft	Lat	29° 35' 33.2207"N	MD	7500	Depth Units	feet	MW Units	PPG
Rig	Rig 123	AFE	123456	RKB-WH	11 ft	Long	19° 35' 10.6348"E	TVD	6715	Temp Units	°F	Pressure	PSI

Casing Design Report	Well Classification	Casing String	Drilling / Production	SW Grad	% Mud Evac	Vert / Dir	Water Depth	Gas/Oil Grad	Risk Class	Well Head
	ONSHORE	Intermediate Csg		.442	60 % Mud Evac	Directional	0.00	0.15	Development	1,000

Section 1

Casing Section	MD	Size	Weight	Grade	Connection	Collapse (psi)	Burst (psi)	Jnt (lbs)	Body (lbs)	Wall (in)	ID (in)	Dr ID (in)	Box OD (in)
Section 1	2,011	13.380	77.00	N-80	ST&C	3,100	5,760	1,122,000	1,772,801	0.550	12.280	12.150	14.380
Section 2	4,011	13.380	72.00	P-110-HC	ST&C	3,470	7,400	1,402,000	2,284,443	0.514	12.352	12.250	14.380
Section 3	5,011	13.380	72.00	N-80	ST&C	2,670	5,380	1,040,000	1,661,413	0.514	12.352	12.250	14.380
Section 4	5,611	13.380	68.00	N-80	ST&C	2,260	5,020	963,000	1,555,616	0.480	12.420	12.290	14.380

Survey Data	MD (ft)	INCL °	AZIM °	TVD (ft)	TVD SS (ft)	N/-S (ft)	E/-W (ft)	DLS (100ft)	Closure (ft)	AZIM °
Well Head	11	0.00	1	11	-79	0.00	0.00	0.00	0.00	0
Btm Sect 1	2,011	1.54	125	2,010	1,920	-8	11	0.08	26	125
MGI	3,105	16.90	125	3,101	3,011	-43	62	9.84	76	125
Btm Sect 2	4,011	35.00	125	3,857	3,767	-327	467	0.00	570	125
Btm Sect 3	5,011	35.00	125	4,676	4,586	-656	937	0.00	1,144	125
Shoe	5,611	35.00	125	5,168	5,078	-853	1,219	0.00	1,488	125
Total Depth	7,500	35.00	125	6,715	6,625	-1,475	2,106	0.00	2,571	125

Onshore Well	
Datum (RKB)	0
RKB - WH	11
RKB - GL	10
GL - MSL	80
RKB - MSL	90
WH - MSL	79

Design Depths	MD	TVD	Minimum Design Safety Factors: Collapse 1.13	Burst 1.20	Tension Jt 1.80	Tension Body 1.80	Weak Point	Design Collapse Loads (60 % Mud Evac)	Design Burst Loads	100% Evac Production Burst Loads	Directional Tension Load
			Calculated Safety Factors								
Datum (RKB)	0	0									
Ground Level	10	10	SF>10	2.69	3.73	5.89	Joint	5	2,163	3,253	303,990
Well Head	11	11	SF>10	2.69	3.73	5.89	Joint	6	2,163	3,253	303,929
Btm Csg Sect 1	2,011	2,010	2.56	4.79	5.75	9.08	Joint	1,057	1,111	2,669	180,583
Top Csg Sect 2	2,011	2,010	2.91	6.16	7.		Joint	1,057	1,111	2,669	180,583
Mud Gas Interface	3,105	3,101	1.84	SF>10	SF		Body	1,631	537	2,350	117,677
Btm Csg Sect 2	4,011	3,857	1.82	SF>10	SF		Body	1,631	537	2,129	74,033
Top Csg Sect 3	4,011	3,857	1.39	8.73	SF>10	SF>10	Body	1,631	537	2,129	74,033
Btm Csg Sect 3	5,011	4,676	1.38	8.53	SF>10	SF>10	Body	1,631	537	1,890	26,778
Top Csg Sect 4	5,011	4,676	1.17	7.96	SF>10	SF>10	Body	1,631	537	1,890	26,778
Btm Csg Sect 4	5,611	5,168	1.16	7.84	SF>10	SF>10	Body	1,631	537	1,747	0
Casing Shoe	5,611	5,168	1.16	7.84	SF>10	SF>10	Body	1,631	537	1,747	0

Section 2

Present Mud Wt	EMW Pore Pressure
13.0	12.8
Present Shoe TVD	**Leak Off EMW**
5,168	15.0
BHP Shoe	**Old Mud Wt**
3,439	13.0
Previous Shoe TVD	**Next Shoe TVD**
2,120	4,450

Design Depths	Rated Strengths: Rated Collapse	Rated Burst	Tensile Joint	Tensile Body	De-Rated Strengths due to Temperature Effect: Temp °F	De-Rating Factors	Tension Load	De-Rated Tensile JT	De-Rated Tensile Body	Tensile Joint SF	Tensile Body SF	De-Rated Collapse	De-Rated Burst
Datum (RKB)					60								
Ground Level	3,100	5,760	1,122,000	1,772,801	60	1.01	303,990	1,132,814	1,789,887	3.73	5.89	3,130	5,816
Well Head	3,100	5,760	1,122,000	1,772,801	60	1.01	303,929	1,132,814	1,789,887	3.73	5.89	3,130	5,816
Btm Csg Sect 1	3,100	5,760	1,122,000	1,772,801	153	0.92	180,583	1,037,670	1,639,557	5.75	9.08	2,867	5,327
Top Csg Sect 2	3,470	7,400	1,402,000	2,284,443	1		180,583	1,296,626	2,112,745	7.18	9.08	3,209	6,844
Mud Gas Interface	3,470	7,400	1,402,000	2,284,443	2		17,677	1,247,343	2,032,443	SF>10	SF>10	3,087	6,584
Btm Csg Sect 2	3,470	7,400	1,402,000	2,284,443	2		4,033	1,222,647	1,992,203	SF>10	SF>10	3,026	6,453
Top Csg Sect 3	2,670	5,380	1,040,000	1,661,413	2		4,033	906,956	1,448,875	SF>10	SF>10	2,328	4,692
Btm Csg Sect 3	2,670	5,380	1,040,000	1,661,413	277	0.85	26,778	886,213	1,415,737	SF>10	SF>10	2,275	4,584
Top Csg Sect 4	2,260	5,020	963,000	1,555,616	277	0.85	26,778	820,599	1,325,584	SF>10	SF>10	1,926	4,278
Btm Csg Sect 4	2,260	5,020	963,000	1,555,616	300	0.84	0	808,441	1,305,945	SF>10	SF>10	1,897	4,214
Casing Shoe	2,260	5,020	963,000	1,555,616	300	0.84	0	808,441	1,305,945	SF>10	SF>10	1,897	4,214

Section 3

Design Depths	Axial De-Rating Factors: Tension / Yield Ratio	Axial De-Rating factors	Temp & Tension De-Rated Collapse	Axial Collapse SF (60 % Mud Evac)	Burst SF	100% Evac Production Burst SF
Datum (RKB)						
Ground Level	0.17	0.90	2,827	SF>10	2.69	1.79
Well Head	0.17	0.90	2,827	SF>10	2.69	1.79
Btm Csg Sect 1	0.10	0.95	2,710	2.56	4.79	2.00
Top Csg Sect 2	0.08	0.96	3,075	2.91	6	
Mud Gas Interface	0.05	0.97	3,005	1.84	SF	
Btm Csg Sect 2	0.03	0.98	2,976	1.82	SF	
Top Csg Sect 3	0.04	0.98	2,275	1.39	8.	
Btm Csg Sect 3	0.02	0.99	2,257	1.38	8.53	2.43
Top Csg Sect 4	0.02	0.99	1,909	1.17	7.96	2.26
Btm Csg Sect 4	0.00	1.00	1,897	1.16	7.84	2.41
Casing Shoe	0.00	1.00	1,897	1.16	7.84	2.41

Section 4

Cementing Collapse Design					
Lead Cmt Density	15.0	Lead Height	250 MD	204 TVD
Tail Cement Density	12.0	Tail Height	150 MD	122 TVD
Old Mud Weight	13.0	Displacement Fluid		10.0

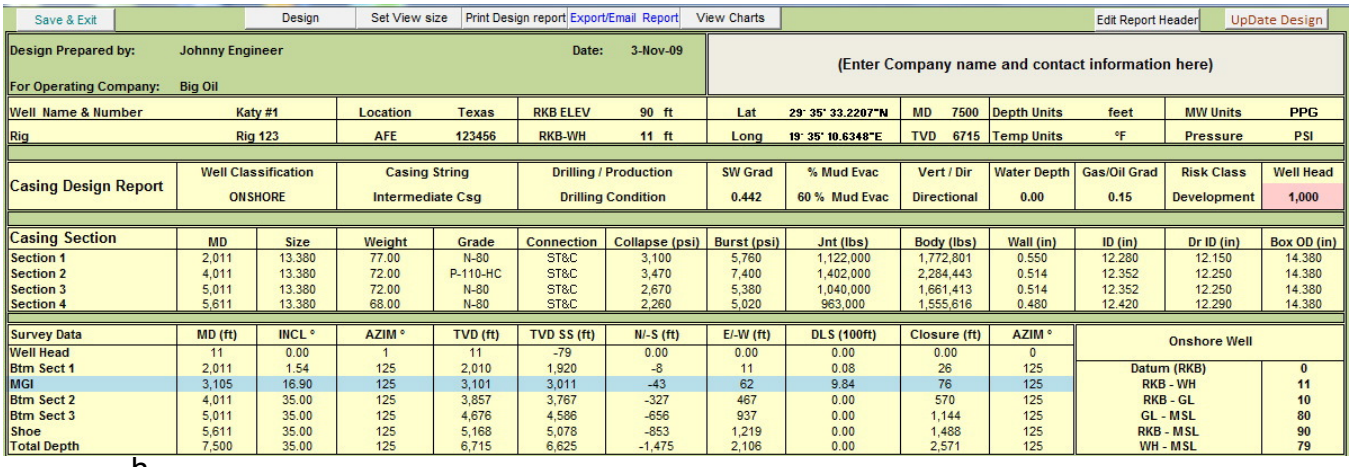
Cement Tops	MTD	TVD	Linear Temp °F	Collapse Loads	Collapse SF
Lead Cmt	5,211	4,840	285	1,905	2.52
Tail Cmt	5,461	5,045	294	1,902	2.35
Shoe	5,611	5,168	300	1,897	2.31

Fig. 24 Typical Design Report

The Design Report is a full and comprehensive report, broken down into four sections.

The Design Report can be exported or e-mailed to the operator. When Export/Email Report is selected, a copy of the report is also exported to the local well file.

(a) Design Report Section 1



Save & Exit | Design | Set View size | Print Design report | Export/Email Report | View Charts | Edit Report Header | UpDate Design

Design Prepared by:	Johnny Engineer				Date:	3-Nov-09	(Enter Company name and contact information here)				
For Operating Company:	Big Oil										
Well Name & Number	Katy #1	Location	Texas	RKB ELEV	90 ft	Lat	29° 35' 33.2207"N	MD	7500	Depth Units	feet	MW Units	PPG
Rig	Rig 123	AFE	123456	RKB-WH	11 ft	Long	19° 35' 10.6348"E	TVD	6715	Temp Units	°F	Pressure	PSI

Casing Design Report	Well Classification	Casing String	Drilling / Production	SW Grad	% Mud Evac	Vert / Dir	Water Depth	Gas/Oil Grad	Risk Class	Well Head
	ONSHORE	Intermediate Csg	Drilling Condition	0.442	60 % Mud Evac	Directional	0.00	0.15	Development	1,000

Casing Section	MD	Size	Weight	Grade	Connection	Collapse (psi)	Burst (psi)	Jnt (lbs)	Body (lbs)	Wall (in)	ID (in)	Dr ID (in)	Box OD (in)
Section 1	2,011	13.380	77.00	N-80	ST&C	3,100	5,760	1,122,000	1,772,801	0.550	12.280	12.150	14.380
Section 2	4,011	13.380	72.00	P-110-HC	ST&C	3,470	7,400	1,402,000	2,284,443	0.514	12.352	12.250	14.380
Section 3	5,011	13.380	72.00	N-80	ST&C	2,670	5,380	1,040,000	1,661,413	0.514	12.352	12.250	14.380
Section 4	5,611	13.380	68.00	N-80	ST&C	2,260	5,020	963,000	1,555,616	0.480	12.420	12.290	14.380

Survey Data	MD (ft)	INCL °	AZIM °	TVD (ft)	TVD SS (ft)	N/-S (ft)	E/-W (ft)	DLS (100ft)	Closure (ft)	AZIM °
Well Head	11	0.00	1	11	-79	0.00	0.00	0.00	0.00	0
Btm Sect 1	2,011	1.54	125	2,010	1,920	-8	11	0.08	26	125
MGI	3,105	16.90	125	3,101	3,011	-43	62	9.84	76	125
Btm Sect 2	4,011	35.00	125	3,857	3,767	-327	467	0.00	570	125
Btm Sect 3	5,011	35.00	125	4,676	4,586	-656	937	0.00	1,144	125
Shoe	5,611	35.00	125	5,168	5,078	-853	1,219	0.00	1,488	125
Total Depth	7,500	35.00	125	6,715	6,625	-1,475	2,106	0.00	2,571	125

Onshore Well	
Datum (RKB)	0
RKB - WH	11
RKB - GL	10
GL - MSL	80
RKB - MSL	90
WH - MSL	79

Fig.24A Design Report Section 1

Section 1 of the Design Report shows:

- The Report Header
- Well Particulars
- Casing Design Report:
  - Well Classification (Onshore/Offshore)
  - Casing String
  - Well Classification (Drilling/Production)
  - SW Grad
  - Mud Evacuation (%)
  - Well Classification (Vertical/Directional)
  - Water Depth
  - Gas/Oil Grad.
  - Risk Class
  - Well Head Rating.
- Casing Section:
  - MD
  - Size
  - Weight
  - Grade
  - Connection
  - Collapse (psi)
  - Burst (psi)
  - Joint (lbs)
  - Body (lbs)
  - Wall
  - ID
  - Drift ID
  - Box OD.

- Survey Data:
  - MD
  - Inclination (˚)
  - Azimuth (˚)
  - TVD
  - TVD SS
  - N/-S
  - E/-W
  - DLS
  - Closure
- Mud Gas Interface (MGI).

Note: The MGI is linked to the % of mud evacuation and is indicated in all four sections of the Design Report.

(b) Design Report: Section 2 (Fig. 24B)

Design Depths	MD	TVD	Minimum Design Safety Factors: Collapse 1.13	Burst 1.20	Tension Jt 1.80	Tension Body 1.80	Weak Point	Design Collapse Loads (60 % Mud Evac)	Design Burst Loads (60 % Mud Evac)	100% Evac Production Burst Loads	Directional Tension Load	Present Mud Wt 13.0	EMW Pore Pressure 12.8
			Calculated Safety Factors										
Datum (RKB)	0	0										Present Shoe TVD	Leak Off EMW
Ground Level	10	10	SF>10	2.69	3.73	5.89	Joint	5	2,163	3,253	303,990	5,168	15.0
Well Head	11	11	SF>10	2.69	3.73	5.89	Joint	6	2,163	3,253	303,929		
Btm Csg Sect 1	2,011	2,010	2.56	4.79	5.75	9.08	Joint	1,057	1,111	2,669	180,583		
Top Csg Sect 2	2,011	2,010	2.91	6.16	7.18	9.08	Joint	1,057	1,111	2,669	180,583	BHP Shoe	Old Mud Wt
Mud Gas Interface	3,105	3,101	1.84	SF>10	SF>10	SF>10	Body	1,631	537	2,350	117,677	3,439	13.0
Btm Csg Sect 2	4,011	3,857	1.82	SF>10	SF>10	SF>10	Body	1,631	537	2,129	74,033		
Top Csg Sect 3	4,011	3,857	1.39	8.73	SF>10	SF>10	Body	1,631	537	2,129	74,033		
Btm Csg Sect 3	5,011	4,676	1.38	8.53	SF>10	SF>10	Body	1,631	537	1,890	26,778	Previous Shoe TVD	Next Shoe TVD
Top Csg Sect 4	5,011	4,676	1.17	7.96	SF>10	SF>10	Body	1,631	537	1,890	26,778	2,120	4,450
Btm Csg Sect 4	5,611	5,168	1.16	7.84	SF>10	SF>10	Body	1,631	537	1,747	0		
Casing Shoe	5,611	5,168	1.16	7.84	SF>10	SF>10	Body	1,631	537	1,747	0		

Fig.24B Design Report Section 2

Section 2 of the Design Report shows:
- MD at the top of each section
- MD at the bottom of each section
- TVD at the top of each section
- TVD at the bottom of each section
- All calculated design safety factors.

(c) Design Report: Section 3 (Fig. 20C)

Design Depths	Rated Strengths: Rated Collapse	Rated Burst	Tensile Joint	Tensile Body	De-Rated Strengths due to Temperature Effect: Temp °F	De-Rating Factors	Tension Load	De-Rated Tensile JT	De-Rated Tensile Body	Tensile Joint SF	Tensile Body SF	De-Rated Collapse	De-Rated Burst
Datum (RKB)					60								
Ground Level	3,100	5,760	1,122,000	1,772,801	60	1.01	303,990	1,132,814	1,789,887	3.73	5.89	3,130	5,816
Well Head	3,100	5,760	1,122,000	1,772,801	60	1.01	303,929	1,132,814	1,789,887	3.73	5.89	3,130	5,816
Btm Csg Sect 1	3,100	5,760	1,122,000	1,772,801	153	0.92	180,583	1,037,670	1,639,557	5.75	9.08	2,867	5,327
Top Csg Sect 2	3,470	7,400	1,402,000	2,284,443	153	0.92	180,583	1,296,626	2,112,745	7.18	9.08	3,209	6,844
Mud Gas Interface	3,470	7,400	1,402,000	2,284,443	204	0.89	117,677	1,247,343	2,032,443	SF>10	SF>10	3,087	6,584
Btm Csg Sect 2	3,470	7,400	1,402,000	2,284,443	239	0.87	74,033	1,222,647	1,992,203	SF>10	SF>10	3,026	6,453
Top Csg Sect 3	2,670	5,380	1,040,000	1,661,413	239	0.87	74,033	906,956	1,448,875	SF>10	SF>10	2,328	4,692
Btm Csg Sect 3	2,670	5,380	1,040,000	1,661,413	277	0.85	26,778	886,213	1,415,737	SF>10	SF>10	2,275	4,584
Top Csg Sect 4	2,260	5,020	963,000	1,555,616	277	0.85	26,778	820,599	1,325,584	SF>10	SF>10	1,926	4,278
Btm Csg Sect 4	2,260	5,020	963,000	1,555,616	300	0.84	0	808,441	1,305,945	SF>10	SF>10	1,897	4,214
Casing Shoe	2,260	5,020	963,000	1,555,616	300	0.84	0	808,441	1,305,945	SF>10	SF>10	1,897	4,214

Fig.24C Design Report Section 3

Section 3 of the Design Report shows:
- All Rated Strengths
- All De-rated Strengths due to temperature effect.

(d) Design Report: Section 4 (Fig. 24D)

Design Depths	Axial De-Rating Factors		Temp & Tension De-Rated Collapse	Axial Collapse SF	Burst SF	100% Evac Production Burst SF
	Tension / Yield Ratio	Axial De-Rating factors		60 % Mud Evac		
Datum (RKB)						
Ground Level	0.17	0.90	2,827	SF>10	2.69	1.79
Well Head	0.17	0.90	2,827	SF>10	2.69	1.79
Btm Csg Sect 1	0.10	0.95	2,710	2.56	4.79	2.00
Top Csg Sect 2	0.08	0.96	3,075	2.91	6.16	2.56
Mud Gas Interface	0.05	0.97	3,005	1.84	SF>10	2.80
Btm Csg Sect 2	0.03	0.98	2,976	1.82	SF>10	3.03
Top Csg Sect 3	0.04	0.98	2,275	1.39	8.73	2.20
Btm Csg Sect 3	0.02	0.99	2,257	1.38	8.53	2.43
Top Csg Sect 4	0.02	0.99	1,909	1.17	7.96	2.26
Btm Csg Sect 4	0.00	1.00	1,897	1.16	7.84	2.41
Casing Shoe	0.00	1.00	1,897	1.16	7.84	2.41

Cementing Collapse Design					
Lead Cmt Density	15.0	Lead Height	250 MD	204 TVD	
Tail Cement Density	12.0	Tail Height	150 MD	122 TVD	
Old Mud Weight	13.0	Displacement Fluid	10.0		
Cement Tops	MTD	TVD	Linear Temp °F	Collapse Loads	Collapse SF
Lead Cmt	5,211	4,840	285	1,905	2.52
Tail Cmt	5,461	5,045	294	1,902	2.35
Shoe	5,611	5,168	300	1,897	2.31

Fig.24D Design Report: Section 4

Section 4 of the Design Report shows:

- All De-rated strengths due to axial loading
- Cementing safety factors.

When UpDate Design is selected in the Design Report, all the design parameters and safety factors are linked and updated. These include:

- De-rated Loads
  - Burst
  - Collapse
  - De-rated Tension
  - Pressure ratings
  - Temperature De-rated Yields.

In addition, all Design Charts are constructed (Ref. Fig. 25).

(17) Typical Design Charts (Fig. 25)

When View Charts is selected in the Design Report, the design charts are displayed to give an instant visual indication for easy analysis

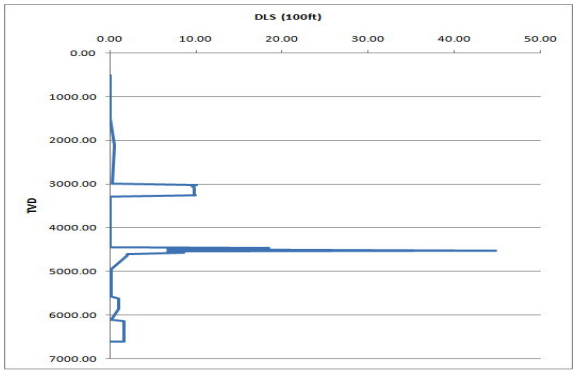


Fig. 25A Design Chart (DLS)

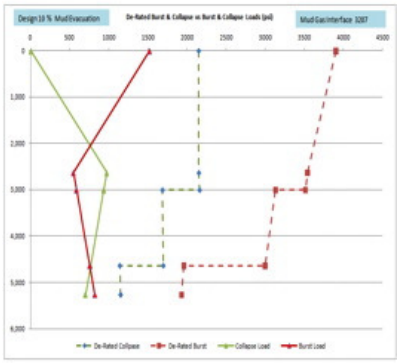


Fig. 25B Design Chart
(De-rated Burst and Collapse vs Rated Burst and Collapse)

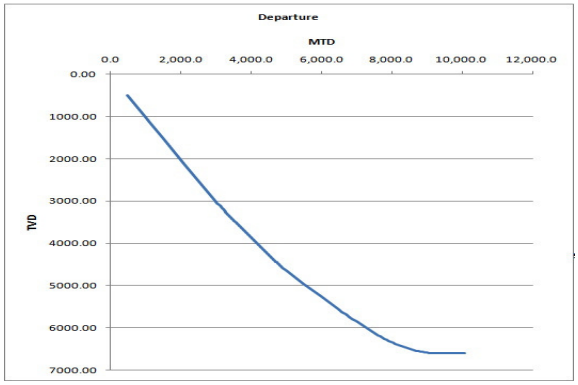


Fig.25C Design Chart (Departure)

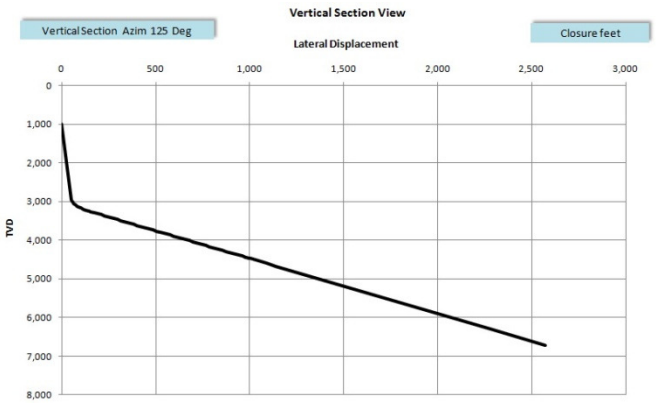


Fig.25D Design Chart (Vertical Section View)

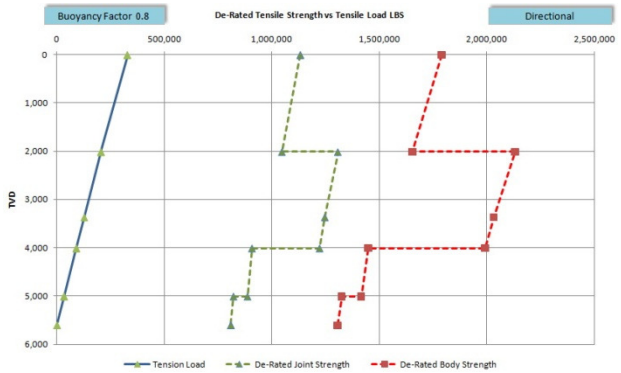


Fig.25E Design Chart
(De-rated Tensile Strength vs Tensile Load)

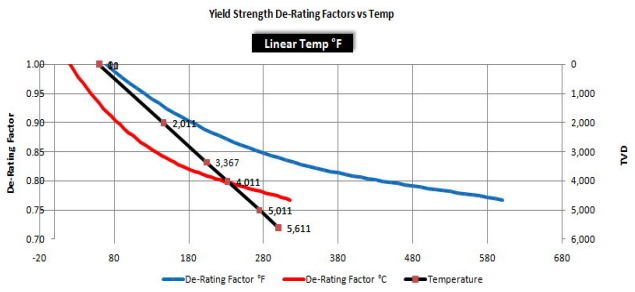
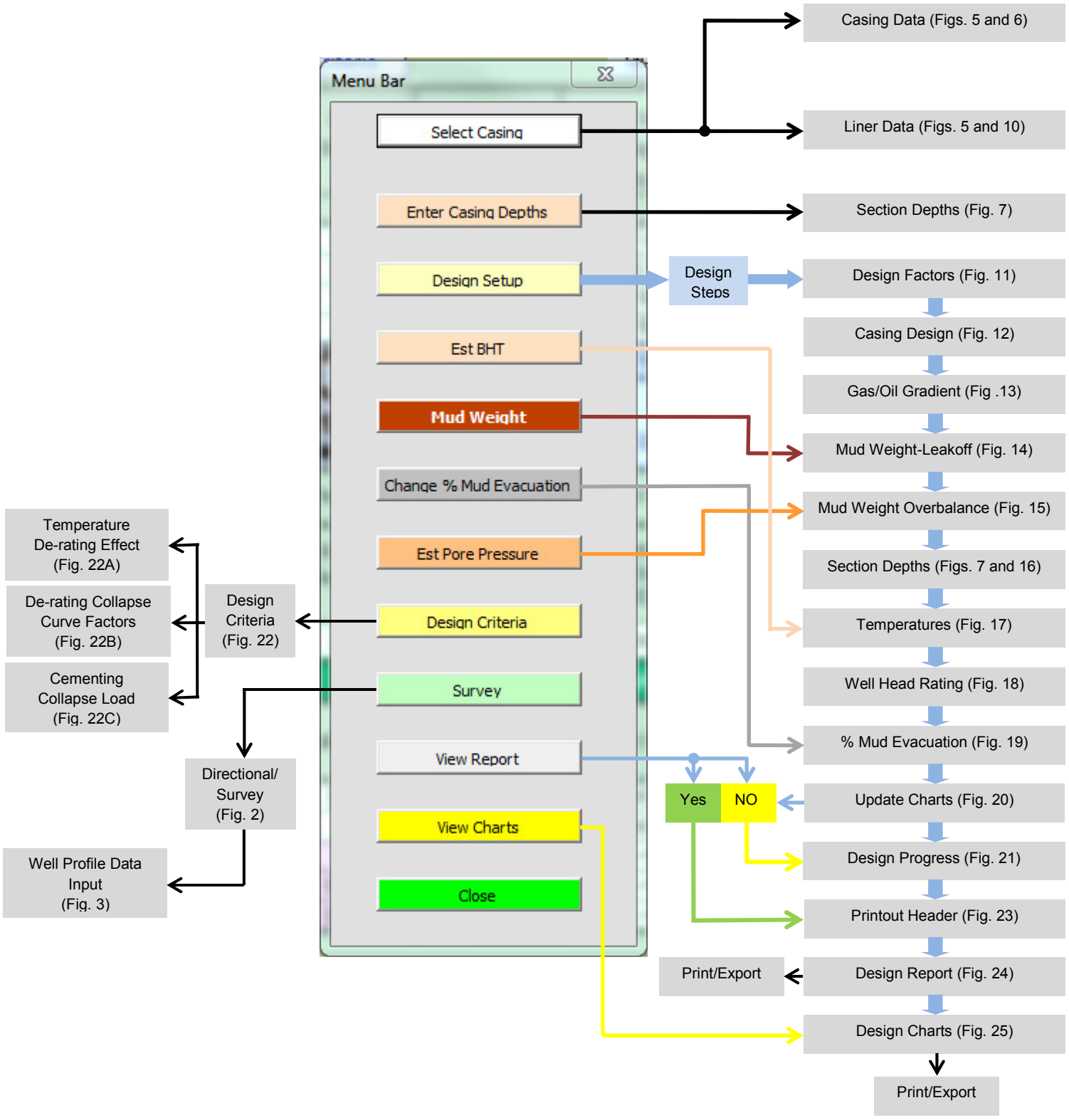


Fig.25F Design Chart
(Yield Strength De-rating Factors vs Temp).

Appendix A

1. Menu Bar Button Functions and Casing Design Flow Chart



Appendix B

1. Glossary

BHT	Bottom Hole Temperature
˚C	Degrees Centigrade
Csg	Casing
DLS	Dog Leg Severity
Drlg	Drilling
E/-W	East/West
˚F	Degrees Fahrenheit
ID	Inside Diameter
in	inches
lbs	pounds
MD	Measured Depth
MGI	Mud Gas Interface
N/-S	North/South
OD	Outside Diameter
ppf	pounds per foot
psi	pounds per square inch
TVD	True Vertical Depth
TVD SS	True Vertical Depth Sub Sea
WSD	Working Stress Design