```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from scipy import interpolate
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
api_casing_bit_size_programme= {'Casing OD': [4.5, 5, 5.5, 6.625, 7, 7.625, 8.625, 9.625, 10.75, 11.75, 13.375, 16, 18.625, 20, 24],
                                'Coupling OD': [5.000, 5.563, 6.050, 7.380, 7.656, 8.500, 9.625, 10.625, 11.750, 12.750, 14.375, 17.000, 19.500, 21.000, 25.500],
                                'Drift': [3.701, 4.283, 4.545, 5.550, 5.785, 6.500, 7.386, 8.379, 9.404, 10.616, 12.791, 14.822, 16.000, 18.936, 21.250],
                                'Min Clearance': [1.000, 1.250, 1.250, 1.750, 2.000, 2.500, 3.000, 3.250, 3.250,3.500,3.500,3.500,3.500,3.500,3.500],
                                'Min. Hole Size': [6.000, 6.833, 7.300, 9.140, 9.656, 11.000, 12.625, 13.875, 15.000, 17.875, 17.875, 20.500, 23.000, 24.500, 29.000],
                                'Min. Bit Size': [6, 7, 7.375, 9.5, 9.75, 11, 12.75, 14.75, 15, 18, 18, 20.75, 23, 25.5, 29]}

df= pd.DataFrame(api_casing_bit_size_programme)
df
```

	Casing OD	Coupling OD	Drift	Min Clearance	Min. Hole Size	Min. Bit Size
0	4.500	5.000	3.701	1.00	6.000	6.000
1	5.000	5.563	4.283	1.25	6.833	7.000
2	5.500	6.050	4.545	1.25	7.300	7.375
3	6.625	7.380	5.550	1.75	9.140	9.500
4	7.000	7.656	5.785	2.00	9.656	9.750
5	7.625	8.500	6.500	2.50	11.000	11.000
6	8.625	9.625	7.386	3.00	12.625	12.750
7	9.625	10.625	8.379	3.25	13.875	14.750
8	10.750	11.750	9.404	3.25	15.000	15.000
9	11.750	12.750	10.616	3.50	17.875	18.000
10	13.375	14.375	12.791	3.50	17.875	18.000
11	16.000	17.000	14.822	3.50	20.500	20.750
12	18.625	19.500	16.000	3.50	23.000	23.000
13	20.000	21.000	18.936	3.50	24.500	25.500
14	24.000	25.500	21.250	3.50	29.000	29.000

```
df.index= [1,2,3,4,5,6,7,8,9,10,11,12,13,14,15]
df
```

	Casing OD	Coupling OD	Drift	Min Clearance	Min. Hole Size	Min. Bit Size
1	4.500	5.000	3.701	1.00	6.000	6.000
2	5.000	5.563	4.283	1.25	6.833	7.000
3	5.500	6.050	4.545	1.25	7.300	7.375
4	6.625	7.380	5.550	1.75	9.140	9.500
5	7.000	7.656	5.785	2.00	9.656	9.750
6	7.625	8.500	6.500	2.50	11.000	11.000
7	8.625	9.625	7.386	3.00	12.625	12.750
8	9.625	10.625	8.379	3.25	13.875	14.750
9	10.750	11.750	9.404	3.25	15.000	15.000
10	11.750	12.750	10.616	3.50	17.875	18.000
11	13.375	14.375	12.791	3.50	17.875	18.000
12	16.000	17.000	14.822	3.50	20.500	20.750
13	18.625	19.500	16.000	3.50	23.000	23.000
14	20.000	21.000	18.936	3.50	24.500	25.500
15	24.000	25.500	21.250	3.50	29.000	29.000

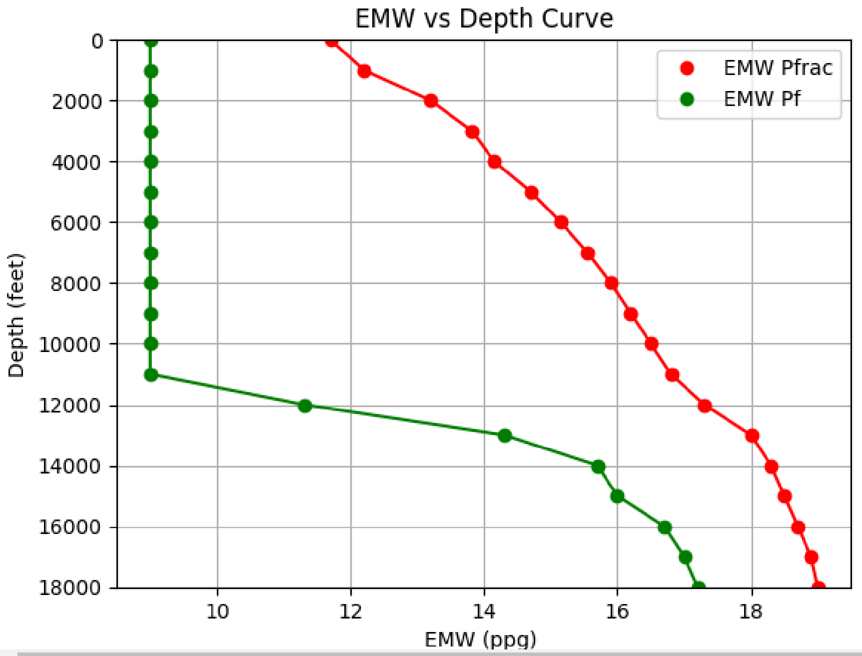
```
#getting casing configuration
def determine_bit_size(casing_od_value):
  global df
  min_bit_size= df.loc[df['Casing OD']==casing_od_value, 'Min. Bit Size'].values[0]
  return min_bit_size

def determine_next_casing_od_value(casing_od_value):
  global df
  df['Drift Diff']=df['Drift']-determine_bit_size(casing_od_value)
  positive_difference= df[df['Drift Diff']>0]
  if not positive_difference.empty:
    nearest_casing_od_row= positive_difference.loc[positive_difference['Drift Diff'].idxmin()]
    nearest_casing_od= nearest_casing_od_row['Casing OD']
    nearest_drift=  nearest_casing_od_row['Drift']
  else:
    nearest_casing_od= None
    nearest_drift= None
  return nearest_casing_od
  df= df.drop('Drift Diff', axis=1)
```

```
production_casing_od_value= 5.500
a= determine_bit_size(production_casing_od_value)
intermediate_casing_od_value= determine_next_casing_od_value(production_casing_od_value)
b= determine_bit_size(intermediate_casing_od_value)
surface_casing_od_value= determine_next_casing_od_value(intermediate_casing_od_value)
c= determine_bit_size(surface_casing_od_value)
conductor_casing_od_value= determine_next_casing_od_value(surface_casing_od_value)
d= determine_bit_size(conductor_casing_od_value)

dict1= {'Name of Casing': ['Conductor Casing', 'Surface Casing', 'Intermediate Casing', 'Production Casing'],
        'Casing Size(inch)': [conductor_casing_od_value, surface_casing_od_value,intermediate_casing_od_value,production_casing_od_value,],
        'Bit Size(inch)': [d, c, b, a]}
dt= pd.DataFrame(dict1)
dt.index=dt.index+1
casing_program = dt
casing_program
```

	Name of Casing	Casing Size(inch)	Bit Size(inch)
1	Conductor Casing	20.000	25.500
2	Surface Casing	13.375	18.000
3	Intermediate Casing	8.625	12.750
4	Production Casing	5.500	7.375

```
# Depth(ft) array
depth_array = np.arange(0, 19000, 1000)

# EMW (Pf) array
emw_pf_array = np.concatenate((np.full(11, 9.0), np.array([ 9.0, 11.3, 14.3, 15.7, 16.0, 16.7, 17.0, 17.2])))

# EMW P(frac) array
emw_pfrac_array = np.array([11.7, 12.20, 13.20, 13.82, 14.15, 14.70, 15.15, 15.55, 15.90, 16.2, 16.50, 16.80, 17.30, 18.00, 18.30, 18.50, 18.70, 18.90, 19.00])

# Interpolation
from scipy.interpolate import splrep, splev
emw_pf_predictator = splrep(depth_array, emw_pf_array, k=3, s=0.0)
emw_pf_predicted = splev(depth_array, emw_pf_predictator )
emw_pfrac_predictator = splrep(emw_pfrac_array, depth_array, k=3, s=4)
fracture_depth_predicted = splev(emw_pfrac_array, emw_pfrac_predictator)


# Create the inverted plot
plt.plot(emw_pfrac_array, depth_array, 'o', label='EMW Pfrac', color='red')
plt.plot(emw_pf_array, depth_array, 'o', label='EMW Pf',color='green')
plt.plot(emw_pfrac_array, fracture_depth_predicted, '-', color='red')
plt.plot(emw_pf_predicted, depth_array, '-',color='green')
```

```
# Set the y-axis limits to start at the bottom of the well till top (inverted)
plt.ylim(depth_array[len(depth_array)-1], 0)
# Customize labels and title
plt.xlabel('EMW (ppg) ')
plt.ylabel('Depth (feet)')
plt.title('EMW vs Depth Curve')

# Add a horizontal line at y=0 for better visualization of mirrored effect (optional)
plt.axhline(y=0, color='gray', linestyle='--', linewidth=0.5)

# Adjust legend placement (optional)
plt.legend(loc='upper right')

# Display the plot
plt.grid(True)
plt.show()
```




```
def casing_setting_depth(emw_pf_array, emw_pfrac_array, depth_array):
  setting_depth = np.array(depth_array[len(depth_array)-1]+100)
  least_emw_pfrac = emw_pfrac_array[0]
  emw = np.array([splev(depth_array[len(depth_array)-1], emw_pf_predictator ) + 0.8])
  emw1 = emw
  while emw > least_emw_pfrac:
    d = splev(emw, emw_pfrac_predictator) + 100
    setting_depth = np.append(setting_depth, d)
```

```
      emw = splev(d, emw_pf_predictator ) + 0.8
      emw1 = np.append(emw1, emw)
    return setting_depth,emw1


setting_depth , emw = casing_setting_depth(emw_pf_array, emw_pfrac_array, depth_array)
setting_depth_rounded = np.ceil(setting_depth/10)*10
emw_rounded = np.ceil(emw*10)/10
setting_depth_rounded = np.flip(setting_depth_rounded)
emw_rounded = np.flip(emw_rounded)


empty = np.empty(1)
empty[0] = np.nan
empty1 = np.empty(1)
empty1[0] = emw_rounded[0]
dict2 = {'Depth(ft)': np.concatenate((empty, setting_depth_rounded)),
         'Mud Weight(ppg)': np.concatenate((empty1, emw_rounded))}
dt1 = pd.DataFrame(dict2)
dt1.index = dt1.index + 1
# Create a new DataFrame by concatenating casing_program and dt1
casing_program_final = pd.concat([casing_program, dt1], axis=1)
casing_program_final.reset_index(drop=True, inplace=True)
casing_program_final = casing_program_final.fillna('As per requirement')
casing_program_final
```

	Name of Casing	Casing Size(inch)	Bit Size(inch)	Depth(ft)	Mud Weight(ppg)
0	Conductor Casing	20.000	25.500	As per requirement	9.8
1	Surface Casing	13.375	18.000	6530.0	9.8
2	Intermediate Casing	8.625	12.750	13100.0	15.4
3	Production Casing	5.500	7.375	18100.0	18.0

```
file_path='/content/table_google_colab.xlsx'
da = pd.read_excel(file_path, sheet_name='5.5')
da
```

	nominal weight	grade	L/S/B	Fj (1000 lbs)	Pb(psi)	Pc(psi)	K(1000lbs)
0	23.0	N-80	L	502	10560	11160	530
1	26.8	C-90	S	507	14320	14880	707
2	26.8	C-90	L	630	14320	14880	707
3	23.0	P-110	L	643	14530	14540	729
4	29.7	C-90	L	704	16090	16510	785
5	26.0	P-110	L	748	16660	17400	826
6	32.6	C-90	L	777	17900	18130	861
7	23.0	V-150	L	823	19810	18390	995
8	35.3	C-90	L	847	19670	19680	935
9	38.0	C-90	L	916	21480	21200	1007

```
file_path='/content/table_google_colab.xlsx'
db = pd.read_excel(file_path, sheet_name='8.625')
db
```

	nominal weight	grade	L/S/B	Fj (1000 lbs)	Pb(psi)	Pc(psi)	K(1000lbs)
0	28	H-40	S	233	2470	1160	318
1	24	J-55	S	241	2950	1370	381
2	32	H-40	S	279	2860	2200	366
3	32	J-55	S	372	3930	2530	503
4	32	J-55	L	417	3930	2530	503
5	36	J-55	S	434	4460	3450	568
6	36	J-55	L	486	4460	3450	568
7	36	N-80	L	688	6490	4100	827
8	40	N-80	L	788	7300	5520	925
9	40	C-90	L	858	8220	5870	1040
10	40	A-324	L	869	9980	5960	1123
11	40	B-123	L	890	9990	6000	1156
12	40	HCP-110	L	1055	10040	7900	1271
13	49	C-90	L	1085	10170	9340	1271
14	49	S-95	L	1159	10740	10400	1341
15	49	Q-125	L	1496	14130	11650	1765
16	49	V-150	L	1789	16950	12950	2118

```
file_path='/content/table_google_colab.xlsx'
dc = pd.read_excel(file_path, sheet_name='13.375')
dc
```

	nominal weight	grade	L/S/B	Fj (1000 lbs)	Pb(psi)	Pc(psi)	K(1000lbs)
0	48.0	H-40	S	322	1730	740	541
1	54.5	J-55	S	514	2730	1130	853
2	61.0	J-55	S	595	3090	1540	962
3	68.0	J-55	S	675	3450	1950	1069
4	68.0	N-80	S	963	5020	2260	1556
5	68.0	C-90	S	1057	5650	2320	1750
6	68.0	P-110	S	1297	6910	2340	2139
7	72.0	P-110	S	1402	7400	2890	2284
8	80.7	P-110	L	2493	8350	4000	2565
9	86.0	P-110	L	2677	8980	4780	2754
10	86.0	P-110	L	2677	8980	4780	2754
11	86.0	Q-125	L	2969	10200	5030	3129

```
def find_matching_row(filtered_df, next_casing_row):
    # Check if the 'L/S/B' entry in next_casing_row is 'S'
    if next_casing_row['L/S/B'].iloc[0] == 'S': # Access the first element of the series using iloc[0]
        # Find the row in filtered_df where 'L/S/B' is 'L' and 'nominal weight' and 'grade' match
        matching_row = filtered_df[
            (filtered_df['L/S/B'] == 'L') &
            (filtered_df['nominal weight'] == next_casing_row['nominal weight'].iloc[0]) & # Access the first element of the series using iloc[0]
            (filtered_df['grade'] == next_casing_row['grade'].iloc[0]) # Access the first element of the series using iloc[0]
        ]
        # Check if any matching row is found
        if not matching_row.empty:
            return matching_row
    return None


def lower_multiple_of_5(number):
    return (number // 5) * 5

def next_multiple_of_5(number):
    return ((number // 5) + 1) * 5


def casing_design(df, Pf, row, d):
    Nc = 1.125
    Nj = 2
    Na = 1.75
    Ni = 1
    df = df.sort_values(by='Fj (1000 lbs)', ascending=True)
```

```
# Filter rows where Pb(psi) is greater than Pf
filtered_df =df[df['Pb(psi)'] > Pf*Ni]
filtered_df = filtered_df.reset_index(drop=True)
P_gr = 0.052*row
B = (65.4 - row) / 65.4
W = 0

Ph = P_gr*d
df_1 = filtered_df[filtered_df['Pc(psi)'] > Ph*Nc]

# Assuming df_1 is your DataFrame and you want to extract values from the first row
first_row = df_1.iloc[0]

# Extracting values into variables
w_1 = first_row['nominal weight']
grade = first_row['grade']
L_S_B = first_row['L/S/B']
Fj_1 = first_row['Fj (1000 lbs)']*1000
Pb = first_row['Pb(psi)']
Pc = first_row['Pc(psi)']
K = first_row['K(1000lbs)']*10**3
LS_1 = d

# Create an empty DataFrame with the specified columns
columns = ['w', 'grade', 'L/S/B', 'Fj', 'Pb', 'Pc', 'K', 'LS', 'W', 'Design Criteria']
casing_design_table = pd.DataFrame(columns=columns)
# Create a dictionary with the extracted values
new_row = {
  'w': w_1,
  'grade': grade,
  'L/S/B': L_S_B,
  'Fj': Fj_1,
  'Pb': Pb,
  'Pc': Pc,
  'K': K,
  'LS': LS_1,
  'W' : W,
  'Design Criteria': 'Collapse'
      }
# Assuming casing_design_table is your DataFrame and new_row is the new data to be added
new_row_df = pd.DataFrame([new_row])

# Filter out empty or all-NA columns from new_row_df
new_row_df = new_row_df.dropna(axis=1, how='all')
# Assuming casing_design_table is your DataFrame and new_row is the new data to be added
casing_design_table = pd.concat([casing_design_table, new_row_df], ignore_index=True)

# Just to start loop
LS_2 = next_multiple_of_5(LS_1)
LM_2 = LS_2 +10
```

```
        top = d
        first_row = pd.DataFrame([first_row])
        while top >= 20:
          if LM_2>LS_2:
            w_1 = first_row['nominal weight'].iloc[0]
            LS_1 = LS_2

            # Get the index of the first row in df_1 within filtered_df
            first_row_index = filtered_df[filtered_df.eq(first_row.iloc[0]).all(axis=1)].index

            # Next Row
            next_casing_row_index = first_row_index - 1

            # Select the row just above the first row of df_1
            next_casing_row = filtered_df.iloc[next_casing_row_index]

            # Extracting values into variables
            w_2 = next_casing_row['nominal weight'].iloc[0]
            grade = next_casing_row['grade'].iloc[0]
            L_S_B = next_casing_row['L/S/B'].iloc[0]
            Fj_2 = next_casing_row['Fj (1000 lbs)'].iloc[0] * 1000
            Pb = next_casing_row['Pb(psi)'].iloc[0]
            Pc = next_casing_row['Pc(psi)'].iloc[0]
            K = next_casing_row['K(1000lbs)'].iloc[0] * 10**3

            # Calculating Setting depth
            LS_2 = Pc/(P_gr*Nc)
            Pcc = Pc
            LS_22 = LS_2
            while True:
                LS_2 = LS_22
                t = w_1*B*(LS_1 - LS_2)
                Pcc = (Pc/K)*( ((K**2) - 3*(W+t)**2)**(0.5) - (W+t))
                LS_22 = Pcc/(P_gr*Nc)
                if abs(LS_2 - LS_22) <= 5:
                    break
            LS_2 =next_multiple_of_5(LS_22)
            t = w_1*B*(LS_1 - LS_2)
            W += t
            LM_2 = ((Fj_2 / Nj) - W) / (w_2*B)

            # Checking for Long Thread Pipe
            if LM_2 <= LS_2:
              temp = find_matching_row(filtered_df, next_casing_row)
              if temp == None:
                 next_casing_row = next_casing_row
                 LS_2 = lower_multiple_of_5(LS_22)
              else:
                # Extracting values into variables
                w_L = temp['nominal weight'].iloc[0]
                Fj_L = temp['Fj (1000 lbs)'].iloc[0]*1000
```

```
        Pc_L = temp['Pc(psi)'].iloc[0]
        K_L = temp['K(1000lbs)'].iloc[0]*10**3

        # Calculating Setting depth
        W_L = W -t
        LS_L = Pc_L/(P_gr*Nc)
        Pcc = Pc_L
        LS_22_L = LS_L
        while True:
            LS_L = LS_22_L
            t_L += w_1*B*(LS_1 - LS_L)
            Pcc = (Pc_L/K_L)*( ((K_L**2) - 3*(W_L + t_L)**2)**(0.5) - (W_L + t_L))
            LS_22_L = Pcc/(P_gr*Nc)
            if (LS_22_L - LS_L) <= 5:
                  break
        LS_L = next_multiple_of_5(LS_22_L)
        t_L += w_1*B*(LS_1 - LS_L)
        W_L += t_L
        LM_L = ((Fj_L / Nj) - W_L) / (w_L*B)
        if LM_L > LS_L:
          next_casing_row = temp
          # Extracting values into variables
          w_2 = next_casing_row['nominal weight'].iloc[0]
          grade = next_casing_row['grade'].iloc[0]
          L_S_B = next_casing_row['L/S/B'].iloc[0]
          Fj_2 = next_casing_row['Fj (1000 lbs)'].iloc[0] * 1000
          Pb = next_casing_row['Pb(psi)'].iloc[0]
          Pc = next_casing_row['Pc(psi)'].iloc[0]
          K = next_casing_row['K(1000lbs)'].iloc[0] * 10**3
          LS_2 = LS_L
          LM_2 = LM_L
          W = W_L
        else:
            next_casing_row = next_casing_row
            LS_2 = lower_multiple_of_5(LS_22)
   # Create a dictionary with the extracted values
    new_row = {
     'w': w_2,
     'grade': grade,
     'L/S/B': L_S_B,
     'Fj': Fj_2,
     'Pb': Pb,
     'Pc': Pc,
     'K': K,
     'LS': LS_2,
     'W' : W,
     'Design Criteria': 'Collapse'
              }
    # Assuming casing_design_table is your DataFrame and new_row is the new data to be added
    new_row_df = pd.DataFrame([new_row])
```

```
        # Filter out empty or all-NA columns from new_row_df
        new_row_df = new_row_df.dropna(axis=1, how='all')
        # Assuming casing_design_table is your DataFrame and new_row is the new data to be added
        casing_design_table = pd.concat([casing_design_table, new_row_df], ignore_index=True)
        first_row = next_casing_row
        top = LS_2

      else:
        LS_3 = lower_multiple_of_5(LS_2 - LM_2)
        top = LS_3
        w_1 = first_row['nominal weight'].iloc[0]
        # Get the index of the first row in df_1 within filtered_df
        first_row_index = filtered_df[filtered_df.eq(first_row.iloc[0]).all(axis=1)].index

        next_casing_row_index = first_row_index + 1

        # Select the row just above the first row of df_1
        next_casing_row = filtered_df.iloc[next_casing_row_index]

         # Extracting values into variables
        w_2 = next_casing_row['nominal weight'].iloc[0]
        grade = next_casing_row['grade'].iloc[0]
        L_S_B = next_casing_row['L/S/B'].iloc[0]
        Fj_2 = next_casing_row['Fj (1000 lbs)'].iloc[0] * 1000
        Pb = next_casing_row['Pb(psi)'].iloc[0]
        Pc = next_casing_row['Pc(psi)'].iloc[0]
        K = next_casing_row['K(1000lbs)'].iloc[0] * 10**3

        W += w_1*B*(LS_2-LS_3)
        LM_2 = ((Fj_2 / Nj) - W) / (w_2*B)
        LS_2 = LS_3
        if LM_2+20 >= top:
            top = 0
        # Create a dictionary with the extracted values
        new_row = {
         'w': w_2,
         'grade': grade,
         'L/S/B': L_S_B,
         'Fj': Fj_2,
         'Pb': Pb,
         'Pc': Pc,
         'K': K,
         'LS': LS_3,
         'W' : W,
         'Design Criteria': 'Tension'
                 }
         # Assuming casing_design_table is your DataFrame and new_row is the new data to be added
        new_row_df = pd.DataFrame([new_row])

         # Filter out empty or all-NA columns from new_row_df
        new_row_df = new_row_df.dropna(axis=1, how='all')
```

```
            # Assuming casing_design_table is your DataFrame and new_row is the new data to be added
            casing_design_table = pd.concat([casing_design_table, new_row_df], ignore_index=True)
            first_row = next_casing_row

    return casing_design_table


production_casing_row = casing_program_final[casing_program_final['Name of Casing'] == 'Production Casing']
if not production_casing_row.empty:
    production_casing_depth = production_casing_row['Depth(ft)'].values[0]
    production_casing_mud_weight_used = production_casing_row['Mud Weight(ppg)'].values[0]
    mud_pro= production_casing_mud_weight_used - 0.8
    pro_pf= 0.052*production_casing_depth*mud_pro
    print("Production Casing Design")
    x= casing_design(da, pro_pf, production_casing_mud_weight_used, production_casing_depth)
    print(x)
else:
    print("No 'Production casing' found in casing_program_final")
```

```
Production Casing Design
      w  grade L/S/B      Fj     Pb     Pc       K       LS              W  \
0  35.3   C-90     L  847000  19670  19680  935000  18100.0              0
1  23.0  V-150     L  823000  19810  18390  995000  16905.0   30701.284404
2  32.6   C-90     L  777000  17900  18130  861000  16370.0   39536.238532
3  23.0  V-150     L  823000  19810  18390  995000   1600.0  388514.752294
4  35.3   C-90     L  847000  19670  19680  935000    220.0  411518.972477

  Design Criteria
0        Collapse
1        Collapse
2        Collapse
3         Tension
4         Tension
<ipython-input-28-3d03730c8315>:53: FutureWarning: The behavior of DataFrame concatenation with empty or all-NA entries is deprecated. In a future version, this will no longer
  casing_design_table = pd.concat([casing_design_table, new_row_df], ignore_index=True)
```

```
intermediate_casing_row = casing_program_final[casing_program_final['Name of Casing'] == 'Intermediate Casing']
if not intermediate_casing_row.empty:
    intermediate_casing_depth = intermediate_casing_row['Depth(ft)'].values[0]
    intermediate_casing_mud_weight_used = intermediate_casing_row['Mud Weight(ppg)'].values[0]
    mud_inter = intermediate_casing_mud_weight_used - 0.8
    inter_pf = 0.052 * intermediate_casing_depth * mud_inter
    print("Intermediate Casing Design")
    y= casing_design(db, inter_pf, intermediate_casing_mud_weight_used, intermediate_casing_depth)
    print(y)
else:
    print("No 'Intermediate casing' found in casing_program_final")
```

```
rmediate Casing Design
v   grade L/S/B      Fj     Pb     Pc       K       LS              W  \
```

```
)    V-150     L  1789000  16950  12950  2118000  13100.0             0
)    Q-125     L  1496000  14130  11650  1765000  12870.0     8803.51682
)     S-95     L  1159000  10740  10400  1341000  10690.0   90470.183486
)     C-90     L  1085000  10170   9340  1271000   8805.0  161085.626911
)  HCP-110     L  1055000  10040   7900  1271000   6585.0  244250.764526
)    B-123     L   890000   9990   6000  1156000   3945.0  324831.804281
)  HCP-110     L  1055000  10040   7900  1271000     15.0   445015.29052

sign Criteria
    Collapse
    Collapse
    Collapse
    Collapse
    Collapse
    Collapse
     Tension
thon-input-28-3d03730c8315>:53: FutureWarning: The behavior of DataFrame concatenation with empty or all-NA entries is deprecated. In a future version, this will no longer exclu
```