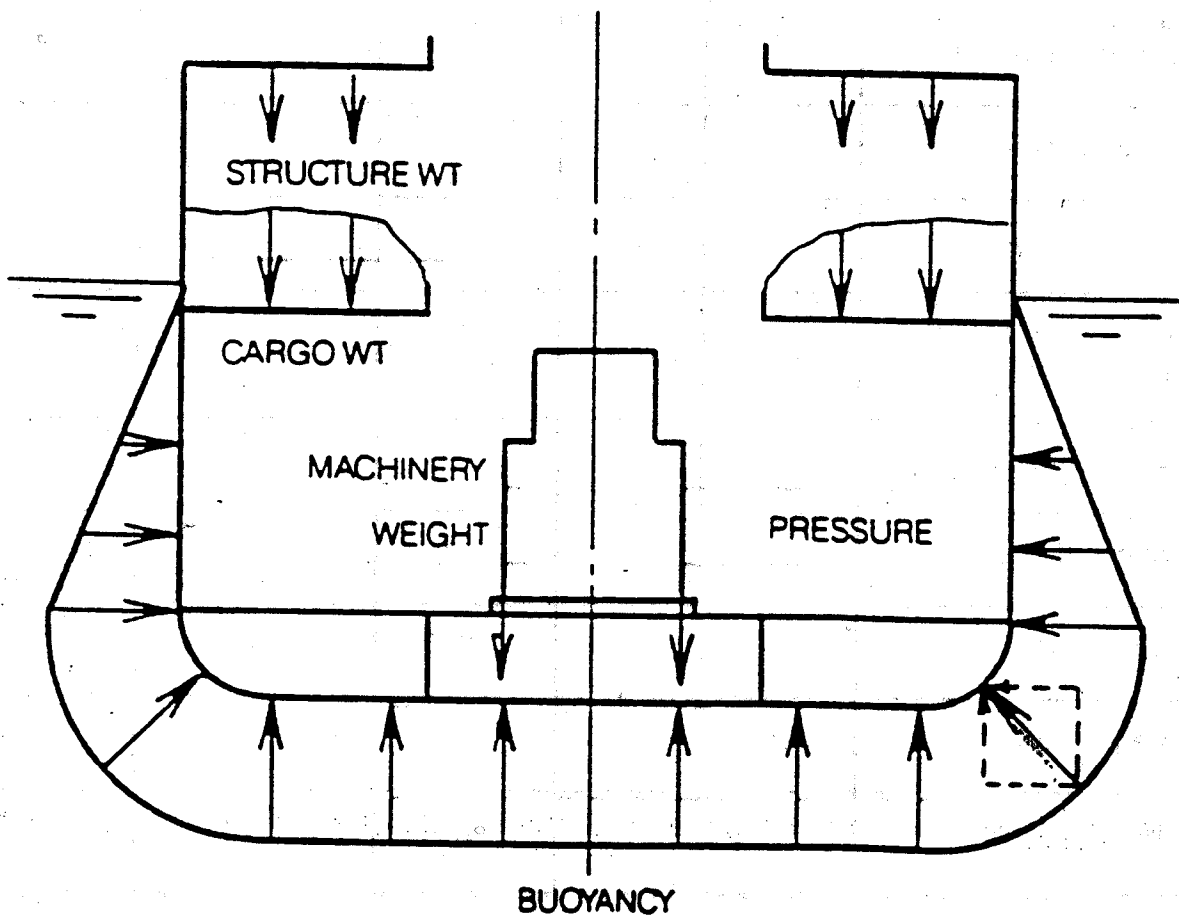


# 13.122

## APPLICATION OF DESIGN LOADS

|    | <u>Loads</u>                         | <u>Bottom Shell</u> | <u>Side Shell</u> | <u>Weather Deck</u> | <u>Continuous Internal Deck</u> | <u>Internal Deck</u> |
|----|--------------------------------------|---------------------|-------------------|---------------------|---------------------------------|----------------------|
| 1. | Sea and Weather<br>(choose largest): |                     |                   |                     |                                 |                      |
|    | Passing Wave                         | X                   | X                 |                     |                                 |                      |
|    | Roll                                 | X                   | X                 |                     |                                 |                      |
|    | Green Water and Pitch                |                     |                   | X                   |                                 |                      |
|    | Wave Slapping                        |                     | X                 |                     |                                 |                      |
| 2. | Damage Load                          |                     |                   |                     | X                               |                      |
| 3. | Dead Load                            |                     |                   | X                   | X                               | X                    |
| 4. | Live Load                            |                     |                   |                     |                                 | X                    |
| 5. | Primary Stress                       | X                   | X                 | X                   | X                               | X                    |

13.122  
**SHIP STRUCTURE LOADS**



MATERIAL PROPERTIES

| Material                 | $\rho$<br>Density<br>lbs/in <sup>3</sup> | E<br>Modulus of<br>Elasticity,<br>KSI | $\mu$<br>Poisson's<br>Ratio | $\sigma_Y$<br>Nominal<br>Yield<br>Strength,<br>KSI | $\sigma_{PL}$<br>Proportional<br>Limit,<br>KSI | $\sigma_{ALW}$<br>Allowable<br>Working<br>Stress,<br>KSI | $\sigma_{MAX}$<br>Maximum<br>Primary<br>Stress,<br>KSI |
|--------------------------|------------------------------------------|---------------------------------------|-----------------------------|----------------------------------------------------|------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|
| Medium Steel, MS, OS     | 0.283                                    | 29.6 x 10 <sup>3</sup>                | 0.30                        | 34                                                 | 25                                             | 27                                                       | 19.04                                                  |
| High Tensile Steel, HTS  | 0.283                                    | 29.6 x 10 <sup>3</sup>                | 0.30                        | 47                                                 | 34                                             | 38                                                       | 21.28                                                  |
| High Strength Steel, HSS | 0.283                                    | 29.6 x 10 <sup>3</sup>                | 0.30                        | 51                                                 | 34                                             | 40                                                       | 21.28                                                  |
| HY-80                    | 0.283                                    | 29.6 x 10 <sup>3</sup>                | 0.30                        | 80                                                 | 60                                             | 55                                                       | 23.52                                                  |
| HY-100                   | 0.283                                    | 29.6 x 10 <sup>3</sup>                | 0.30                        | 100                                                | 75                                             | 66                                                       | 24.19                                                  |
| AL 5086-H116, Plates     | 0.094                                    | 10 x 10 <sup>3</sup>                  | 0.33                        | 22                                                 | 22                                             | 18                                                       | 10.08                                                  |
| AL 5086-H111, Shapes     | 0.094                                    | 10 x 10 <sup>3</sup>                  | 0.33                        | 16                                                 | 16                                             | 14                                                       | 10.08                                                  |
| AL 5456-H116, Plates     | 0.094                                    | 10 x 10 <sup>3</sup>                  | 0.33                        | 26                                                 | 26                                             | 21                                                       | 10.08                                                  |
| AL 5456-H111, Shapes     | 0.094                                    | 10 x 10 <sup>3</sup>                  | 0.33                        | 21                                                 | 21                                             | 17                                                       | 10.08                                                  |

sourced from TABLE 5.1-2 MATERIAL PROPERTIES of ASSET

## STEEL PLATE CATALOG

| CODE<br>(NUMBER) | THICKNESS<br>(INCHES) | WEIGHT<br>(PSF) |
|------------------|-----------------------|-----------------|
| 1                | 0.1250 *              | 5.10            |
| 2                | 0.1563                | 6.38            |
| 3                | 0.1875 *              | 7.65            |
| 4                | 0.2188                | 8.93            |
| 5                | 0.2500 *              | 10.20           |
| 6                | 0.2813                | 11.48           |
| 7                | 0.3125 *              | 12.75           |
| 8                | 0.3438                | 14.03           |
| 9                | 0.3750 *              | 15.30           |
| 10               | 0.4375                | 17.85           |
| 11               | 0.5000 *              | 20.40           |
| 12               | 0.5625                | 22.95           |
| 13               | 0.6250 *              | 25.50           |
| 14               | 0.6875                | 28.05           |
| 15               | 0.7500 *              | 30.60           |
| 16               | 0.8750                | 35.70           |
| 17               | 1.0000 *              | 40.80           |
| 18               | 1.1250                | 45.90           |
| 19               | 1.2500                | 51.00           |
| 20               | 1.3750                | 56.10           |
| 21               | 1.5000                | 61.20           |
| 22               | 1.7500                | 71.40           |
| 23               | 2.0000                | 81.60           |

Source: TABLE 5.2-1 of ASSET

\* allowable plates for 13.122 designs = 13.122 CATALO

### 13.122 STEEL STIFFENER/GIRDER/FRAME CATALOG

|             |                 |                    |                |                 |                |
|-------------|-----------------|--------------------|----------------|-----------------|----------------|
| STIF := 1   | SCG ≡ 2.98-in   | SDEPTH ≡ 3.95-in   | TSW ≡ .17-in   | BSF ≡ 3.94-in   | TSF ≡ .205-in  |
| STIF := 3   | SCG := 4.22-in  | SDEPTH := 5.9-in   | TSW := .17-in  | BSF := 3.94-in  | TSF := .215-in |
| STIF := 3   | GCG := 4.22-in  | GDEPTH := 5.9-in   | TGW := .17-in  | BGF := 3.94-in  | TGF := .215-in |
| STIF := 3   | FCG := 4.22-in  | FDEPTH := 5.9-in   | TFW := .17-in  | BFF := 3.94-in  | TFF := .215-in |
| STIF := 6   | SCG := 5.35-in  | SDEPTH := 7.89-in  | TSW := .17-in  | BSF := 3.94-in  | TSF := .205-in |
| STIF := 6   | GCG := 5.35-in  | GDEPTH := 7.89-in  | TGW := .17-in  | BGF := 3.94-in  | TGF := .205-in |
| STIF := 6   | FCG := 5.35-in  | FDEPTH := 7.89-in  | TFW := .17-in  | BFF := 3.94-in  | TFF := .205-in |
| STIF := 14  | SCG := 6.37-in  | SDEPTH := 9.87-in  | TSW := .19-in  | BSF := 3.96-in  | TSF := .21-in  |
| STIF := 14  | GCG := 6.37-in  | GDEPTH := 9.87-in  | TGW := .19-in  | BGF := 3.96-in  | TGF := .21-in  |
| STIF := 14  | FCG := 6.37-in  | FDEPTH := 9.87-in  | TFW := .19-in  | BFF := 3.96-in  | TFF := .21-in  |
| STIF := 24  | SCG := 7.49-in  | SDEPTH := 11.91-in | TSW := .2-in   | BSF := 3.97-in  | TSF := .225-in |
| STIF := 24  | GCG := 7.49-in  | GDEPTH := 11.91-in | TGW := .2-in   | BGF := 3.97-in  | TGF := .225-in |
| STIF := 24  | FCG := 7.49-in  | FDEPTH := 11.91-in | TFW := .2-in   | BFF := 3.97-in  | TFF := .225-in |
| STIF := 35  | SCG := 7.95-in  | SDEPTH := 12.16-in | TSW := .235-in | BSF := 4.01-in  | TSF := .35-in  |
| STIF := 35  | GCG := 7.95-in  | GDEPTH := 12.16-in | TGW := .235-in | BGF := 4.01-in  | TGF := .35-in  |
| STIF := 35  | FCG := 7.95-in  | FDEPTH := 12.16-in | TFW := .235-in | BFF := 4.01-in  | TFF := .35-in  |
| STIF := 49  | GCG := 9.39-in  | GDEPTH := 13.91-in | TGW := .255-in | BGF := 5.03-in  | TGF := .42-in  |
| STIF := 49  | FCG := 9.39-in  | FDEPTH := 13.91-in | TFW := .255-in | BFF := 5.03-in  | TFF := .42-in  |
| STIF := 60  | GCG := 10.61-in | GDEPTH := 15.88-in | TGW := .275-in | BGF := 5.53-in  | TGF := .44-in  |
| STIF := 60  | FCG := 10.61-in | FDEPTH := 15.88-in | TFW := .275-in | BFF := 5.53-in  | TFF := .44-in  |
| STIF := 81  | GCG := 12.39-in | GDEPTH := 17.99-in | TGW := .355-in | BGF := 7.5-in   | TGF := .57-in  |
| STIF := 81  | FCG := 12.39-in | FDEPTH := 17.99-in | TFW := .355-in | BFF := 7.5-in   | TFF := .57-in  |
| STIF := 107 | GCG := 16.48-in | GDEPTH := 24.28-in | TGW := .52-in  | BGF := 9.06-in  | TGF := .87-in  |
| STIF := 107 | FCG := 16.48-in | FDEPTH := 24.28-in | TFW := .52-in  | BFF := 9.06-in  | TFF := .87-in  |
| STIF := 112 | GCG := 18.24-in | GDEPTH := 27.06-in | TGW := .52-in  | BGF := 10.02-in | TGF := .83-in  |
| STIF := 112 | FCG := 18.24-in | FDEPTH := 27.06-in | TFW := .52-in  | BFF := 10.02-in | TFF := .83-in  |
| STIF := 120 | GCG := 19.01-in | GDEPTH := 30.01-in | TGW := .55-in  | BGF := 12.0-in  | TGF := .89-in  |

# SHIP STRUCTURE LIMIT STATES

| <u>Structure<br/>Component/Level</u> | <u>Serviceability</u>                                        | <u>Collapse</u>      |
|--------------------------------------|--------------------------------------------------------------|----------------------|
| Plate                                | PSPBT<br>PSPBL<br>PFLB<br>PSET                               | PCMY                 |
| Panel                                | PYTF (+bend)<br>PYCP (+bend)<br>PYTP (-bend)<br>PYCF (-bend) | PCSF<br>PCCB<br>PCSB |
| Girder                               | GYBF<br>GYBP<br>GYTF<br>GYTP                                 | GCT<br>GCCF<br>GCCP  |
| Frame                                | FYCF1,2,3<br>FYTF1,2,3<br>FYCP1,2,3<br>FYTP1,2,3             | FCPH1,2,3            |
| Stanchion                            |                                                              | CCB                  |

## Modes of Failure

| Name      | Definition                                                                       |
|-----------|----------------------------------------------------------------------------------|
| PCSF      | Panel Collapse -Stiffener Flexure                                                |
| PCCB      | Panel Collapse -Combined Buckling                                                |
| PCMY      | Panel Collapse -Membrane Yield                                                   |
| PCSB      | Panel Collapse -Stiffener Buckling                                               |
| PYTF      | Panel Yield -Tension, Flange                                                     |
| PYTP      | Panel Yield -Tension, Plate                                                      |
| PYCF      | Panel Yield -Compression, Flange                                                 |
| PYCP      | Panel Yield -Compression, Plate                                                  |
| PSPBT     | Panel Serviceability -Plate Bending, Transverse                                  |
| PSPBL     | Panel Serviceability -Plate Bending, Longitudinal                                |
| PFLB      | Panel Failure -Local Buckling                                                    |
| GCf       | Girder Collapse -Tripping                                                        |
| GCCF      | Girder Collapse -Compression, Flange                                             |
| GCCP      | Girder Collapse -Compression, Plate                                              |
| GYBF      | Girder Yield -Bending, Flange                                                    |
| GYBP      | Girder Yield -Bending, Plate                                                     |
| GYff      | Girder Yield -Tension, Flange                                                    |
| GYTP      | Girder Yield -Tension, Plate                                                     |
| FCPHI,2,3 | Frame Collapse -Plastic Hinge                                                    |
| FYCFI,2,3 | Frame Yield -Compression, Flange                                                 |
| FYTFI,2,3 | Frame Yield -Tension, Flange                                                     |
| FYCP,2,3  | Frame Yield -Compression, Plate                                                  |
| FYTP,2,3  | Frame Yield -Tension, Plate                                                      |
|           | Strake Edge 1,<br>  Strake Edge 2,<br>  and<br>  midlength of<br>  frame segment |
| CCBB      | Cylinder Collapse -Bay Buckling                                                  |
| CCGB      | Cylinder Collapse -General Buckling                                              |
| CCLB      | Cylinder Collapse -Local Buckling                                                |

The last three are used in strakes that form part of a cylinder; they replace PCSF, PCCB and PCSB respectively.

Figure 28 Modes of Failure Examined by MAESTRO