

MEMO 502

 BSF - MAIN DIMENSIONS AND MATERIAL  
 PROPERTIES OF BEAM AND COLUMN  
 UNITS  
 PLANNING

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## BSF - MAIN DIMENSIONS AND MATERIAL PROPERTIES OF BEAM AND COLUMN UNITS<sup>1</sup>

### QUALITIES

Reinforcement 500C (EN 1992-1-1, Annex C)

$$f_{yd} = f_{yk}/\gamma_s = 500/1,15 = 435 \text{ MPa}$$

Steel Sxxx (EN 10025-2):

 S355: Tension:  $f_{yd} = f_y/\gamma_{M0} = 355/1,1 = 322 \text{ MPa}$ 

 Compression:  $f_{yd} = f_y/\gamma_{M0} = 355/1,1 = 322 \text{ MPa}$ 

 Shear:  $f_{sd} = f_y/(\gamma_{M0}\times\sqrt{3}) = 355/(1,1\times\sqrt{3}) = 186 \text{ MPa}$ 

$$\text{Weld S355: } f_{w,d} = \frac{f_u}{\gamma_{M2}\sqrt{3}} \times \frac{1}{\beta_w} = \frac{510}{1,25 \times \sqrt{3}} \times \frac{1}{0,9} = 262 \text{ MPa}$$

 S275: Tension:  $f_{yd} = f_y/\gamma_{M0} = 275/1,1 = 250 \text{ MPa}$ 

 Compression:  $f_{yd} = f_y/\gamma_{M0} = 275/1,1 = 250 \text{ MPa}$ 

 Shear:  $f_{sd} = f_y/(\gamma_{M0}\times\sqrt{3}) = 275/(1,1\times\sqrt{3}) = 144 \text{ MPa}$ 

$$\text{Weld S275: } f_{w,d} = \frac{f_u}{\gamma_{M2}\sqrt{3}} \times \frac{1}{\beta_w} = \frac{430}{1,25 \times \sqrt{3}} \times \frac{1}{0,85} = 233 \text{ MPa}$$

Threaded bars/nut:

$$8.8 \text{ quality steel: } f_{yd} = 0,9\times f_u/\gamma_{M2} = 0,9\times 800/1,25 = 576 \text{ MPa}$$

<sup>1</sup> The design of the column unit and horizontal anchoring of the threaded bars in the beam/column is based on the assumption of minimum concrete grade C35/45. For NDP's and further information, see Memo 521 "BSF units – Design of reinforcement" and Memo "BSF- Design of steel units"

## DIMENSIONS AND CROSS-SECTION PARAMETERS

| UNIT   | KNIFE  |        |        |             | POSITION      | HALF ROUND STEEL |        |             | HORIZONTAL ANCHORING <sup>1)</sup>             |
|--------|--------|--------|--------|-------------|---------------|------------------|--------|-------------|--|
|        | L [mm] | H [mm] | t [mm] | Steel grade |               | D [mm]           | L [mm] | Steel grade |  |
| BSF225 | 510    | 195    | 20     | S355        | FRONT (TOP)   | Ø76              | 100    | S355        | 2×M12, 8.8+ nut, L=650mm & st.pl.50×50×8, S355 |
|        |        |        |        |             | BACK (BOTTOM) | Ø76              | 100    | S275        | 1×M16, 8.8+nut, L=350mm & st.pl.70×70×10,S355  |
| BSF300 | 510    | 235    | 20     | S355        | FRONT (TOP)   | Ø76              | 100    | S355        | 2×M12, 8.8+nut, L=650mm & st.pl.50×50×8, S355  |
|        |        |        |        |             | BACK (BOTTOM) | Ø76              | 100    | S275        | 1×M16, 8.8+nut, L=350mm & st.pl.70×70×10,S355  |
| BSF450 | 645    | 250    | 30     | S355        | FRONT (TOP)   | Ø76              | 140    | S355        | 2×M12, 8.8+nut, L=750mm & st.pl.50×50×8, S355  |
|        |        |        |        |             | BACK (BOTTOM) | Ø76              | 100    | S275        | 1×M16, 8.8+nut, L=350mm & st.pl.70×70×10,S355  |
| BSF700 | 645    | 280    | 40     | S355        | FRONT (TOP)   | Ø175             | 140    | S355        | 2×M16, 8.8+nut, L=750mm & st.pl.70×70×10, S355 |
|        |        |        |        |             | BACK (BOTTOM) | Ø76              | 100    | S275        | 1×M20, 8.8+nut, L=350mm & st.pl.90×90×12,S355  |

**Table 1: Dimensions and steel qualities - beam unit.**

| UNIT   | BOTTOM PLATE |            |                |             | VERTICAL REINFORCEMENT BAR | HORIZONTAL ANCHORING                    |
|--------|--------------|------------|----------------|-------------|----------------------------|---|
|        | Length [mm]  | Width [mm] | Thickness [mm] | Steel grade |                            |   |
| BSF225 | 110          | 100        | 20             | S355        | 1×Ø20 L=600mm              | 2×M12, 8.8 +nut & st.pl. 50×50×8, S355  |
| BSF300 | 110          | 100        | 20             | S355        | 1×Ø20 L=600mm              | 2×M12, 8.8 +nut & st.pl. 50×50×8, S355  |
| BSF450 | 125          | 140        | 25             | S355        | 1×Ø25 L=600mm              | 2×M16, 8.8 +nut & st.pl. 70×70×10, S355 |
| BSF700 | 150          | 150        | 40             | S355        | 2×Ø25 L=790mm              | 2×M20,8.8 +nut & st.pl. 90×90×12, S355  |

**Table 2: Dimensions and steel qualities - column unit.**

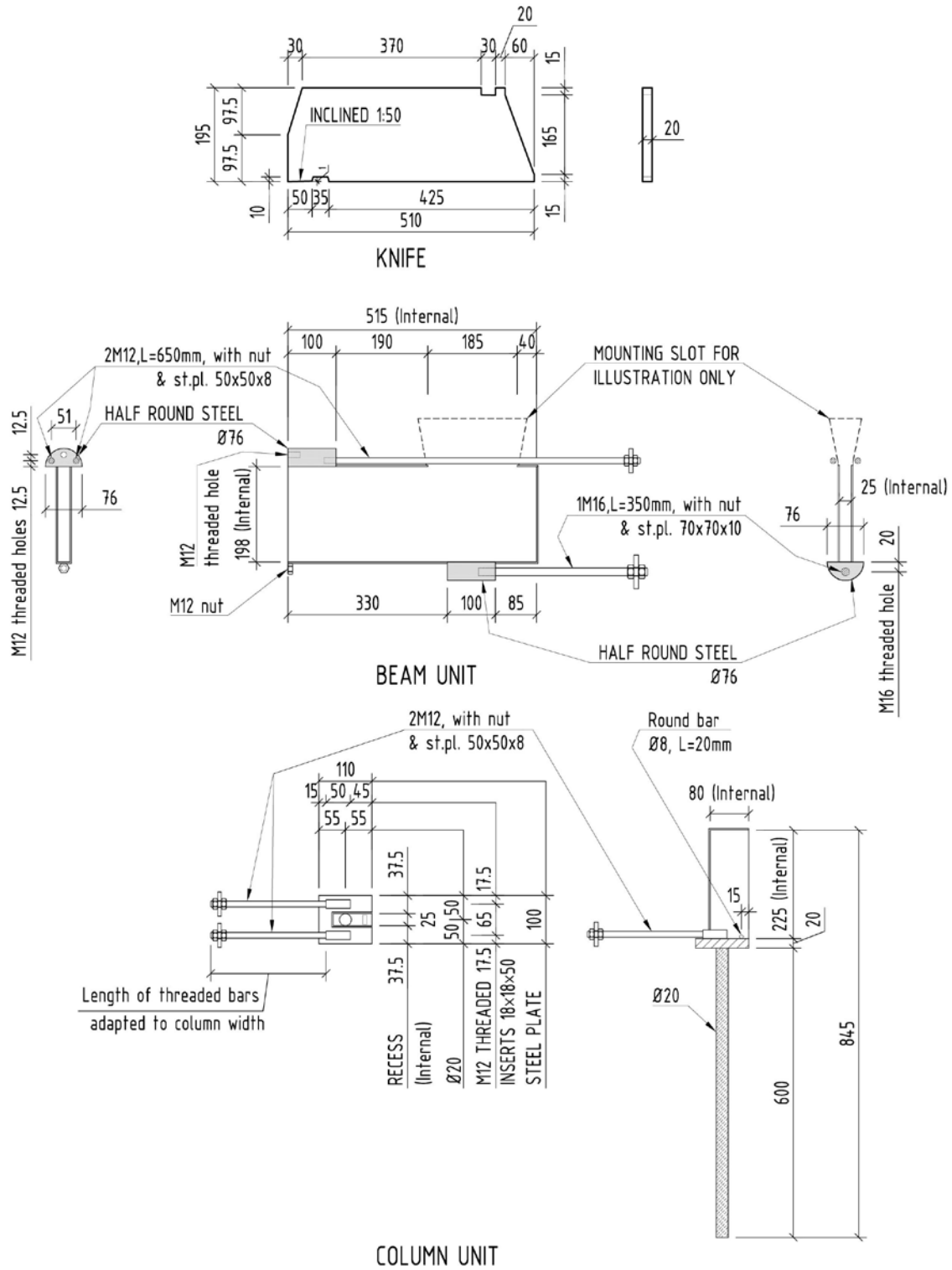
| NOMINAL DIAMETER   |      | M12          | M16           | M20           |
|--|------|--------------|---------------|---------------|
| Equivalent diameter:<br>$\varnothing_{eq}$ [mm]                    |      | 10,4         | 14,1          | 17,7          |
| Stress area:<br>$A_s$ [mm <sup>2</sup> ]                           |      | 84           | 157           | 245           |
| Tensile capacity (8.8):<br>$F_{cap} = f_{yd} \times A_s$ [kN]      |      | 48           | 90            | 141           |
| With across flats:<br>NV [mm]                                      |      | 19           | 24            | 30            |
| Dim. of square steel plate anchoring $F_{cap}$<br>Steel grade S355 |      | Select 50×50 | Select 70×70  | Select 90×90  |
| Thickness of steel plate anchoring $F_{cap}$ ,<br>Steel grade S355 |      | Select t=8mm | Select t=10mm | Select t=12mm |
| Standard height of nut:<br>(H) [mm]                                |      | 10,0         | 13,0          | 16,0          |
| Required thread length in blind holes:                             | S275 | 18mm         | 24mm          | 30mm          |
|  | S355 | 18mm         | 24mm          | 30mm          |
| Dimension of corresponding threaded insert [mm]                    |      | 50×18×18     | 60×22×22      | 70×30×30      |

**Table 3: Dimensions and steel qualities - threaded bars, inserts and anchoring steel plates.**

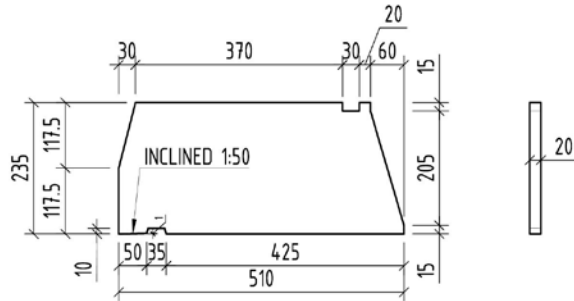
## GENERAL INFORMATION TO THE BELOW ILLUSTRATIONS

- Thickness of the box sides: 2mm for both the column and the beam units.
- Length of the threaded bars in beam unit: The given length are the overall length before screwed into the half round steels.
- Length of the threaded bars in column unit: The length of the threaded bars in the column unit is to be adapted to the column dimension. The user in each case must ensure the bars have a proper length to avoid ripping out a concrete cone.

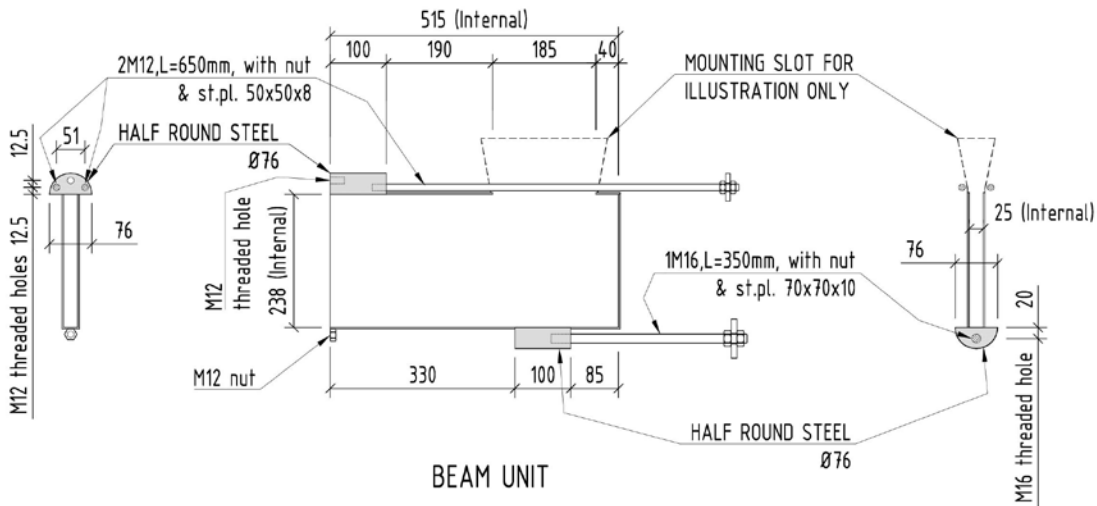
**BSF225**



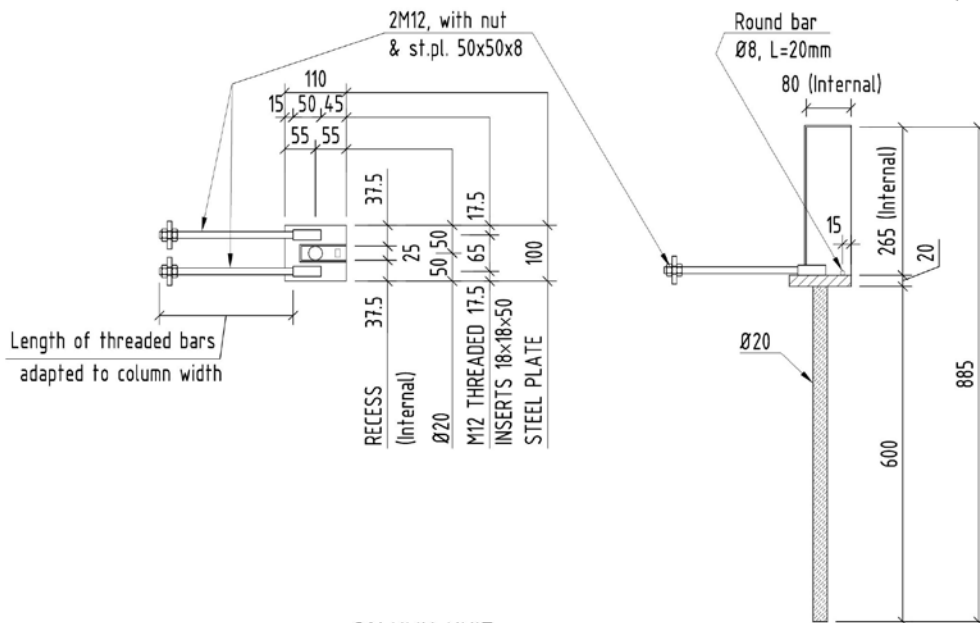
**BSF300**



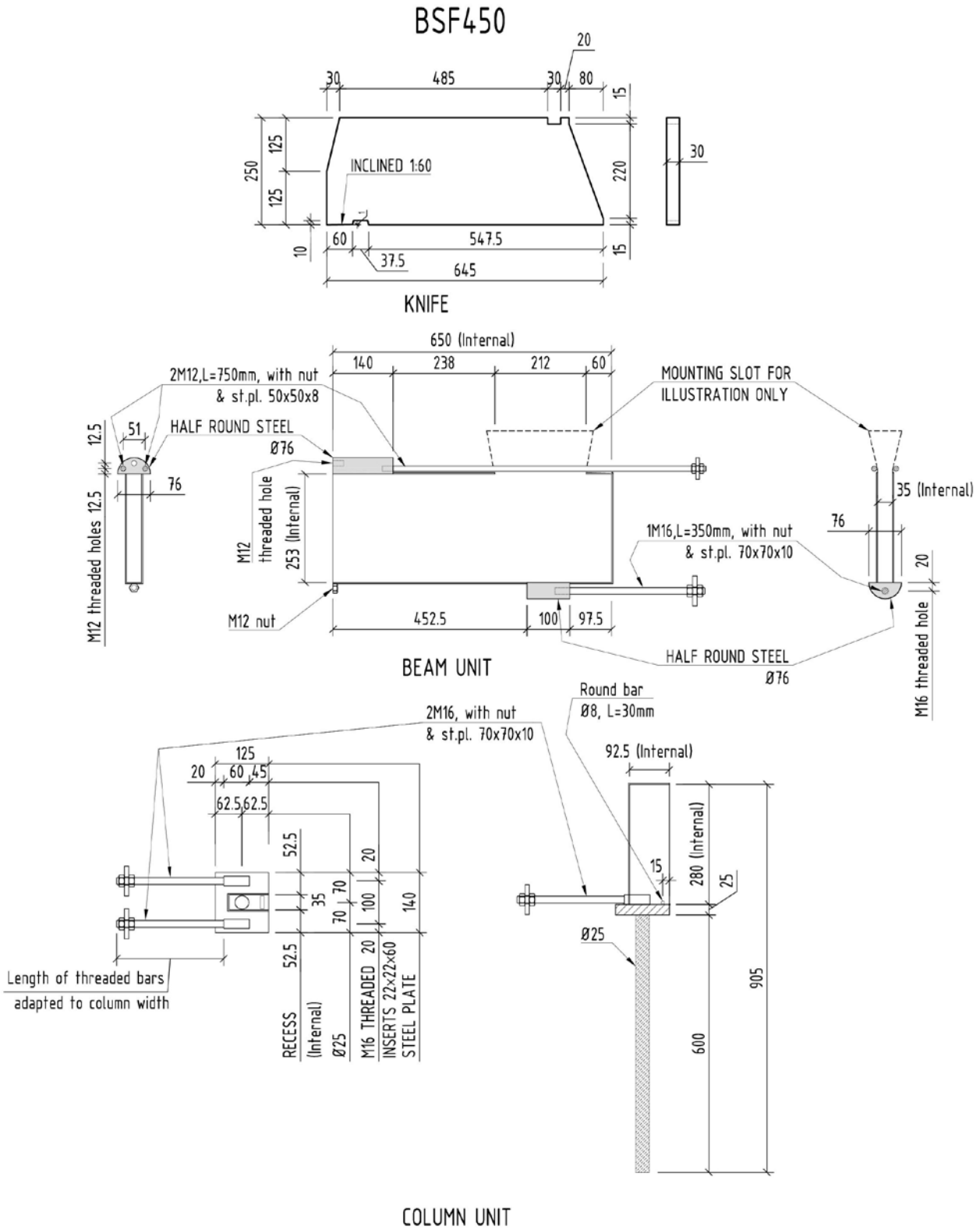
**KNIFE**

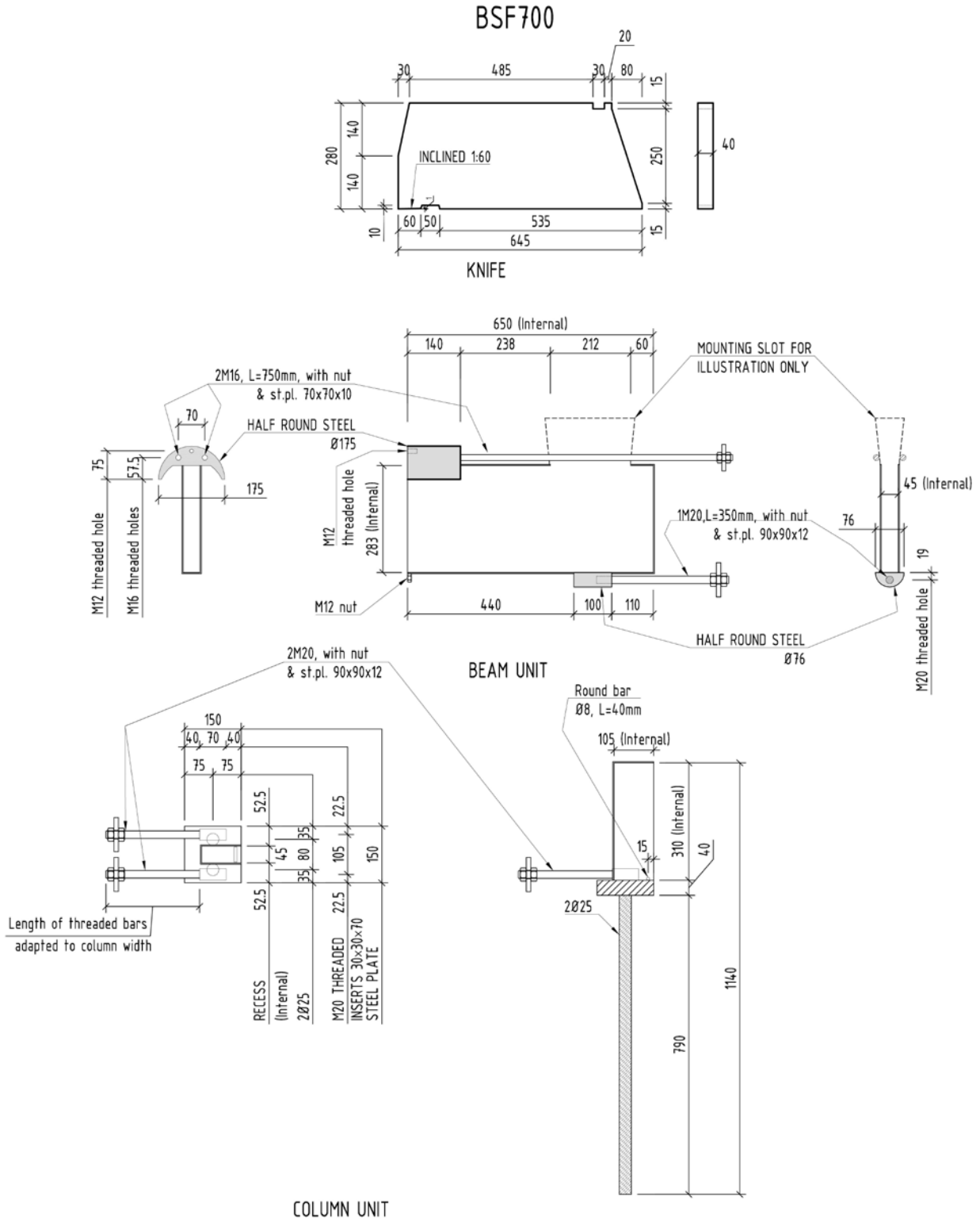


**BEAM UNIT**



**COLUMN UNIT**





| <b>REVISION HISTORY</b> |   |
|-------------------------|---|
| <b>Date:</b>            | <b>Description:</b>   |
| 17.04.2013              | First Edition (for ETA)   |
| 12.06.2013              | Updated before ETA. Corrected reinforcement quality from B500C to 500C. Included reference to EN10025-2 for steel quality.                            |
| 03.10.2013              | Replaced "Figure xx" textbox with heading on each unit. Reorganized Table 1.  |
| 06.11.2013              | Included comments from external review. Included additional dimensions in the drawings. Included chapter 1.3  |
| 26.06.2014              | Changed half round steel BSF700 unit.   |
| 19.08.2014              | Changed position of threaded bars in half round steel BSF700 unit   |
| 13.01.2015              | Updated Table 3. Required thread length in blind holes.   |
| 27.02.2015              | Included a nut on the front side of the steel plate anchoring the threaded bars. (To ensure correct position of the plate when casting the concrete). |
| 24.11.2015              | Corrected misprint on page 6, illustration of BSF700 unit. (Threaded hole at rear: M20)   |
| 23.05.2016              | New template  |