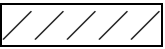


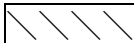
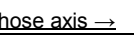


PARTS LIST AND NOTES
WHOI DRAWING SM 4D 01
MBARI MOOS Snubber Hose, 4.0" ID, 8 meter long
 with Stainless Steel Weld-Neck Couplings
 Date: June 5, 2002

Find No.	Component, Description	Dimensions , Thickness [inch]	Notes
1	Coupling Flange, ¹ 316 L or 316/316 L stainless steel, polished & passivated	9.0 outer diameter, 15/16 thick	HBD Weldneck, 7.5" bore circle ^{*)} with 8 holes @ 3/4" diameter
2	Nipple, Tubing, same material as 1	4.062 inner diameter,	4.50" OD, 15" long, *), 0.235 " Wall Thickness welded to 1 , die penetrant test on weld seam
3	Stainless Steel Bands	3/8 diameter 4.5 inner dia.	Two places each coupling, 15.32" on center, 5" apart along 2 welded around 2 , same material as 1
4	Inner Liner, Neoprene Rubber	0.188 thick	HBD#8220 Compound, ribbon width 10.0", Length 25 ft 9 inch, over entire hose length
Note: All components #5 through #10 are applied in the same S-Wrap² helical direction  The wrap angle is measured between hose axis and wrap direction → ∠ ∠ ∠ hose axis			
5	First Main Helical Strength Member, 54° +/- 1.5° wrap angle, S-Wrap	0.032 thick	Nylon woven cord in skim stock, HBD #F099 (1999), <u>uninterrupted over entire hose length</u> Ribbon length 52 ft, ribbon width 8.25 inch.
6	Second Main Helical Strength Member, Same as Part 5 , same 54° +/- 1.5° wrap angle, S-Wrap	0.032 thick	Same Nylon reinforcing material as in 5 <u>uninterrupted over entire hose length.</u> Ribbon length 52 ft, ribbon width 8.25 inch.
Start of cord and rubber layer buildup at each coupling to add stiffness and reduce hose stretch, see Figure 1 for details			
7	Inner Highest Stretch Limiter 48° +/- 3° wrap angle, S- Wrap ,	0.032 thick	Same reinforcing material as in 5 , counter-helical to 15 . Covers hose between flange and G₂ , 56" from flange. Ribbon Length 8.5 ft, ribbon width 10.0",

¹ Coupling Parts #1 to #3 are for a single coupling, two couplings per hose

² **S-Wrap** is the wrap direction of the center diagonal section of the letter **S** [Northwest to Southeast] when placing the letter parallel to the hose axis (also called left hand twist). The opposite is **Z-Wrap**, running in the direction of the center diagonal of the letter **Z**, when placing the letter Z parallel to the hose axis. This wrap direction is also called a right hand twist

Find No.	Component, Description	Dimensions , Thickness [inch]	Notes
7A	Neoprene Rubber Separation Layer, in Compliant Hose Section	0.032 thick	Starts at G₂ , 56" from flange, towards other end of hose, ~17 ft long, ribbon width 14¼ ". Apply layer after laying up #7 on each side, see Figure 1
8	Inner <u>High Stretch</u> Limiter 42° +/- 2° wrap angle, S Wrap	0.032 thick	Same material as 5 . Covers hose between flange and F₂ , 50" from flange. Ribbon Length 7.0 ft, ribbon width 14¼ "
9	Inner <u>Medium Stretch</u> Limiter 36° +/- 2° wrap angle, S Wrap	0.032 thick	Same material as 5 , Covers hose between flange and E₂ , 44" from flange. Ribbon Length 5 ½ ft, ribbon width 12¼ "
10	Inner <u>Low Stretch</u> Limiter 30° +/- 2° wrap angle, S Wrap	0.032 thick	Same material as 5 , Covers hose between flange and D₂ , 38" from flange. Ribbon Length 52¼ ", ribbon width 13"
11	End-Block #1, longitudinal	0.032 thick	Same material as 5 . Covers hose between flange and C , 30" from flange. Ribbon Length 30", ribbon width 15.1" and growing
Note: Components #12 through #17 are all applied in right hand or <u>Z-Wrap</u>³ direction  The wrap angle is measured between wrap direction and hose axis →⇒  hose axis →			
12	Outer <u>Low Stretch</u> Limiter 30° +/- 2° wrap angle, Z-Wrap	0.032 thick	Same material as 5 . Counter-helical to 10 . Covers hose from flange to D₁ , 36" from flange. Ribbon Length 49½", ribbon width 13",
13	Outer <u>Medium Stretch</u> Limiter 36° +/- 2° wrap angle, Z-Wrap	0.032 thick	Same material as 5 . Counter-helical to 9 . Covers hose from flange to E₁ , 42" from flange. Ribbon Length 63", ribbon width 12¼ ",
14	Outer <u>High Stretch</u> Limiter 42° +/- 2° wrap angle, Z-Wrap	0.032 thick	Same material as 5 . Counter-helical to 8 . Covers hose from flange to F₁ , 48" from flange. Ribbon Length 78", ribbon width 11¼ "
15	Outer <u>Highest Stretch</u> Limiter 48° +/- 2° wrap angle, Z-Wrap	0.032 thick	Same material as 5 . Counter-helical to 7 . Covers hose from flange to G₁ , 54" from flange. Ribbon Length 8 ft 1", ribbon width 10.0"
End of cord and rubber buildup in each coupling section, start of outer strength member layers			

³ **Z-Wrap** is the wrap direction of the center diagonal section of the letter **Z** [Northeast to Southwest] when placing the letter parallel to the hose axis (also called right hand twist). The opposite wrap direction is **S-Wrap**, running Northwest to Southeast, see footnote 1)

16	Outer Main Helical Strength Member, same as Part 5, same wrap angle $54^{\circ} \pm 1.5^{\circ}$, but opposite spiraling direction, Z-Wrap	0.032 thick	Same Nylon reinforcing material as in 5, <u>uninterrupted over entire hose length.</u> Ribbon length 53 ft, ribbon width $9\frac{1}{2}$ ".
Find No.	Component, Description	Dimensions , Thickness [inch]	Notes
17	Outer Main Helical Strength Member, Same as Part 5, same $54^{\circ} \pm 1.5^{\circ}$ wrap angle, Z-Wrap , same wrap direction as 16	0.032 thick	Same Nylon reinforcing material as in 5, <u>uninterrupted over entire hose length.</u> Ribbon length 53 ft, ribbon width $9\frac{1}{2}$ ".
<i>Apply Binding Wire, 0.0625" diameter, spiral around nipple to secure cord layers on coupling.</i>			
18	Neoprene Rubber Layer, same material as in 4 and 7A	0.094 thick	Neoprene (HBD#8820), over entire hose length ~ $24\frac{1}{2}$ ft long, ribbon width $14\frac{3}{4}$ "
<i>Start of non load bearing outer Layer, protects hose against fish bite and mechanical abrasion</i>			
19	Inner Kevlar Protective Layer, $64^{\circ} \pm 2^{\circ}$ wrap angle, S-Wrap	0.04 thick	Kevlar Woven Cord, embedded in HBD#8824 skim stock, over entire hose length, (can finish 6 inch from flanges). Ribbon length 57 ft, ribbon width $16\frac{3}{4}$ " <i>Note: This layer can be overlap spliced.</i>
20	End-Block, longitudinal, same material as 19 or 5.	0.032 or 0.04 thick	Reinforcement parallel to hose axis Covers hose from flange to B, 24"-26" from flange. Ribbon width $17\frac{1}{2}$ "
20A	Separation Layer, Neoprene Rubber Same material as 4 or 7A	0.032 or 0.04 thick	To cover compliant hose length, starting at B, 24"-26" from each hose end. ~ $24\frac{1}{2}$ ft long, ribbon width $14\frac{3}{4}$ ". Apply after layers #20 on both hose ends have been laid up. Fill possible gaps near couplings
21	Inner Kevlar Protective Layer, $64^{\circ} \pm 2^{\circ}$ wrap angle, opposing wrap direction to 19, Z-Wrap	0.04 thick	Kevlar Woven Cord, embedded in HBD#8824 skim stock, over entire hose length, (can finish 6 inch from flanges). Ribbon length 57 ft, ribbon width $16\frac{3}{4}$ " <i>Note: This layer can be overlap spliced.</i>
22	Outer Jacket, Neoprene Rubber	0.096 thick	Same material as 4 or 7A, HBD#8820 compound, Ribbon length 25 ft 8", ribbon width 18.1"

23	Outer Neoprene Rubber Filler Layer	0.1 to 0.15 thick	Same material as 4 or 7A , to fill “valley” in center hose to result in firmer hose. Start 4 ft from flanges, ~18 ft 3” long, ribbon width 18 ¼”
24	MOOS Stretch Hose Assembly with Stainless Steel Weldneck Couplings		26 ft 3” (8 meter) long, 4” inner diameter, couplings from Stainless 316L or 316/316L Steel

MARKINGS

Please emboss markings:
(Marking tape doesn't hold)

1.)	<u>SM-4-01</u>	(Part Number)
2.)	<u>"3/02"</u>	(Production Date: Quarter/ Year),

Apply embossed letters and numbers starting at ~15” from flange at each hose end, letters and numbers should be 3/8 “ high or larger.

REVISIONS MADE IN THIS SPECIFICATION:

None

NOTES

- [1] Main Load Support: The lay-up of the four main counter-helical nylon layers #5, #6, #16, and #17 must be butt-wrapped (with no overlap or gap). [The layer must be a continuous skim coated woven nylon cord ribbon. **No cuts or overlap splices are allowed** (The hose would fail under light tensions at overlaps)]. The butt-wrap will maintain a constant pitch length along the hose axis, and a close tolerance of the wrap angle of $54^{\circ} \pm 1.5^{\circ}$, which is important.
- [2] Please measure and record the pitch length of the above layers at three different locations in the center section of the hose during manufacturing. The pitch length should be $5.75" \pm 0.375"$.
- [3] Apply cord layers #5 through #10 and #19 with an **S-Wrap** (a left hand twist).
Apply cord layers #12 through #17 and #21 with a **Z-Wrap** (a right hand twist), to build up a rotation resistant hose.
- [4] In the cord and rubber buildup on the hose termination area the dimension tolerances given are not critical (Parts #7 to #15). The purpose of the termination buildup is to transition from the stretching center hose to a near zero elongation and non-rotating response of the tensioned hose in contact with the coupling. Purpose is also to build up bend stiffness in the transition area near the termination in order to prevent folding of the hose
- [5] Measure and record at three random locations outer diameter of 32 ft long hose compliant center length on data sheet.
- [6] Record hose length and hose in air weight on data sheet.
- [7] Perform pressure test at 40 ± 5 psi for 20 minutes
- [8] Please send copy of Data Sheet with hose shipment.
- [9] Thank you for your work and patience.

Proprietary Note:

This Drawing, prepared for the Monterey Bay Research Institute (MABRI), is considered proprietary between

Woods Hole Oceanographic Institution (WHOI), Woods Hole, MA, and Thermoid HBD Industries, Salisbury, NC. In particular, design details such as the arrangement of nylon and Kevlar woven cord layers, and the selection and dimension of components in the hose body and its terminations, are considered proprietary to WHOI, while in particular rubber compounds, woven cord, and adhesive components as well as the termination and manufacturing technology and know-how are proprietary to Thermoid HBD Industries. Unauthorized duplication of this specification is prohibited. Changes in this drawing to improve coherence and performance of the specified item require the mutual agreement between Thermoid HBD Industries and the Woods Hole Oceanographic Institution.

For questions call: Walter Paul at WHOI, 508/289-3506, or fax at 508/457-2132

