June 12, 2002

1151 Boston-Providence Turnpike
P.O. Box 9102 Norwood, MA 02062 USA
T: 781 762 4300 F: 781 762 9375 www.fmglobal.com

Technical Service Manager
BEMO USA
3062 N. Maple Street
Mesa, AZ 85215

Subject: Approval Evaluation of BEMO 305 and BEMO 305/400 Metal Standing Seam Roof Panel per Factory Mutual Research Standard 4471 (1995)
Factory Mutual Research J.I 3013527

This letter is to inform you on the results of the tests recently competed in the subject project.

During the week of May 13th seven 12 ft by 24 ft simulated wind uplift tests were conducted with the following metal panels and clip spacing;

- BEMO 305, 0.040-in. thick, 12 in. wide aluminum panel with BEMO Halter Clip and 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plate spaced at 30 in. o.c. secured to FM Approved 22 ga ASTM Designation A1008/A1008M-01a SS Grade 80.

- BEMO 400, 0.040 in. thick, 15-¾ in. wide aluminum panel with BEMO Halter Clip or Hook Clip and 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plate spaced at 36 in. o.c. to FM Approved 22 ga. deck.

- BEMO 400, 0.040 in. thick, 15-¾ in. wide aluminum panel with BEMO Halter Clip or Hook Clip spaced at 42 in. o.c. secured to FM Approved 22 ga. deck.

- BEMO 400, 0.040 in. thick, 15-¾ in. wide aluminum panel with BEMO Halter Clip or Hook Clip and 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plate spaced at 42 in. o.c. secured to FM Approved 22 ga. deck.

- BEMO 400 22 ga. G-90 Galvanized steel, 15 ¾ in. wide panels with BEMO Hook Clip and 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plate spaced at 42 in. o.c. to FM Approved 22 ga. deck.

- BEMO 400, 0.040 in. thick, 15-¾ in. wide aluminum panel with BEMO Halter Clip or Hook Clip and 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plate spaced at 42 in. o.c. secured to FM Approved 22 ga. deck with polyethylene sheet loose laid over the deck.

Base upon the results of the above testing, your BEMO Standing Seam Roof Panels are eligible to be used in the following constructions:

BEMO 305 Aluminum Standing Seam Roof Panel, 0.040-in. thick

Construction #1: 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm)] thick], 1.5 in. (38 mm) deep, Approved steel roof deck meeting ASTM Designation A1008/A1008M-01a SS Grade 80 or ASTM Designation A653/A653M-01a Grade SS Grade 80 (Mill certification to the building owner or designated representative required). Approved steel roof deck secured to min 0.25 in. (6.4 mm) thick steel purlins or structural steel supports spaced max 6 ft 0 in. (1828 mm) o.c. with SFS Intec 12-24 x 1 1/4" Impax 45 or Impax 5 fasteners max 6 in. (150 mm) o.c. at each purlin or structural support. Deck side laps secured with SFS Intec 1/4-14 x 7/8" Lap Tek fasteners max 30 in. (760 mm) o.c. Optional layer of min 1.5 in. (38 mm) thick Approved polyisocyanurate roof insulation loose laid over deck. Optional Factory Mutual Research Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid or self adhered Stormguard HT to insulation. BEMO 305, 0.040 in. thick, 12 in. wide aluminum standing seam roof panels installed perpendicular to steel deck and secured through insulation, if present, to deck max 2 ft 6 in. (76 mm) o.c. at each standing seam with BEMO Halter or BEMO Hook Clips and two SFS Intec #14 Deckfast or two SFS Intec SD2-S Stainless Steel fasteners per clip. Clips staggered 12 in. (305 mm) from clip in adjacent standing seam. 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plates required between BEMO Halter Clips and polyisocyanurate roof insulation, if present. Standing seams sealed with BEMO electric seamer. Meets Class 1-180.

Construction #1a: Same as construction #1 except an optional cover board of min. ½ in. (.13 mm) Approved Type X gypsum, woodfiber board or DensDeck, or min. 7/16 in (11 mm) OSB loose laid over min 1.5 in. (38 mm) thick Approved polyisocyanurate roof insulation. Meets Class 1-180.

BEMO 400 Aluminum Standing Seam Roof Panel, 0.040-in. thick

Construction #2: 18, 20 or 22 gauge Approved steel roof deck secured to min 0.25 in. (6.4 mm) thick steel purlins or structural steel supports spaced max 6 ft 0 in. (1828 mm) o.c. with SFS Intec 12-24 x 1 1/4" Impax 45 or Impax 5 fasteners max 6 in. (150 mm) o.c. at each purlin or structural support. Deck side laps secured with SFS Intec 1/4-14 x 7/8" Lap Tek fasteners max 30 in. (760 mm) o.c. Optional layer of min 1.5 in. (38 mm) thick Approved polyisocyanurate roof insulation loose laid over deck. Optional Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid or Stormguard HT self adhered to insulation. BEMO 400, 0.040 in. thick, 15-¾ in. wide aluminum standing seam roof panels installed perpendicular to steel deck and secured through insulation, if present, to deck max 3 ft 0 in. (915 mm) o.c. at each standing seam with BEMO Halter or BEMO Hook Clips and two SFS Intec #14 Deckfast or two SFS Intec SD2-S Stainless Steel fasteners per clip. Clips staggered 12 in. (305 mm) from clip in adjacent standing seam. 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plates required between BEMO Halter Clips and polyisocyanurate roof insulation, if present. Standing seams sealed with BEMO electric seamer. Meets Class 1-120.

Construction #2a: same as construction #2 except a cover board of min. ½ in. (0.13 mm) Approved Type X gypsum, woodfiber board or DensDeck, or min. 7/16 in (11 mm) OSB loose laid over min 1.5 in. (38 mm) thick Approved polyisocyanurate roof insulation. Meets Class 1-120.

Construction #3: Same as Construction 2 except, BEMO Halter or BEMO Hook Clips max 3 ft 6 in. (1066 mm) o.c. at each standing seam. Meets Class 1-90.

Construction #3a: Same as Construction 2a except, BEMO Halter or BEMO Hook Clips max 3 ft 6 in. (1066 mm) o.c. at each standing seam. Meets Class 1-90.

Construction #4: 18, 20 or 22 gauge Approved steel roof deck secured to structural steel as indicated in listing for steel deck. Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over the deck. Min 2.0 in. (51 mm) thick Approved polyisocyanurate roof insulation presecured to the deck with fasteners and plates Approved for use with the insulation and deck. Plates applied at a rate of 4.0 ft^2 (0.37m^2) max contributory area per fastener. BEMO 400, 0.040 in. thick, 15-¾ in. wide aluminum standing seam roof panels installed perpendicular to steel deck and secured through insulation, if present, to deck max 3 ft 6 in. (1066 mm) o.c. at each standing seam with BEMO Halter or BEMO Hook Clips and two SFS Intec #14 Deckfast or two SFS Intec SD2-S Stainless Steel fasteners per clip. Clips staggered 12 in. (305 mm) from clip in adjacent standing seam. 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plates required between BEMO Halter Clips and polyisocyanurate roof insulation, if present. Standing seams sealed with BEMO electric seamer. Meets Class 1-90.

Construction #4a: same as Construction #3a except a cover board od min. ½ in. (.13 mm) Approved Type X gypsum, woodfiber board or DensDeck, or min. 7/16 in (11 mm) OSB presecured to the deck with fasteners and plates Approved for use with the cover board and deck through min 2.0 in. (51 mm) thick Approved polyisocyanurate roof insulation to the deck. Plates applied at a rate of 4.0 ft^2 (0.37m^2) max contributory area per fastener.

BEMO 400 Zincalume and G-90 Galvanized steel Standing Seam Roof Panel, 22 ga thick

Construction #5: 18, 20 or 22 gauge Approved steel roof secured to structural steel as indicated in listing for steel deck. Optional layer of min 1.5 in. (38 mm) thick Approved polyisocyanurate roof insulation loose laid over deck. Optional Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid or Stormguard HT self adhered to insulation. BEMO 400 Zincalume and G-90 Galvanized steel Standing Seam Roof Panel, 22 ga thick, 15-¾ in. wide, installed perpendicular to steel deck and secured through insulation, if present, to deck max 3 ft 6 in. (1066 mm) o.c. at each standing seam with BEMO Hook Clips and two SFS Intec #14 Deckfast or two SFS Intec SD2-S Stainless Steel fasteners per clip. Clips staggered 12 in. (305 mm) from clip in adjacent standing seam. 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plates required between BEMO Halter Clips and polyisocyanurate roof insulation, if present. Standing seams sealed with BEMO electric seamer. Meets Class 1-90.

Construction #5a: Same as Construction 5 except an optional cover board of min. ½ in. (.13 mm) Approved Type X gypsum, woodfiber board or DensDeck, or min. 7/16 in (11 mm) OSB loose laid over min 1.5 in. (38 mm) thick Approved polyisocyanurate roof insulation. Meets Class 1-90.

Construction #6: 18, 20 or 22 gauge Approved steel roof deck secured to structural steel as indicated in listing for steel deck. Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over the deck. Min 2.0 in. (51 mm) thick Approved polyisocyanurate roof insulation presecured to the deck with fasteners and plates Approved for

use with the insulation and deck. Plates applied at a rate of 4.0 ft ^{2} (0.37m ^{2}) max contributory area per fastener. BEMO 400 Zincalume and G-90 Galvanized steel Standing Seam Roof Panel, 22 ga thick, 15-¾ in. wide, installed perpendicular to steel deck and secured through insulation, if present, to deck max 3 ft 6 in. (1066 mm) o.c. at each standing seam with BEMO Hook Clips and two SFS Intec #14 Deckfast or two SFS Intec SD2-S Stainless Steel fasteners per clip. Clips staggered 12 in. (305 mm) from clip in adjacent standing seam. 22 ga. 4 by 6 in. (101 by 150 mm) Bearing Plates required between BEMO Halter Clips and polyisocyanurate roof insulation, if present. Standing seams sealed with proprietary electric seamer. Meets Class 1-90.

Construction #6a: same as Construction #6 except a cover board min. of ½ in. (.13 mm) Approved Type X gypsum, woodfiber board or DensDeck, or min. 7/16 in (11 mm) OSB presecured to the deck with fasteners and plates Approved for use with the cover board and deck through min 2.0 in. (51 mm) thick Approved polyisocyanurate roof insulation to the deck. Plates applied at a rate of 4.0 ft ^{2} (0.37m ^{2}) max contributory area per fastener. Meets Class 1-90.

Please be advised that the information above indicates only the status of the subject project. Approval is still pending addition testing, review, issuance of the final report and receipt of an executed Approval Agreement.

If you have any questions, you may contact me by phone at 781-255-4856, by fax at 781-762-9375 or by e-mail at gerhard.daday@fmglobal.com .

Very truly yours,

G. K. Daday
Engineer - Materials Group

L. N. D'Angelo
Technical Team Manager- Materials Group

Trade Name:	Butlerib® II Roof Panel
Facer:	Min 26 ga. (0.0179 in., 0.44 mm) steel or min 0.026 in. (0.7 mm) aluminum
Insulation:	Optional glass fiber insulated core, max 6 in. (152 mm) thick
Size:	3 ft (0.9 m) wide panel

Ceco Building Systems, Box 6500, Columbus MS 39703

Trade Name:	CXP and CCR/CXP Roof Systems with CL75 & CL76 Clips
Size:	Min 24 ga. (0.0239 in., 0.061 mm) or AZ55 galvalume steel panels, 24 in. (610 mm) wide
Supports:	Min 16 ga. (0.059 in., 1.5 mm) steel supporting members

Centria, 1005 Beaver Grade Rd, Moon Township PA 15108

Trade Name:	SDP 200-16, SDP 200-18
Size:	24 ga. [min 0.0225 in. (0.57 mm) base steel thickness] [min 0.0284 in. (0.72 mm) base steel thickness] Galvalume steel [min 50 ksi (345 MPa)] with Hylar 5000® or Kynar 500® finish, 16 in. (406 mm) wide — SDP 200-16 or 18 in. (457 mm) wide — SDP 200-18 panels
Supports:	Min 16 ga. [min 0.0568 in. (0.72 mm) base steel thickness] steel [min 50 ksi (345 MPa)] purlins or structural members
Trade Name:	SRS 3-1.0, SRS 3-1.33, SRS 3-1.5
Size:	20, 22 or 24 ga. [minimum 0.0344, 0.0284 or 0.0225 in. (0.87, 0.72 or 0.57 mm) base steel thickness] painted (optional) G-90 galvanized or AZ-50 or AZ-55 Galvalume steel [min 40 ksi (275 MPa)] 12 in. (305 mm) wide (SRS 3 — 1.0), 16 in. (405 mm) wide (SRS 3 — 1.33) or 18 in. (455 mm) wide (SRS 3 — 1.5) panels with 3 in. (76 mm) high standing seams when installed with separate SRS 3 Battens
Supports:	Min 16 ga. [min 0.0568 in. (0.72 mm) base steel thickness] steel [min 33 ksi (228 MPa)] purlins or structural members or min 22 ga. FM Approved steel [min 33 ksi (228 MPa)] deck

Chief Industries Inc, 3942 Old West Hwy #30, Box 2078, Grand Island NE 68802-2078

Trade Name:	Mechanically Seamed Construction (MSC) Roof System with Low Floating – HW 214 Clips and High Floating – HW 216 Clips
Size:	Min 24 ga. (0.0261 in., 0.66 mm) steel panels, max 24 in. (610 mm) wide coated with Galvalume AZ 55
Supports:	Min 16 ga. (0.062 in., 1.6 mm) steel supporting members

Corle Building Systems, 114 Rosemont Lane, Imler PA 16655

Trade Name:	Seam-Lok with Low Floating — HW 214 Clips and High Floating — HW 216 Clips
Size:	Min 24 ga. (0.0261 in., 0.66 mm) steel panels, max 24 in. (610 mm) wide coated with Galvalume AZ55
Supports:	Min 16 ga. (0.062 in., 1.6 mm) steel supporting members

Enduro Systems Inc, 16602 Central Green Blvd, Houston TX 77032

Trade Name:	Tuff-Span Series FM 10, FM 13, FM 16
Material:	Nominal 10.5, 13 or 16.5 oz/ft^2 (3.2, 4.0, 5.0 kg/m^2) glass fiber reinforced plastic (polyester)
Size:	Various lengths and widths (weight defines thickness)

Englert Inc, 1200 Amboy Ave, Perth Amboy NJ 08861

Trade Name:	Series 2500 Standing Seam System (Series 2500 FM/90 or FM/75 Clip Assemblies and associated components)
Size:	24-22 ga. (0.024-0.029 in., 0.61-75 mm) Galvalume coated or painted Galvalume steel panels, or ASTM A666 Type 316L-⅛ hard stainless steel, 16 in. (405 mm) wide, various lengths
Supports:	16 ga. (0.060 in., 1.52 mm) steel supporting members
Trade Name:	Series 3000 T Standing Seam System

MANUFACTURERS' INDEX

Building Materials

MANUFACTURERS' INDEX

Building Materials

American Buildings Co, 1150 State Docks Rd, Eufaula AL 36027

Trade Name:	Standing Seam 360 Roof Systems (S3PC Panel Clip Assemblies — Low or High and associated components or S3PC-1R Panel Clip Assemblies – Low or High and associated components)
Size:	22 ga. (0.0285 in., 0.72 mm) or 24 ga. (0.023 in., 0.58 mm) Galvalume coated or painted Galvalume steel panels, 24 in. (610 mm) wide, various lengths
Supports:	Min 16 ga. (0.059 in. — 1.5 mm) steel supporting members
Trade Name:	Long Span Roof System
Size:	24 ga. (0.023 in., 0.58 mm) Galvalume coated or painted Galvalume steel panels, 36 in. (610 mm) wide, various lengths
Supports:	Min 16 ga. (0.059 in.-1.5 mm) steel supporting members.
Trade Name:	Long Span III (L3P) Roof System
Size:	24 ga. (0.023 in., 0.58 mm) Galvalume coated or painted Galvalume steel panels, 36 in. (610 mm) wide, various lengths
Supports:	Min 16 ga. (0.059 in.-1.5 mm) steel supporting members.

Behlen Industries, 927 Douglas St, Brandon, Manitoba R7A 7B3, Canada

Trade Name:	SSR 24 Roof System (SSR 24 steel panels and SSR 24 clips)
Size:	24 ga. (0.0276 in., 0.70 mm) G90 galvalume steel panels, 24 in. (610 mm) wide
Supports:	Min 16 ga. (0.0598 in., 1.51 mm) steel supporting members

BEMO USA, 3062 N Maple St, Mesa AZ 85215-1115

Trade Name:	BEMO 305 Standing Seam Standing Seam Roof System, Aluminum
Size:	smooth or embossed, Aluminum min 0.40 in. (10.2 mm) thick, 12 in. (305 mm) wide panels
Deck:	FM Approved steel deck. See listings
Optional Insulation:	FM Approved polyisocyanurate roof insulation and Approved wood fiber, gypsum or OSB cover boards
Trade Name:	BEMO 400 Standing Seam Roof System, Aluminum, AZ50 Galvalume steel or G-90 Galvanized Steel
Size:	smooth or embossed, Aluminum min 0.40 in. (10.2 mm) thick or 22 gauge (base metal 0.0296 in., 0.75 mm), AZ50 Galvalume steel or G-90 Galvanized having min yield strength of 50 ksi (345 N/mm^2), optional painted Kynar 500 finish 15.75 in. (400 mm) wide panels
Deck:	FM Approved steel deck. See listings
Optional Insulation:	FM Approved polyisocyanurate roof insulation and FM Approved wood fiber, gypsum or OSB cover boards

Berridge Manufacturing Co, 1720 Maury, Houston TX 77026

Trade Name:	Zee-Lock and Zee-Lock Double Lock Standing Seam Roof Systems
Size:	24 ga. ASTM A653 Grade 40 galvanized or Galvalume with Kynar 500 coating. Panels are 16 in. (406 mm) wide and various lengths
Supports:	Min 16 ga. steel supporting members

Butler Manufacturing Co, Research Center, 13500 Botts Rd, Grandview MO 64030

Trade Name:	MR-24 and CMR-24 Roof Systems (MR-24 panels, MR-24 Panel Clip Assemblies — Low or High and associated components)
Size:	22 ga. (0.0285 in., 0.72 mm) or 24 ga. (0.023 in., 0.58 mm) Galvalume coated or painted galvanized (G90) steel panels, 12 or 24 in. (305 or 610 mm) wide, various lengths
Supports:	Min 0.060 in. (1.5 mm) steel supporting members with 5/16 in. (8 mm) dia. pre-punched holes
Trade Name:	MR-24 Roof System (MR-24 panels, MR-24 Insulated Panel Clip Assemblies and associated components)
Size:	0.66 mm (0.026 in.) thick Galvalume coated or painted galvanized (G90) steel panels, 600 mm (23.6 in.) wide, various lengths
Supports:	Min 0.060 in. (1.5 mm) steel supporting members with 5/16 in. (8 mm) dia. pre-punched holes
Trade Name:	VSR Roof System (VSR panels, moveable VSR Roof Clip or fixed VSR Roof Clip and associated components)
Size:	24 ga. (0.023 in., 0.58 mm) Galvalume coated or painted galvanized (G90) steel panels, 16 in. (406 mm) wide, various lengths
Supports:	Min 0.060 in. (1.5 mm) steel supporting members
Trade Name:	Butterib II Roof System (Butterib II panels with associated components)
Size:	26 ga. (0.018 in., 0.46 mm) or 24 ga. (0.023 in., 0.58 mm) Galvalume coated or painted galvanized (G90) steel panels, coverage width of 36 in. (914 mm), various lengths
Supports:	Min 0.070 in. (1.8 mm) steel supporting members with 5/16 in. (8 mm) dia. pre-punched holes
Trade Name:	Butler Rib II Roof Panel
Facer:	Min 26 ga. (0.0179 in., 0.44 mm) steel or min 0.026 in. (0,7 mm) aluminum
Insulation:	Optional glass fiber insulated core, max 6 in. (152 mm) thick
Size:	3 ft (0.9 m) wide panel

Ceco Building Systems, Box 6500, Columbus MS 39703

Trade Name:	CXP and CCR/CXP Roof Systems with CL75 & CL76 Clips
Size:	Min 24 ga. (0.0239 in., 0.061 mm) or AZ55 galvalume steel panels, 24 in. (610 mm) wide
Supports:	Min 16 ga. (0.059 in., 1.5 mm) steel supporting members

BEMO USA, 3062 N Maple St, Mesa AZ 85215-1115

Roof Panel:	BEMO 305 and BEMO 400 Standing Seam Roof Systems
Hail Rating:	Class 1-SH
ASTM E 108:	Class A at max 5 in 12 slope

Construction #1: FM Approved steel roof deck 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick], 1.5 in. (40 mm) deep, meeting ASTM Designation A1008/A1008M-01a SS Grade 80 or ASTM Designation A653/A653M-01a Grade SS Grade 80 (Mill certification to the building owner or designated representative required) is secured to min 0.25 in. (6.4 mm) thick steel purlins or structural steel supports spaced max 6 ft 0 in. (1828 mm) o.c. with SFS Intec 12-24 x 1¼ Impax 45 or Impax 5 fasteners max 6 in. (150 mm) o.c. at each purlin or structural support. Deck side laps are secured with SFS Intec ¼-14 x ⅞ Lap Tek fasteners max 30 in. (760 mm) o.c. FM Approved polyisocyanurate roof insulation, min 1.5 in. (40 mm) thick, min 1 in. (25 mm) Rockwool 360, Rockacier nu 381 Delta +, Rockacier Soudable 398 Delta +, Rockterras 340, Rockterras Soudable 348, Rockwool SA 360, Rockwool SA Soudable 369, Roofslab 341, Roofslab 345, min 1.2 in. (30 mm) Hardrock (unfaced, bitumen and tissue faced), min 2 in. (50 mm) Hardrock 391, Hardrock Soudable 393, Taurox C (unfaced and bitumen faced), Taurox D (unfaced and bitumen faced), Taurox DUO NP (unfaced and bitumen faced), DuoRock FM (faced and unfaced), Taurox DUO XP (unfaced and bitumen faced), or min 5 in Taurox ECO (unfaced and bitumen faced) insulation, optional, is loose laid over deck. Optional cover board, min ½ in. (13 mm), of FM Approved wood fiberboard, Dens Deck, Type X gypsum or min 7/16 in. (11 mm) OSB is loose laid over polyisocyanurate roof insulation. Optional, FM Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 30 in. (762 mm) o.c. is secured through roof insulation boards if present, to the steel deck with two SFS Intec Dekfast #14 or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. BEMO 305 Aluminum Standing Seam, 12 in. (305 mm) wide panels, 0.040 in. (1.0 mm) thick, installed perpendicular to steel deck are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-180.

Construction #2: FM Approved steel roof deck, 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick] 1.5 in. (40 mm) deep, meeting ASTM Designation Specification A653/A653M-01a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) Grade 33 is secured to min 0.25 in. (6.4 mm) thick steel purlins or structural steel supports spaced max 6 ft 0 in. (1828 mm) o.c. with SFS Intec 12-24 x 1¼ Impax 45 or Impax 5 fasteners max 6 in. (150 mm) o.c. at each purlin or structural support. Deck side laps are secured with SFS Intec ¼-14 × ⅞ Lap Tek fasteners max 36 in. (915 mm) o.c. FM Approved insulations in Construction #1, optional, are loose laid over deck. Optional cover board, min ½ in. (13 mm), of FM Approved wood fiberboard, Dens Deck, Type X gypsum or min 7/16 in. (11 mm) OSB is loose laid over polyisocyanurate roof insulation. Optional FM Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet is loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 36 in. (762 mm) o.c. is secured through roof insulation boards if present, to the steel deck with two SFS Intec Dekfast #14 or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Aluminum Standing Seam 15¾ in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, installed perpendicular to steel deck are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-120.

Construction #3: FM Approved roof deck construction same as Construction #2 above. FM Approved insulations in Construction #1, optional, are loose laid over deck. Optional FM Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 42 in. (1066 mm) o.c., is secured through roof insulation boards if present, to the steel deck with two SFS Intec Dekfast #14 or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Aluminum Standing Seam 15¾ in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, installed perpendicular to steel deck are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-105.

Construction #4: Steel roof deck FM Approved, 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick] is installed per the steel deck listing in the current edition of the Approval Guide. Same as Construction #3 above except roof insulation optional, min ½ in. (13 mm) FM Approved Type X gypsum, wood fiber board, Dens Deck, or min 7/16 in. (11 mm) OSB cover board is loose laid over substrate. Meets Class 1-90

Construction #5: Steel roof deck FM Approved, 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick], is installed per the steel deck listing. FM Approved insulations in Construction #1, optional, are loose laid over deck. Optional cover board, min ½ in. (13 mm), of FM Approved wood fiberboard, Dens Deck, Type X gypsum or min 7/16 in. (11 mm) OSB is loose laid over polyisocyanurate roof insulation. Optional FM Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Hook Clip, spaced 42 in. (1066 mm) o.c., is secured through roof insulation boards if present, to the steel deck with two SFS Intec Dekfast #14 or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 AZ50 Galvalume steel or G-90 Galvanized steel Standing Seam Roof Panel, 22 ga. (0.75 mm), 15¾ in. (400 mm) wide panels, installed perpendicular to the steel deck are seamed together along the side laps and to the BEMO Hook clips with the BEMO Power Seamer. Meets Class 1-90.

Construction #6: Steel roof deck same as Construction #5 above. FM Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet is loose laid over deck. Optional, FM Approved insulation in Construction #1, min 2.0 in. (50 mm) thick, is presecured to the deck at 4.0 ft^2 (0.37m^2) max contributory area per fastener or loose laid and min ½ in. (13 mm), FM Approved Dens Deck, Type X gypsum or min 7/16 in. (11 mm) OSB coverboard is presecured through the insulation board to the deck at 4.0 ft^2 (0.37m^2) max contributory area per fastener. See listings in the Insulation and Fastener Tables for FM Approved Glass and Organic Felt Built Up Roofs for FM Approved insulation, fastener and plate combination. Optional GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 42 in. (1066 mm) o.c., is secured through roof insulation/cover boards to the steel deck with two SFS Intec Dekfast #14 or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Aluminum Standing Seam 15¾ in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick and BEMO Hook or Halter clip, or BEMO 400 AZ50 Galvalume steel or G-90 Galvanized steel Standing Seam 15¾ in. (400 mm) wide panels, 22 ga. (0.75 mm) and BEMO Hook clip, installed perpendicular to steel deck, are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-90.

APPROVAL REPORT

APPROVAL OF BEMO 305 AND BEMO 400 STANDING SEAM METAL PANEL ROOF SYSTEM AS A CLASS 1 PANEL ROOF

Prepared for:

BEMO USA
419 E. Juanita Ave.
Mesa, AZ 85204-8521

Project JI 3013527
Class 4471
Date: February 21, 2003

FM Approvals
1151 Boston Providence Turnpike
P.O. Box 9102
Norwood, MA 02062

FM APPROVALS
Project ID: 3013527

APPROVAL OF BEMO 305 AND BEMO 400 STANDING SEAM METAL PANEL ROOF SYSTEM AS A CLASS 1 PANEL ROOF
Febuary 21,2003

from

BEMO USA
419 E. JUANITA AVE.
MESA, AZ 85204-8521

I INTRODUCTION

1.1 BEMO USA submitted their BEMO 305 and BEMO 400 aluminum and BEMO 400 AZ50 Galvalume steel and G-90 Galvanized Standing Seam Metal Roof Systems to determine if they meet the Approval requirements of FM Approvals Standard 4471 (1995) for Class 1 panel roofs.

1.2 Examination included Simulated Wind Uplift Pressure, Susceptibility to Hail damage, Foot Traffic, and ASTM E108-00 spread of flame testing.

1.3 FM Approvals Calorimeter for the potential for fire spread below the roof deck was waived because of previous satisfactory performance of the insulations in more combustible constructions.

1.4 This Report may be reproduced only in its entirety and without modification.

1.5 **Standard:**

Title	Class Number	Date
Class 1 Panel Roofs	4471	August, 1995

1.6 Tests show that the BEMO 305 and BEMO 400 Standing Seam Metal Panel Roof Systems, as tested, meet FM Approvals requirements of the **Standard** listed above for Class 1 Panel Roofs when installed in constructions as specified in the **CONCLUSIONS** of this report.

1.7 **Listings:** The tested constructions meet the Approval criteria of FM Approvals when installed as specified in the **CONCLUSIONS** of this report and when Approval is effective will be listed in the FM Approval Guide.

II DESCRIPTION

2.1 BEMO USA Standing Seam Metal Panel Roof System consists of BEMO 305 and 400 Aluminum and BEMO 400 AZ50 Galvalume steel or G-90 Galvanized steel standing seam roof panels, BEMO Halter clips, BEMO Hook clips and associated components. The panels are seamed to the clips that are secured through FM Approved insulation, if present to FM Approved steel decks with two screws per clip.

2.1.1 BEMO 400 roof panels are smooth or embossed roll-formed, minimum 22 gauge (base metal 0.0296 in.; 0.75 mm), AZ50 Galvalume steel or G-90 Galvanized steel panels joined together by an interlocking seam and secured to the structure with interlocking fixed or sliding type clips. The

panels also are available painted with a Kynar 500 finish over the AZ50 Galvalume steel or G-90 Galvanized coatings. The panels are produced from ASTM Grade 50 steel having minimum yield strength of 50 ksi (345 N/mm²). The panels are supplied maximum 15-3/4 in. (400 mm) wide and are manufactured to various lengths. One side of the panel has a 0.28 in. (7 mm) high rib plus a 2.24 in. (57 mm) high seam, forming a 2.52 in. (64 mm) overall panel height. The other side of the panel has a matching profile forming a 2.56 in. (65 mm) overall panel height. The higher seam fits over the lower seam, and the adjacent panels are interlocked with a roof seaming apparatus. The finished seam includes BEMO Hook sliding or fixed type clip.

2.1.2 BEMO 305 and 400 aluminum standing seam roof panels are smooth or embossed roll-formed, 0.040 in. (1.0 mm) thick aluminum panels joined together by an interlocking seam and secured to the structure with interlocking fixed or sliding type clips. The panels are available with a Kynar 500 painted finish. The panels are supplied 12 in. (305 mm) or 15-3/4 in. (400 mm) wide and are manufactured to various lengths. One side of the panel has a 0.28 in. (7 mm) high rib plus a 2.24 in. (57 mm) high seam, forming a 2.52 in. (64 mm) overall panel height. The other side of the panel has a matching profile, forming a 2.56 in. (65 mm) overall panel height. The higher seam fits over the lower seam, and the adjacent panels are interlocked with a roof seaming apparatus. The finished seam includes BEMO Halter clips or BEMO Hook sliding or fixed type clips.

2.1.3 The BEMO Hook clip, sliding type, is a two piece clip consisting of a base and tab. The base is produced from 18 ga. (0.478 in.: 12 mm) G-90 galvanized steel having minimum yield strength of 33 ksi (288 N/mm²). The base has three stiffing elements 0.313 in. (8 mm) wide by 1.44 in. long (36.6 mm), 0.125 in. (3.2 mm) high and is 5 in. (127 mm) long. The clip tab is produced from Type 301 or equivalent stainless steel having minimum yield strength of 75 ksi (517 N/mm²). The width of the clip tab is nominal 0.47 in. (12 mm) thick. The clip tab is 3 in. (76 mm) long and floats between two end stops to maintain its location within the base.

2.1.4 The BEMO Fixed Hook clip is a one-piece clip, 3 in. (76 mm) long, produced from Type 301 or equivalent stainless steel having minimum yield strength of 75 ksi (517 N/mm²). The clip is used during installation to secure the BEMO 400 AZ50 Galvalume steel or G-90 Galvanized steel panels at the roof ridge.

2.1.5 The BEMO Halter clip is a one-piece clip extruded from 6063-T6 aluminum alloy having a min. yield strength of 25 ksi (172 N/mm²). The head of the clip is formed to fit into the roll of the underside roof panel. The clip base is 4.75 in. by 2.362 in. (121 mm by 60 mm) by 0.228 in. (5.8 mm) thick. The total clip height is 3.15 in. (80 mm). The clip web has two widths, the first section nearest the base is a tapered, reduced-thickness section and is 0.797 in. (20.2 mm) long. The second web section has a constant thickness of 0.087 in. (2.2 mm) which extends to the bottom of the clip head. The clip head is a solid, asymmetrical triangular shape with a 0.0117 in. (0.3 mm) round protrusion at top of the head. The head section is 0.438 in. (11 mm) high, max 0.438 in. (11 mm) thick and min 0.125 in. (3.2 mm) thick. The clip head sloping portion of the asymmetrical triangular shape must face away from the panel being installed.

2.1.6 BEMO bearing plate is a 22 ga. (0.75 mm) galvanized steel plate, 4 by 6 in. (102 by 152 mm) with pre drilled holes for fasteners. The plate is used with polyisocyanurate roof insulation boards.

2.2 GAF Storm Guard HT is a 0.06 in. (1.5 mm) thick, self adhering; rubberized, fiberglass-reinforced membrane used as vapor barrier applied to the rigid roof insulation boards.

2.3 SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners w/ Reduced Point are a self-drilling stainless steel screw with a 0.40 in. (10 mm) hex washer head. The screws are supplied in lengths 1-1/4 in. to 8 in. (32 to 203 mm) and are used to fasten the clips though the roof insulation boards, if present, to the steel deck.

2.4 SFS Intec #14 Dekfast fasteners are self-drilling carbon steel screws with a No. 3 recess Phillips. The screws are supplied in lengths 1-5/8 in. to 14 in. (41 to 356 mm) and are used to fasten the clips though the roof insulation boards, if present, to the steel deck. The screws are coated with a black Sentri coating.

III EXAMINATIONS AND TESTS

3.1 Tests conducted were as required by the **Standard** listed in paragraph 1.5 above.

3.1.1 Samples were submitted for examination and testing as follows:

3.1.2 Examination included simulated wind uplift pressure testing, ASTM E108-00 spread of flame testing, simulated foot traffic testing and hail damage testing.

3.1.3 All data is on file at FM Approvals under JI 3013527 along with other documents and correspondence applicable to this program.

3.2 FM Approvals 12 x 24 ft (3.7 x 7.3 m) Simulated Wind Uplift Pressure Tests

3.2.1 Tests were conducted using the FM Approvals Uplift Pressure Test Apparatus to evaluate the ability of the above deck components of the roofing system to resist a minimum simulated wind uplift pressure of 60 psf (2.9 kPa) without failure of the assemblies.

3.2.2 The simulated wind uplift pressure tests utilized a 24 ft. (7.3 m) long by 12 ft. (3.7 m) wide by 2 in. (51 mm) deep steel pressure vessel arranged to apply air pressure at pre-established standard rates to the underside of the test sample which formed the top of the pressure vessel. The vessel was pressurized with compressed air.

3.2.3 A net pressure of 30 psf (1.4 kPa) was applied to the test sample and maintained for 1 minute. The pressure was increased to 45 psf (2.2 kPa), then to 60 psf (2.9 kPa) and held for 1 minute at each increment. The pressure was increased in increments of 15 psf (0.7 kPa) every minute until failure occurred.

3.2.4 Six 12 x 24 ft. (3.7 x 7.3 m) test samples were prepared. The components, sequence of installation and test results were as follows:

3.2.4.1 Sample No. 1: 22 ga. (0.75 mm) steel deck meeting ASTM Designation A1008/A1008M-01a SS Grade 80 was secured to supports spaced at 6 ft-0 in.(1829 mm) o.c. with SFS Intec 12-24 x 1-¼ Impax 5 spaced at 6 in. (152 mm) o.c. and with side laps secured with SFS Intec ¼ -14 x 7/8 Lap Tek screws spaced 30 in. (762 mm) o.c. ACFoam-II roof insulation, 1.5 in. (38 mm) thick, was loose laid on the deck. BEMO Halter Clip and BEMO Hook Clip, with 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate, spaced 30 in. (762 mm) o.c. was secured through roof insulation boards to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast fasteners per clip. The test sample construction alternate clips

and clip/fastener combinations. The next rows of clips were staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 305 Standing Seam aluminum 12 in. (305 mm) wide panels, 0.040 in. (1.0 mm) thick, were seamed together along the side laps and to the BEMO Hook and Halter clips with a BEMO Power Seamer.

Test Results: The test sample met the 180 psf (8.6 kPa) minimum FM Approvals requirement for Class 1-180 windstorm classification. The construction failed during the incremental increase from 180 to 195 psf (8.6 to 9.3 kPa). Mode of failure was seam disengagement from the BEMO Hook clip.

3.2.4.2 Sample No. 2: 22 ga. (0.75 mm),1.5 in. (38 mm) deep, FM Approved steel roof deck meeting ASTM Designation Specification A653/A653M-01a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) Grade 33, was secured to supports spaced at 6 ft –0 in. (1829 mm) o.c. with SFS Intec 12-24 x 1-¼ Impax 5 spaced at 6 in. (152 mm) o.c. and with side laps secured with SFS Intec ¼ -14 x 7/8 Lap Tek screws spaced 30 in. (762 mm) o.c. ACFoam-II roof insulation, 1.5 in. (38 mm) thick, was loose laid on the deck. BEMO Halter Clip and BEMO Hook Clip, with a 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate, spaced 36 in. (914 mm) o.c. were secured through roof insulation boards to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. The test sample construction alternated clips and clip/fastener combinations. The next rows of clips were staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Standing Seam aluminum 15-3/4 in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, were seamed together along the side laps and to the BEMO Hook and Halter clips with a BEMO Power Seamer.

Test Results: The test sample met the 120 psf (5.7 kPa) minimum FM Approvals requirement for Class 1-120 windstorm classification. The construction failed at 7 seconds at the 135 psf (6.5 kPa) pressure level . Mode of failure was the SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners pull out from the deck.

3.2.4.3 Sample No. 3: ACFoam-II roof insulation, 1.5 in. (38 mm) thick, was loose laid on an Approved 22 ga. (0.75 mm) steel deck. Dens Deck coverboard, 0.5 in. (25 mm) thick was loose laid on insulation with joints staggered. BEMO Halter Clip and BEMO Hook Clip spaced 42 in. (1067 mm) o.c. were secured through roof insulation boards to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. The test sample construction alternated clips and clip/fastener combinations. The next rows of clips were staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Standing Seam aluminum 15-3/4 in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, were seamed together along the side laps and to the BEMO Hook and Halter clips with a BEMO Power Seamer.

Test Results: The test sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The construction failed during the incremental increase from 90 to 105 psf (4.3 to 5.0 kPa). Mode of failure was SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners pull out from the deck.

3.2.4.4 Sample No.4: ACFoam-II roof insulation, 1.5 in. (38 mm) thick, was loose laid on an Approved 22 ga. (0.75 mm) steel deck. BEMO Hook Clip and 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate spaced 42 in. (1067 mm) o.c. were secured through the roof insulation boards to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. The test sample construction alternated clip/fastener

combinations. The next rows of clips were staggered 12 in. (305 mm) from previous clip locations and in a continuous progression row to row. BEMO 400 Galvanized Steel Standing Seam 15-3/4 in. (400 mm) wide panels, 22 ga. (0.75 mm) thick were seamed together along the side laps and to the BEMO Hook clips with a BEMO Power Seamer.

Test Results: The test sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The construction failed during the incremental increase from 90 to 105 psf (4.3 to 5.0 kPa). Mode of failure was SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners pull out from the deck.

3.2.4.5 Sample No.5: Steel deck construction same as 3.2.4.2 above. ACFoam-II roof insulation, 1.5 in. (38 mm) thick, was loose laid on the deck. BEMO Halter Clip and BEMO Hook Clip spaced 42 in. (1067 mm were secured through a 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate and the roof insulation boards to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. The test sample construction alternated clips and clip/fastener combinations. The next rows of clips were staggered 12 in. (305 mm) from previous clip locations and in a continuous progression row to row. BEMO 400 Standing Seam aluminum 15-3/4 in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, were seamed together along the side laps and to the BEMO Hook and Halter clips with a BEMO Power Seamer.

Test Results: The test sample met the 105 psf (5.7 kPa) minimum FM Approvals requirement for Class 1-105 windstorm classification. The construction failed during the incremental increase from 105 to 120 psf (5.0 to 5.7 kPa). Mode of failure was seam disengagement from the BEMO Hook clip.

3.2.4.6 Sample No.6: A 6 mil (0.15 mm) polyethylene vapor barrier was loose laid on 22 ga. (0.75 mm) steel deck. ACFoam-II roof insulation, 2.0 in. (51 mm) thick, is mechanically secured through the vapor barrier to the deck with SFS 2-7/8 Hex Plates and #14 Dekfast fasteners applied at a contributory area of 4ft^2 (0.37 m^2) per fastener. BEMO Halter Clip and BEMO Hook Clip, spaced 42 in. (1067 mm), were secured through a 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate, vapor barrier, and roof insulation board to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. The test sample construction alternated clips and clip/fastener combinations. The next rows of clips were staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Standing Seam aluminum 15-3/4 in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, were seamed together along the side laps and to the BEMO Hook and Halter clips with a BEMO Power Seamer.

Test Results: The test sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The sample was disassembled after meeting the requirements at the 90 psf increment to examine the insulation boards. No evidence of failure was observed.

3.3 ASTM E108-00 Spread of Flame Tests

3.3.1 The fire tests from above the roof cover were conducted in accordance with ASTM E108-00 Spread of Flame Tests.

3.3.2 The wind velocity over the top of the standard panel was adjusted to 12 ± 0.5 mph (5.3 ± 0.2 m/s).

3.3.3 Flame exposure: The flame was adjusted to 1400±50°F (760±28°C) for the Class A tests. The flame temperature was measured by a thermocouple located 1 in. (25.4 mm) above the surface of the standard panel and 1/2 in. (13 mm) toward the flame source from the lower edge of the standard panel. The flame was applied to each test panel for 10 minutes.

3.3.4 During and after the application of the flame, each panel was observed for the distance of maximum flame spread, glowing brands and other damage.

3.3.5 Two 3-1/3 x 8 ft. (1.0 x 2.4 m) test samples were prepared. The components and sequence of installation were as follows:

3.3.6 Sample No. 1 and 2: BEMO 400 Standing Seam Metal Roof Panels, 15-3/4 in. wide, with a Kynar 500 painted finish over the G-90 Galvanized steel were seamed together. A seam was placed in the center of the test panel and secured to the plywood deck.

3.3.7 Test Results: Flaming or glowing brands, lateral flame spread, displacement of portions of the sample and exposure of the bottom panel skin from above were not observed during the tests. The test sample met Class A at 5 in 12 slope.

3.4 FM Approval Foot Traffic Test

3.4.1 Testing was conducted using the FM Approvals Resistance to Foot Traffic Test Apparatus to evaluate the ability of the panel roof to resist simulated foot traffic without damage. There must be no puncture of the roof panel or disengagement of the laps.

3.4.2 A 200 lb (91 kg) load, which incorporates a 3 in. (76 mm) square steel plate with rounded corners, was imposed on the sample. The load was placed in the approximate center of the sample (midspan) and adjacent to the side lap. The load was then removed. This cycle was repeated four additional times. The roof panels were inspected for damage after the last cycle at the steel plate interface.

3.4.3 Wind uplift sample No. 2 was tested for foot traffic resistance.

3.4.3.1 No damage to the roof panels or disengagement of the side lap on the test panels was observed after the test.

3.5 Test FM Approvals Simulated Hail Damage Tests

3.5.1 Tests were conducted using the FM Approvals Simulated Hail Damage Test Apparatus to evaluate the ability of the roof covers to withstand a hailstorm without damage to the metal roofing.

3.5.2 For the severe hail damage tests, a 1-¾ in. (49 mm) diameter steel ball weighing 0.79 lbs. (0.359 kg) was dropped on the test sample from a 17 ft 9-½ in. (5.42 m) height through a 33-¾ in. (0.86 m) length of PVC pipe with a 2 in. (51 mm) inside diameter. This procedure was repeated several times on various sections of the sample. After each drop the sample was inspected for damage to the weatherproof metal roof panels.

3.5.3 After each drop the sample is inspected and there must be no evidence of splitting, delamination or rupture of the roof cover.

3.5.4 Two 4 x 4 ft. (1.2 x 1.2 m) samples were prepared. The components and sequence of installation were as follows:

3.5.4.1 Sample No.1: BEMO 305 22 ga. 0.0327 in. thick (including paint), 12 in. (305 mm) wide panels with Kynar 500 painted finish over the G-90 Galvanized steel were seamed together along the side laps and to the BEMO Hook clips.

Test Results: No damage to the roof panel coating was observed after each drop of the simulated hail impactor. The test sample met Class SH hail resistance.

3.5.4.2 Sample No.2: BEMO 400 aluminum Standing Seam Metal Roof Panels, 0.040 in. (1.0 mm) thick, 15-3/4 in. (400 mm) wide with Kynar 500 painted finish were seamed together along the side laps and to the BEMO Hook and Halter clips.

Test Results: No damage to the roof panel coating was observed after each drop of the simulated hail impactor. The test sample met Class SH hail resistance.

IV MARKING

4.1 The manufacturer shall mark each individual roof panel (or each pallet or bundle of panels), each package of clips, and each package of screws with at least one label containing, at minimum, the manufacturer's name and product trade name. In addition, each package or container must be marked with the FM Approval Mark and the words "Subject to the conditions of Approval as a Class 1 roof panel (or "standing seam roof clip" or "roof fastener", etc. as appropriate) as described in the current edition of the FM Approval Guide".

4.2 Markings denoting Approval by FM Approvals shall by applied by the manufacturer only within and on the premises of manufacturing locations that is under the FM Approvals Facilities and Procedures Audit program.

4.3 The manufacturer agrees that use of the FM Approvals name or Approval Mark is subject to the conditions and limitations of Approval by FM Approvals. Such conditions and limitations must be included in all references to Approval by FM Approvals.

V REMARKS

The securement of the roof system must be enhanced at the building corners and perimeter as outlined in FM Global Property Loss Prevention Data Sheet 1-31.

VI FACILITIES AND PROCEDURES AUDITS

6.1 A Facilities and Procedures Audit of the following facilities has indicated that BEMO USA has the necessary equipment, facilities, personnel, and quality controls to fabricate standing seam metal roof system as listed in this report in accordance with the FM Approval requirements:

BEMO USA, Mesa, AZ
GAF, Mount Vernon, IN
SFS Intec, Wyomissing, PA

6.2 The BEMO USA manufacturing locations are subject to periodic audit inspections to determine that the quality and uniformity of the materials have been maintained and will provide the same level of performance as originally Approved. The facilities and quality control procedures in place have been found to be satisfactory to manufacture product identical to that examined and tested as described in this report.

VII MANUFACTURER'S RESPONSIBILITIES

7.1 To assure compliance with his procedures in the field, the manufacturer shall supply to the roofer such necessary instruction or assistance required to produce the desired performance achieved in the tests.

7.2 The manufacturer shall notify FM Approvals of any planned change in the Approved product, prior to general sale or distribution, using Form 797, Approved Product Revision Report.

VIII DOCUMENTATION

The following documents describe the BEMO 305/400 Standing Seam Metal Roof System and are filed under J.I. 3013527.

Document	Issue or Revision	Description
BEMO USA - BEMO 305/400 See F&PA Manual BEMO USA (January 2003)	January 15, 2001	BEMO 305/400 Panel Specifications
BEMO USA - BEMO 305/400 Installation, Flashings, & Detail Guide See F&PA Manual BEMO USA (January 2003)	February 2001	BEMO 305/400 Installation Manual
BEMO USA - Quality Manual See F&PA Manual BEMO USA (January 2003)	January 25, 2001 (Rev 6)	BEMO 305/400 Quality Control Information
F&PA Manual BEMO USA at GAF Materials Corporation	January 2003	Vapor Barrier
F&PA Manual BEMO USA at SFS Intec	January 2003	Fastener

IX CONCLUSIONS

9.1 The results indicate that BEMO 305/400 Standing Seam Metal Panel Roof Systems meet the FM Approvals Standard 4471 requirements when used in the manner as stated below:

9.1.1 Approved steel roof deck 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick], 1.5 in. (38 mm) deep, meeting ASTM Designation A1008/A1008M-01a SS Grade 80 or ASTM Designation A653/A653M-01a Grade SS Grade 80 (Mill certification to the building owner or designated representative required) is secured to min 0.25 in. (6.4 mm) thick steel purlins

or structural steel supports spaced max 6 ft 0 in. (1828 mm) o.c. with SFS Intec 12-24 x 1-1/4 Impax 45 or Impax 5 fasteners max 6 in. (150 mm) o.c. at each purlin or structural support. Deck side laps are secured with SFS Intec 1/4-14 x 7/8 Lap Tek fasteners max 30 in. (760 mm) o.c. Approved polyisocyanurate roof insulation, min 1.5 in. (38 mm) thick, optional, is loose laid over deck. Optional cover board, min. ½ in. (13 mm), of Approved wood fiberboard, Dens Deck, Type X gypsum or min. 7/16 in. (11 mm) OSB is loose laid over polyisocyanurate roof insulation. Optional, Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 30 in. (762 mm) o.c. is secured through roof insulation boards if present, to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. BEMO 305 Aluminum Standing Seam, 12 in. (305 mm) wide panels, 0.040 in. (1.0 mm) thick, installed perpendicular to steel deck are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-180.

9.1.2 Approved steel roof deck, 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick] 1.5 in. (38 mm) deep, meeting ASTM Designation Specification A653/A653M-01a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) Grade 33 is secured to min 0.25 in. (6.4 mm) thick steel purlins or structural steel supports spaced max 6 ft 0 in. (1828 mm) o.c. with SFS Intec 12-24 x 1 1/4 Impax 45 or Impax 5 fasteners max 6 in. (150 mm) o.c. at each purlin or structural support. Deck side laps are secured with SFS Intec 1/4-14 x 7/8 Lap Tek fasteners max 36 in. (915 mm) o.c. Approved polyisocyanurate roof insulation, min 1.5 in. (38 mm) thick, optional, is loose laid over deck. Optional cover board, min. ½ in. (13 mm), of Approved wood fiberboard, Dens Deck, Type X gypsum or min. 7/16 in. (11 mm) OSB is loose laid over polyisocyanurate roof insulation. Optional Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet is loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 36 in. (762 mm) o.c. is secured through roof insulation boards if present, to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Aluminum Standing Seam 15-3/4 in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, installed perpendicular to steel deck are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-120.

9.1.3 Steel roof deck construction same as 9.1.2 above. Approved polyisocyanurate roof insulation, min 1.5 in. (38 mm) thick, optional, is loose laid over deck. Optional Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 42 in. (1066 mm) o.c., is secured through roof insulation boards if present, to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Aluminum Standing Seam 15-3/4 in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick, installed perpendicular to steel deck are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-105.

9.1.4 Steel roof deck Approved by FM Approvals, 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick] is installed per the steel deck listing in the current edition of the FM Approval Guide. Same as 9.1.3 above except roof insulation optional, min. ½ in. (13 mm) Approved Type X gypsum, wood fiber board, Dens Deck, or min. 7/16 in. (11 mm) OSB cover board is loose laid over substrate. Meets Class 1-90.

9.1.5 Steel roof deck Approved by FM Approvals, 18, 20 or 22 gauge [0.0474, 0.0358 or 0.0295 in. (1.20, 0.91 and 0.75 mm) thick] is installed per the steel deck listing in the current edition of the FM Approval Guide. Approved polyisocyanurate roof insulation, min 1.5 in. (38 mm) thick, optional, is loose laid over deck. Optional cover board, min. ½ in. (13 mm), of Approved wood fiberboard, Dens Deck, Type X gypsum or min. 7/16 in. (11 mm) OSB is loose laid over polyisocyanurate roof insulation. Optional Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet loose laid over substrates or GAF Storm Guard HT is adhered to the roof insulation. BEMO Hook Clip, spaced 42 in. (1066 mm) o.c., is secured through roof insulation boards if present, to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 AZ50 Galvalume steel or G-90 Galvanized steel Standing Seam Roof Panel, 22 ga. (0.75 mm), 15-¾ in. (400 mm) wide panels, installed perpendicular to the steel deck are seamed together along the side laps and to the BEMO Hook clips with the BEMO Power Seamer. Meets Class 1-90.

9.1.6 Steel roof deck same as 9.1.5 above. Approved vapor retarder or min 0.004 in. (0.1 mm) thick polyethylene sheet is loose laid over deck. Optional, Approved polyisocyanurate roof insulation, min 2.0 in. (51 mm) thick, is presecured to the deck at 4.0 ft^2 (0.37m^2) max contributory area per fastener or loose laid and min. ½ in. (13 mm), Approved Dens Deck, Type X gypsum or min. 7/16 in. (11 mm) OSB coverboard is presecured through the insulation board to the deck at 4.0 ft^2 (0.37m^2) max contributory area per fastener. See listings in the Insulation and Fastener Tables for Approved Glass and Organic Felt Built Up Roofs for Approved insulation, fastener and plate combination. Optional GAF Storm Guard HT is adhered to the roof insulation. BEMO Halter Clip or BEMO Hook Clip, spaced 42 in. (1066 mm) o.c., is secured through roof insulation/cover boards to the steel deck with two SFS Intec #14 Dekfast or SFS Intec #14-13 HWH (5/16 AF) Buttress Thread Dekfast Fasteners per clip. A 22 ga. (0.75 mm), 4 by 6 in. (102 by 152 mm) bearing plate is required between clip and polyisocyanurate roof insulation. The next rows of clips are staggered 12 in. (305 mm) from previous clip locations in a continuous progression row to row. BEMO 400 Aluminum Standing Seam 15-3/4 in. (400 mm) wide panels, 0.040 in. (1.0 mm) thick and BEMO Hook or Halter clip, or BEMO 400 AZ50 Galvalume steel or G-90 Galvanized steel Standing Seam 15-3/4 in. (400 mm) wide panels, 22 ga. (0.75 mm) and BEMO Hook clip, installed perpendicular to steel deck, are seamed together along the side laps and to the BEMO Hook or Halter clips with the BEMO Power Seamer. Meets Class 1-90.

9.2 BEMO USA BEMO 305/400 Standing Seam Metal Panel Roof System panels meet Class 1-SH hail damage requirements.

9.3 BEMO USA. BEMO 305/400 Standing Seam Metal Panel Roof System Panels meet Class 1A Fire Classification when installed at a maximum roof slope of 5 in 12 (42%).

9.4 Tests show that the tested roof constructions in and of themselves would not create a need for automatic sprinklers.

9.5 Approval is effective when the Approval Agreement is signed and received by FM Approvals.

9.6 Continued Approval will depend upon satisfactory field experience and periodic Facilities and Procedures Audits.

TESTING SUPERVISED BY:	**G. K. Daday**
PROJECT DATA RECORD:	**J.I. Number 3013527**
ORIGINAL TEST DATA:	**PDR for J.I. 3013527**
ATTACHMENTS:	**Appendix A - Illustration 1 to 11** **BEMO USA Panel System Drawings**

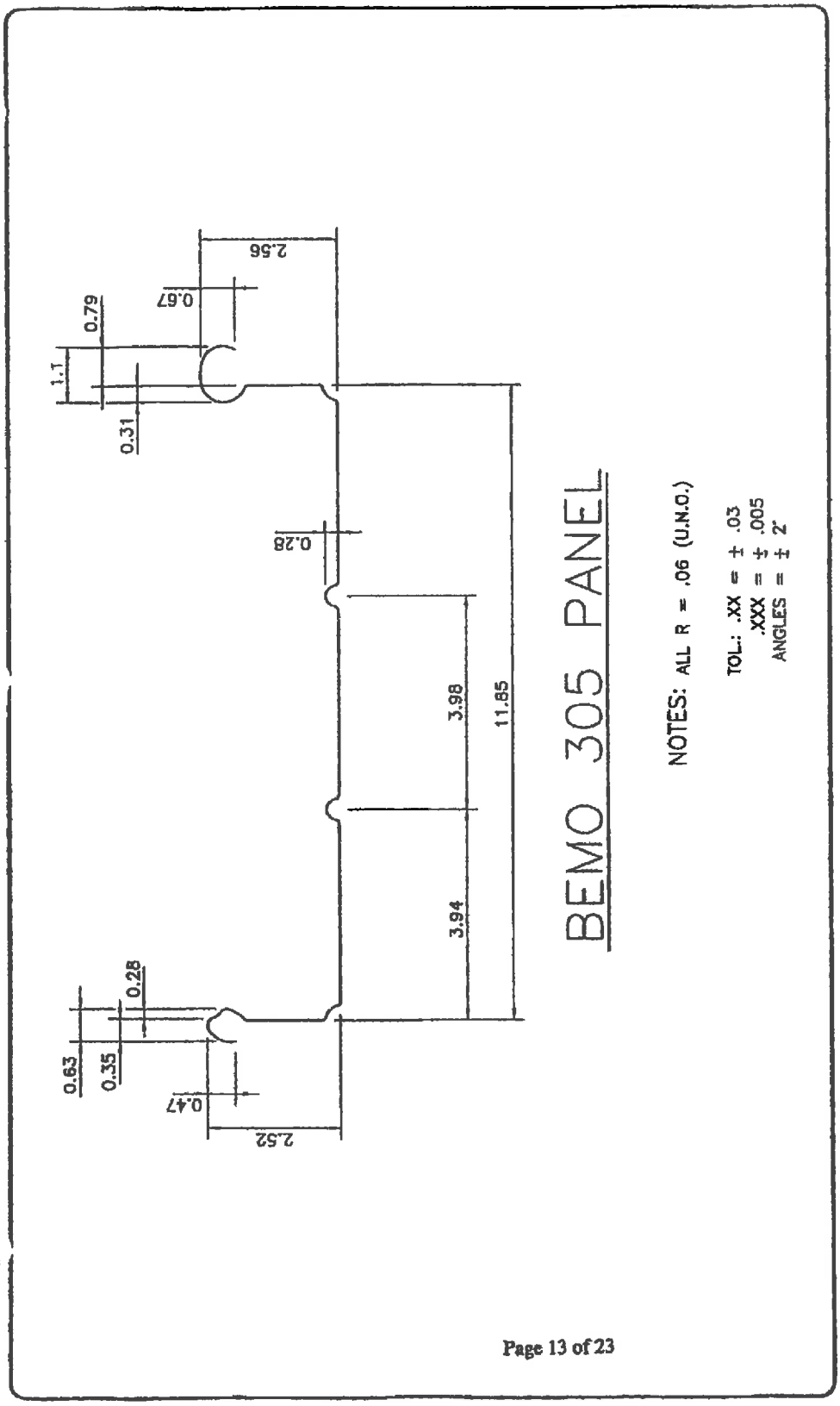
REPORT BY:

G. K. Daday
Engineer - Materials Group

REPORT REVIEWED BY:

P. J. Smith
Technical Team Manager - Materials Group

Appendix A Illustration 1



BEMO 305 PANEL

NOTES: ALL R = .06 (U.N.O.)

TOL.: .XX = ± .03
.XXX = ± .005
ANGLES = ± 2°

PANEL: BEMO

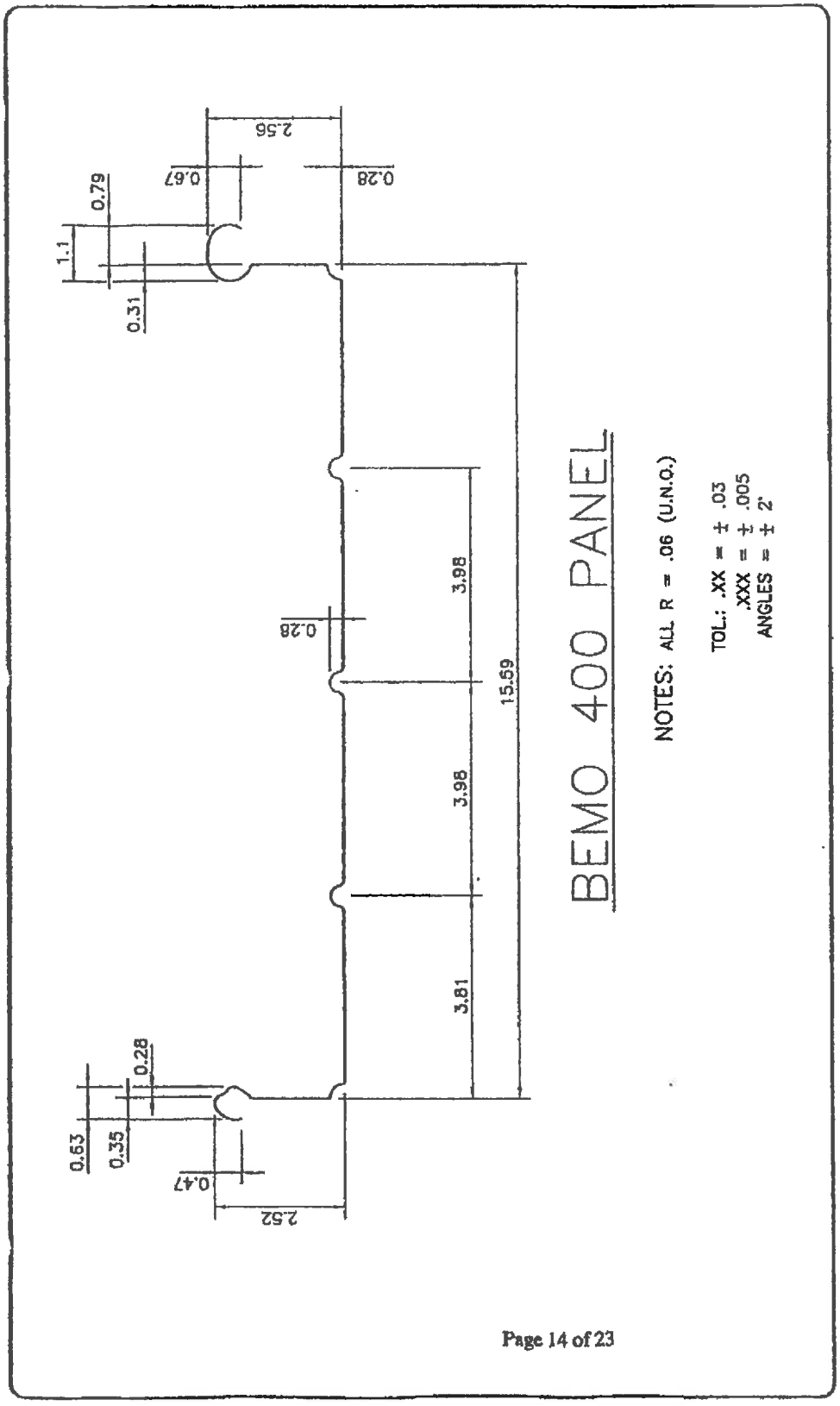
DETAIL: 305mm PANEL (12")

DATE: 9/26/01

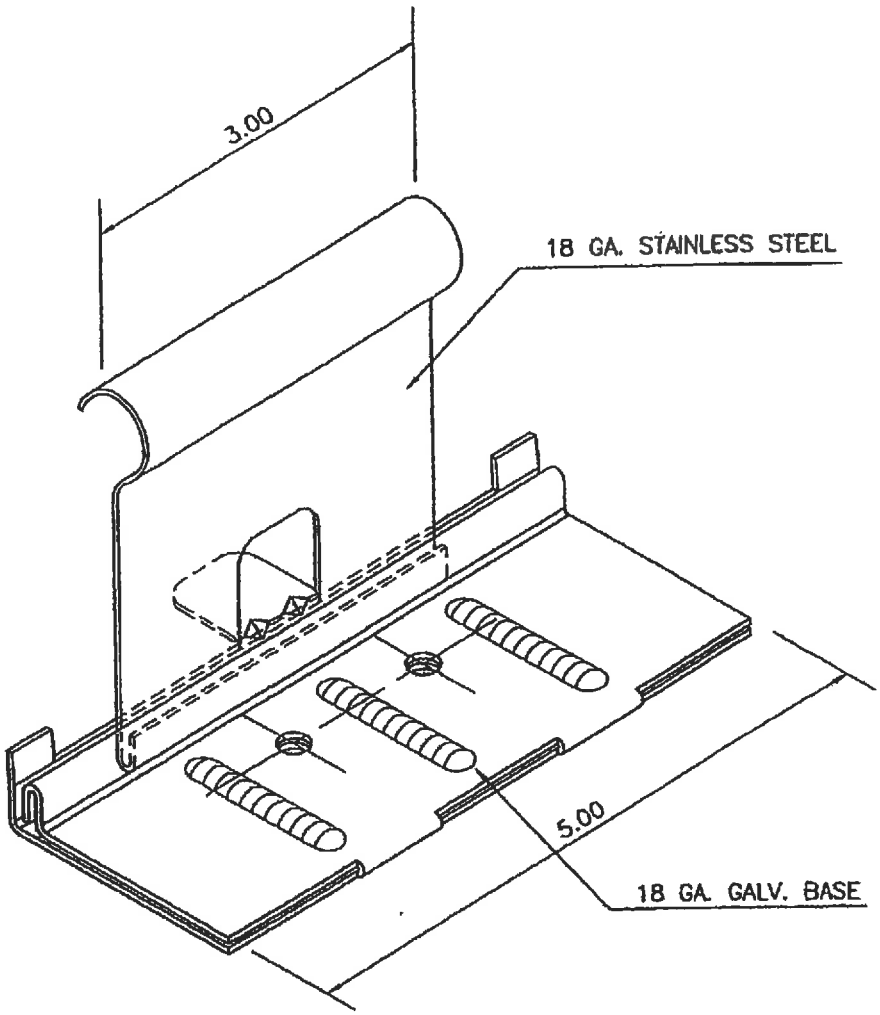
PAGE: 1 OF 1

BEMO·USA
The New Dimension In Metal Roofing
p: 1.800.926.2366

Appendix A Illustration 2

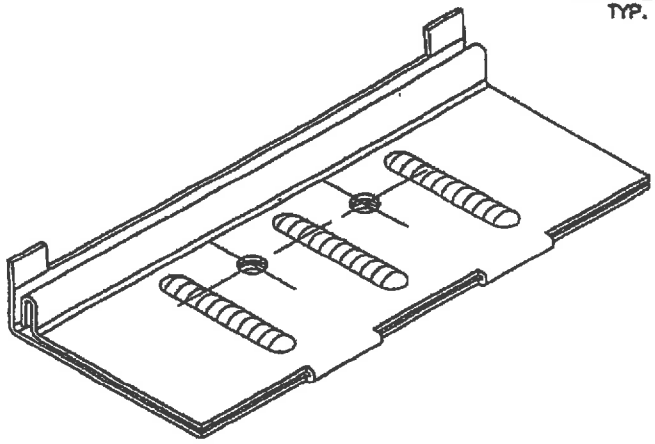


Appendix A Illustration 3



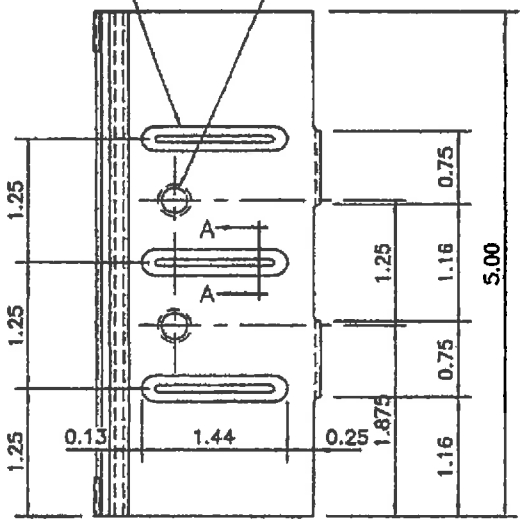
BEMO SLIDING HOOK CLIP
3 1/2" CLIP MOVEMENT

3/12/98 REV. 0

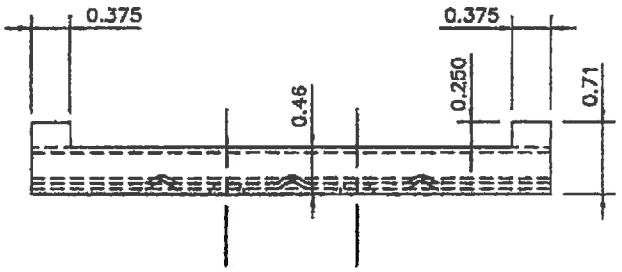


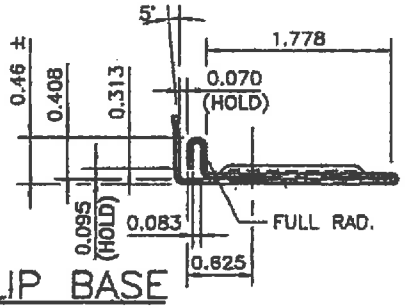
STIFFENING ELEMENT
TYP. (3) PLACES

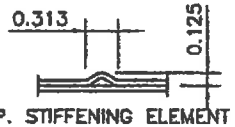
(2) .250 DIA. HOLES (TOPSIDE)
(2) .320 DIA. HOLES (BOTTOM SIDE)



NOTES:
1. MATERIAL: G-90 GALVANIZED STEEL- PLAIN FINISH. MIN. 33 KSI YIELD, .047 TO .052 THICK
2. ALL RADII TO BE .04 UNLESS OTHERWISE NOTED.







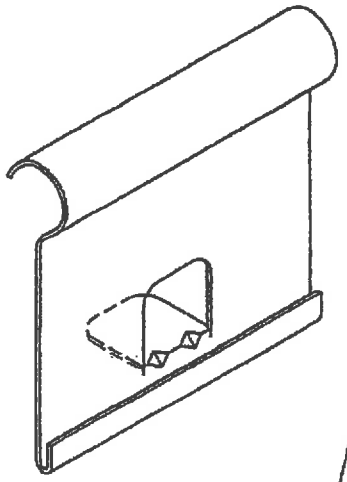
TYP. STIFFENING ELEMENT
SECT. A-A

BEMO HOOK CLIP BASE

18 GA. GALV. STEEL

3/17/98 REV. 1

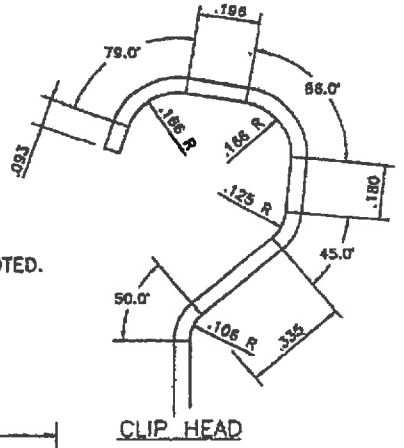
BEMO·USA The New Dimension In Metal Roofing p: 1.800.926.2366	PANEL: BEMO PANEL	DATE: 02/18/02
	DETAIL: Sliding Hook Clip Base	PAGE: 2 OF 3

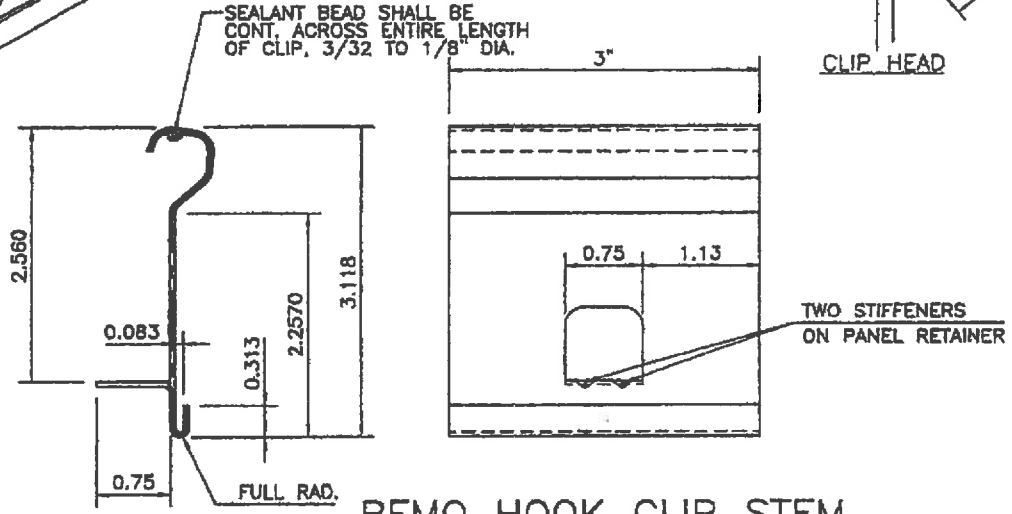


NOTES:

1 MATERIAL: STAINLESS STEEL, TYPE 301 OR EQUIVALENT, 0.047 TO 0.52 THICK

2. ALL RADII TO BE .06 UNLESS OTHERWISE NOTED.





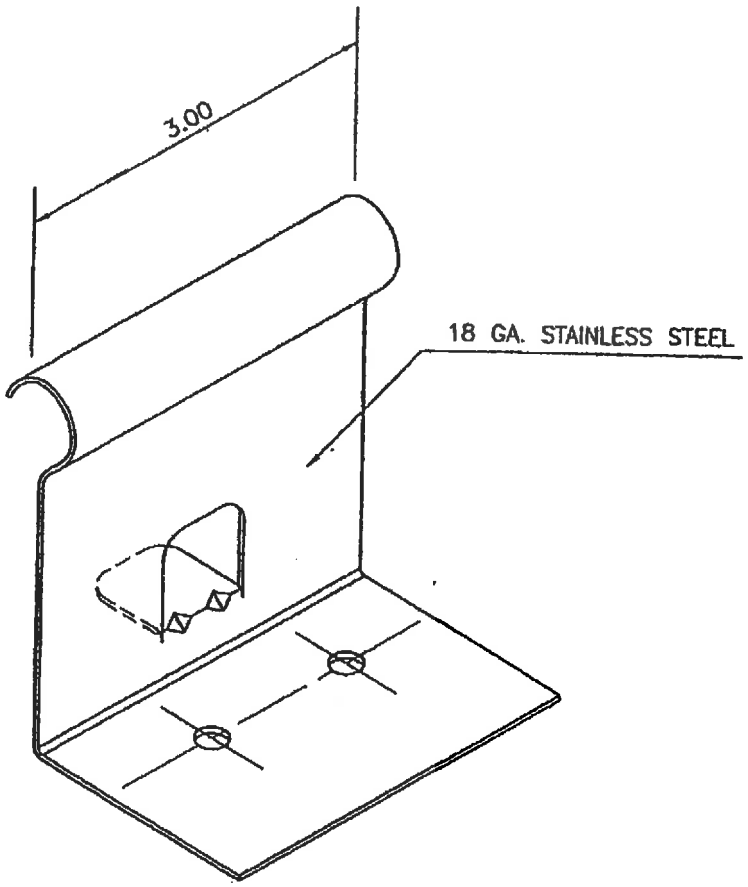
BEMO HOOK CLIP STEM

18 GA. STAINLESS STEEL TYPE 301

3/12/98 REV 0

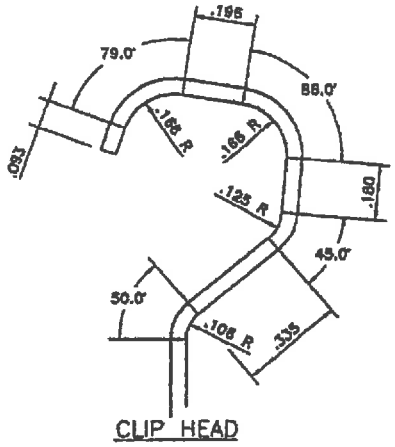
BEMO·USA The New Dimension In Metal Roofing p: 1.800.926.2366	PANEL: BEMO PANEL	DATE: 02/18/02
	DETAIL: Sliding Hook Clip Stem	PAGE: 3 OF 3

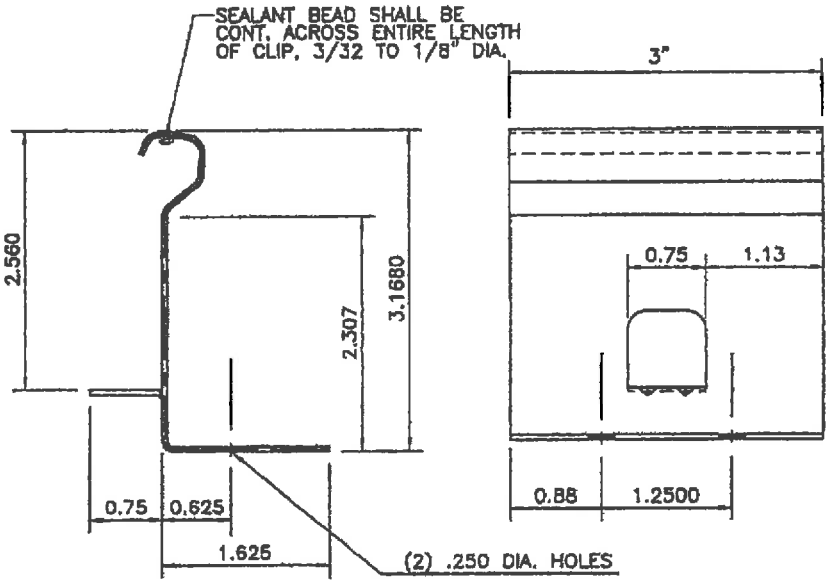
Appendix A Illustration 6

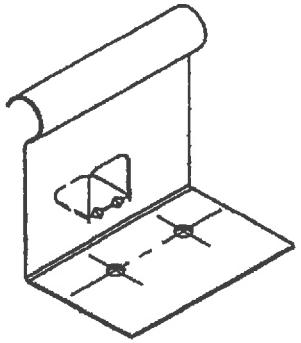


BEMO FIXED HOOK CLIP

3/12/98 REV 0







NOTES:

1 MATERIAL: STAINLESS STEEL, TYPE 301 OR EQUIVALENT, 0.047 TO 0.52 THICK

2. ALL RADII TO BE .06 UNLESS OTHERWISE NOTED.

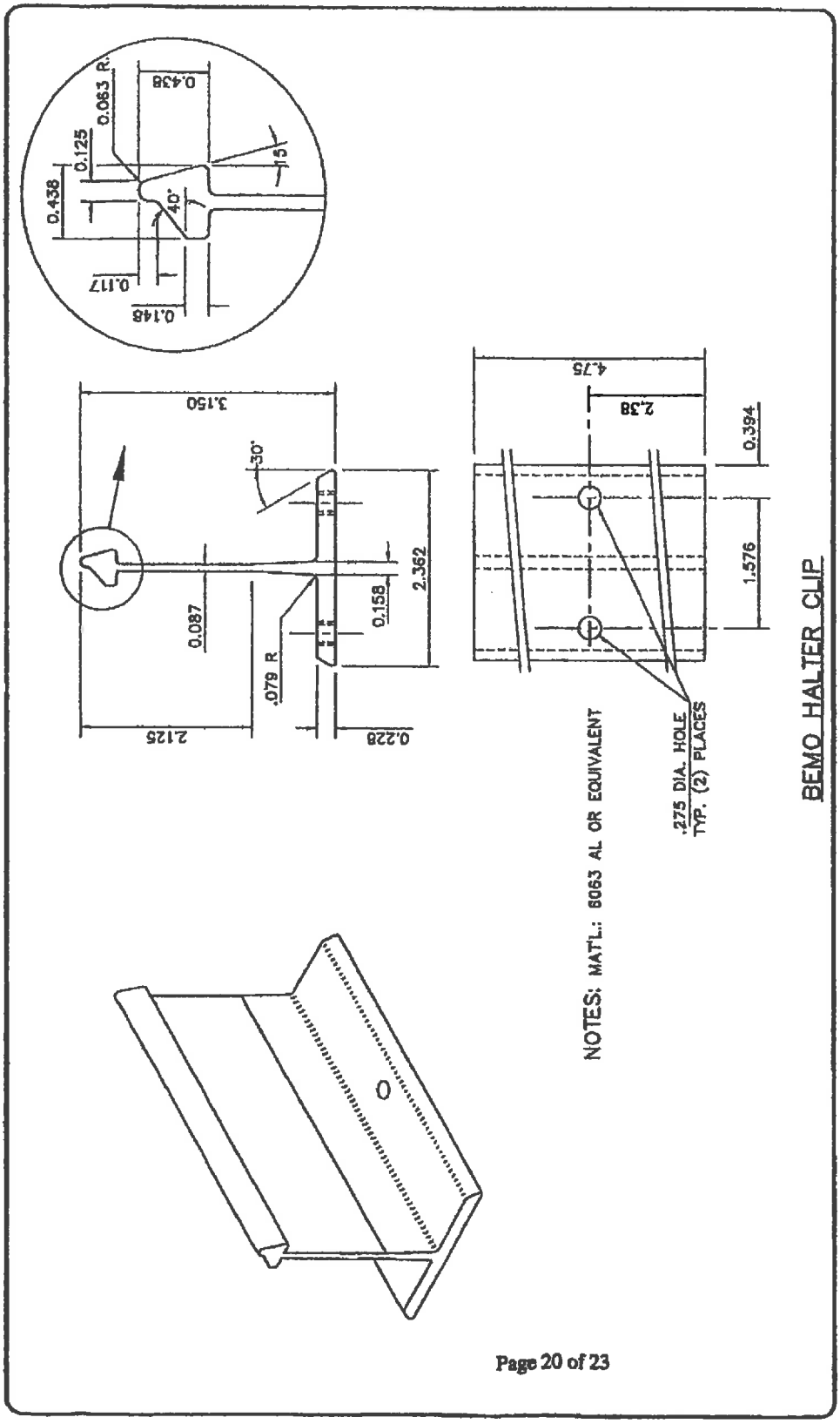
BEMO FIXED CLIP

18 GA. STAINLESS STEEL TYPE 301

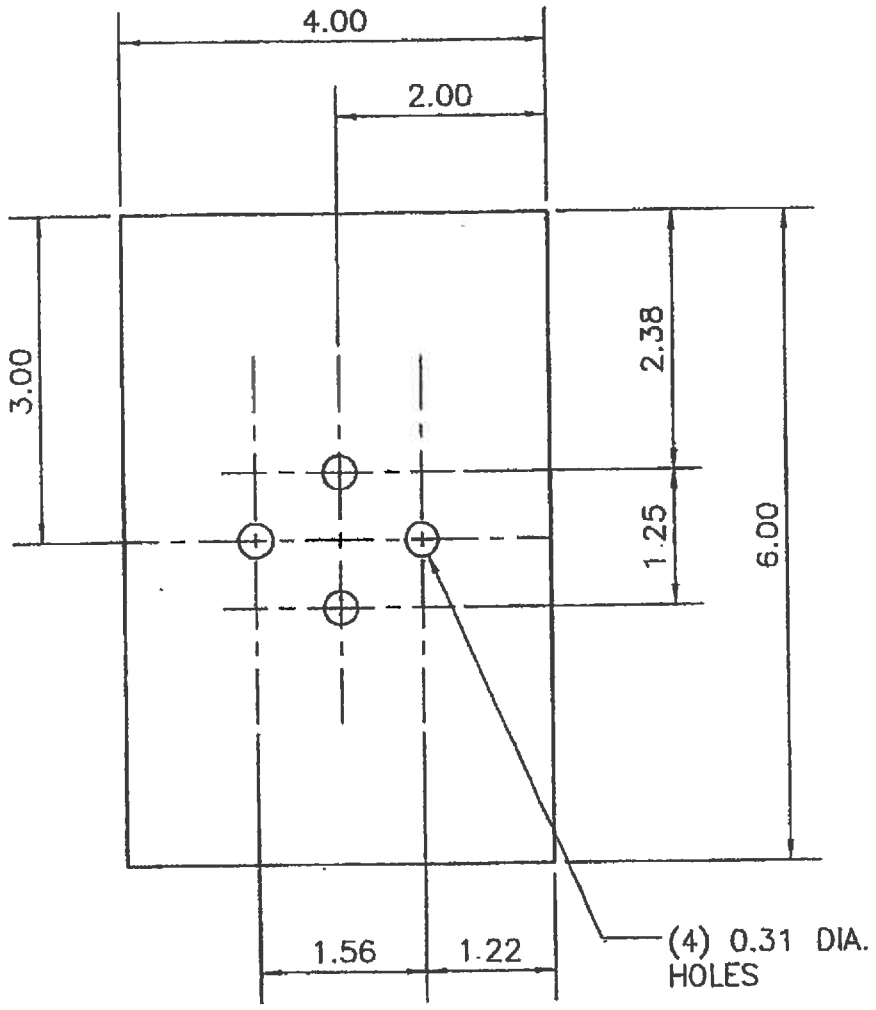
3/13/98 REV. 0

BEMO·USA The New Dimension In Metal Roofing p: 1.800.926.2366	PANEL: BEMO PANEL	DATE: 02/18/02
	DETAIL: , Fixed Hook Clip	PAGE: 2 OF 2

Appendix A Illustration 8



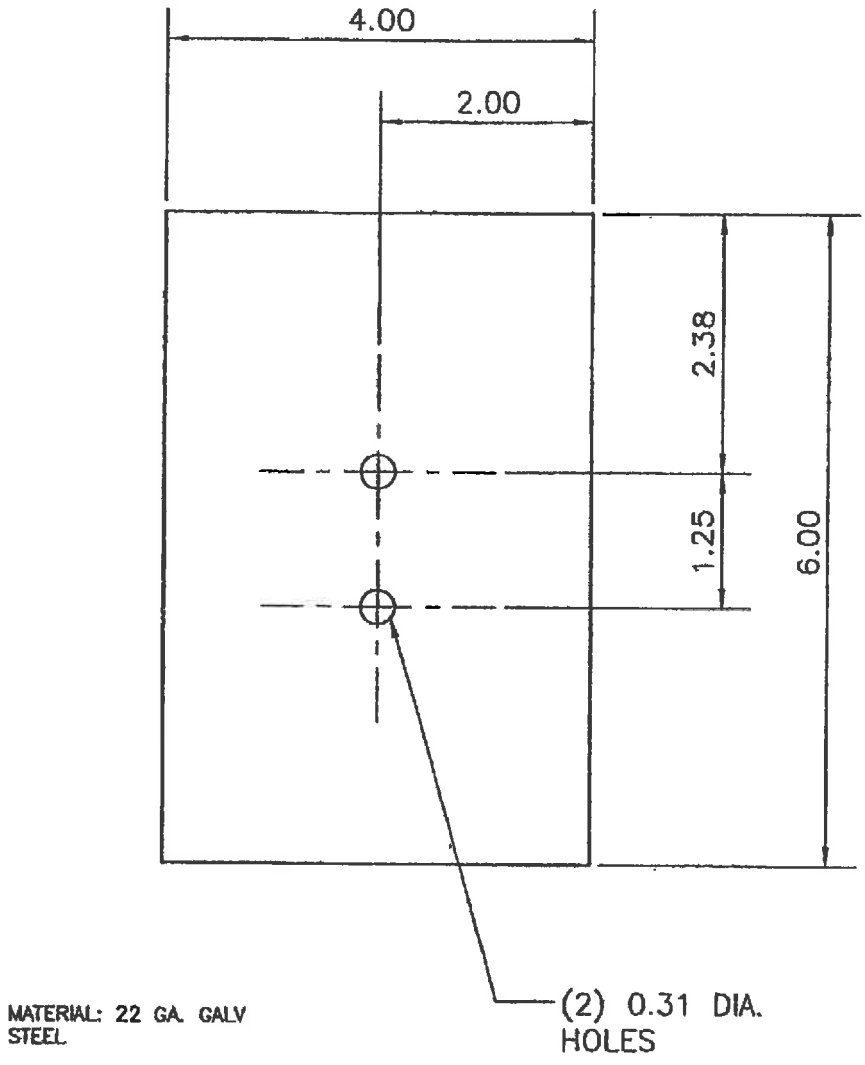
Appendix A Illustration 9



MATERIAL: 22 GA. GALV.
STEEL

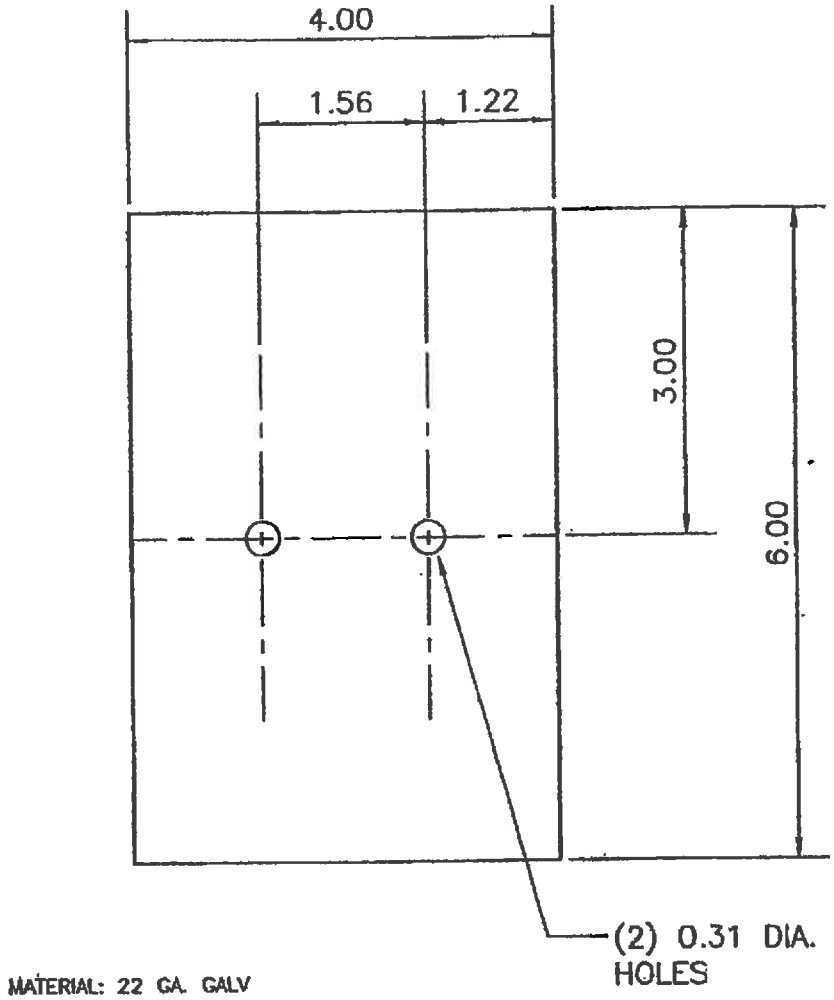
BEAING PLATE FOR HALTER CLIP

Appendix A Illustration 10



BEAING PLATE FOR HOOK CLIP

Appendix A Illustration 11



BEAING PLATE FOR HALTER CLIP