SILVER EAGLE
MANUFACTURING COMPANY

VAST20W CONVERTER DOLLY
PARTS & SERVICE MANUAL

As Built For

UPS FREIGHT

PART NUMBER: 17666
UNIT NUMBER: 4846 - 5167
VIN: 15716 - 16037

This document can be found by going to
www.silvereaglemfg.com
and entering the last 7 digits of any VIN from this build

5825 NE Skyport Way Portland, OR 97218
(503)281-0727 ◆ (800) 547-6792
Fax (503) 335-2171

August 2006

TABLE OF CONTENTS

(503 281-0727 - 800) 547-6792
5825 NE Skyport Way - Portland, OR 97218
www.silvereagle.com

GENERAL INFORMATION

SILVER EAGLE MANUFACTURING COMPANY

5825 NE Skyport Way
Portland, OR 97218

(503) 281-0727
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silvereaglemfg.com

Hours:

Mon – Thu	7:00a.m. – 5:00p.m. (PST)
Fri	7:00a.m. – 12:00p.m. (PST)

SPECIFICATIONS

VAST20W (17666)

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Toll Free: 1-800-547-6792
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Fax: 503-335-2171
Email: sales@silvereaglemfg.com

Quantity: 322 Unit
VAST20W Eagle Series
Single Axle Converter Dolly, 102"

UPS Freight, Inc.

1 FRAME
1-001 50,000 psi yield strength steel channel drawbar, counter-balanced Huck-bolted frame
1-005 Lunette eye rubber-mounted in steel shock housing
1-011 Induction hardened steel eye, 2-3/8" I.D. X 1-5/8" thick with 3/8" thick wall welded shank
1-034 Lunette eye height **34"**
1-080 Drawbar length, center of eye to centerline of axle **80"**
1-220 Two hinged drawbar lifting handles
1-347 Unladen 5th wheel height **47"**
1-360 Steel stiff leg with replaceable rubber foot pad
1-370 **OMIT** Frame-mounted watertight lexan document holder
1-380 Expanded metal drawbar basket for air/electric lines stowage
1-409 Furnish and install decals to frame - **Unit Numbers and UPS Shield**
2 FIFTH WHEEL
2-020 36" fabricated steel table 5th wheel w/ cast steel center, mounted directly above axle-- ROADSIDE (LH) **FRONT PULL HANDLE**
3 AXLE
3-003 Direct drawbar pull on cambered axle w/ 1/16" toe-in-- **77-1/2" track for 102" wide trailer**
3-132 Meritor Axle TP 4881-L w/16-1/2" X 8-5/8" S-Cam Q Plus Brakes w/R-301 ABEX 931-362 linings
3-212 Haldex 5-1/2" SABA Automatic Slack Adjusters and 30 sq in **Haldex** service chambers.
3-340 10-stud Conmet Preset cast steel hubs & cast iron brake drums for dual hub pilot mount steel disc wheels **(CR Seals)**
3-522 **Mobil #75W90 Synthetic Oil (Not Grease)**
4 SUSPENSION
4-005 Spring eyes mounted in shock-absorbing rubber boots
4-010 4" wide 7-leaf (plus rebound leaf) 2-stage transverse-mounted leaf springs, 20,000 lb capacity
5 PAINT
5-001 Steel grit blast, 8-stage pretreatment, epoxy primer (E-Coat) for u-bolts & 5th wheel, air reservoir and axle beam
5-002 Hot Dipped Galvanizing as separate frame pieces prior to assembly
5-210 BASF R-M Uno-HD Light Grey Acrylic Polyurethane topcoat paint on non-galvanized items
6 SAFETY CHAINS
6-010 Two 1/2" X 32" grade 70 chains w/ 5 ton hooks
7 AIR SYSTEM
7-116 Haldex 2S-1M Anti-Lock Brake System w/ Haldex Emergency Valve
7-224 Haldex Relay Valve, Pressure Protection Valve, Emergency Valve & Check Valve
7-228 Haldex Hostling Valve
7-221 Sealco Anti-Back (False) Charge Valve
7-299 Steel air tank, rubber isolated
7-305 Black rubber air lines for connection to lead trailer
7-319 **Philatron** color-coded 12 foot coiled nylon air lines for connection to 2nd trailer
7-310 Two pair of Tramac service/emergency gladhands w/ full face seals
8 ELECTRICAL
8-112 Phillips QCS molded assembly with full 8/10/12 cable between receptacles w/lead to ABS valve, & rear sill AMP
8-214 (1) Phillips 7ft straight cable - 8/10/12 Ga Wiring and 12' Coiled
8-321 **Four 12-Volt 4" diameter TRUCKLITE LED stop/tail/turn lamps**, rubber grommet-mounted.
8-412 LED ABS lamp
8-417 Insulated fifth wheel ground wire
9 TIRES & WHEELS
9-221 (4) 295/75R22.5 14 ply Bridgestone R195 steel belted radial tire
9-792 (4) 22.5" X 8.25" ACCURIDE hub pilot mount **5-hand hole** steel disc wheels (10 stud), Powder coated black with silver edge. Accuride Mylar wheel spacer rings, 4 per dolly
9-905 Schrader TR572 Valve Stem
MUDFLAPS
X-111 24 " wide 45 degree cornered black anti-sail flaps w/ no logo.
X-220 Hanger - Spring flatbar type, **Betts Direct Flex** - 25" long - galvanized

MAINTENANCE PROCEDURES

Laser Axle Alignment
Drawbar Eye Removal & Installation
Fifthwheel: Operation, Alignment & Jaw Wear
Phillips Electrical

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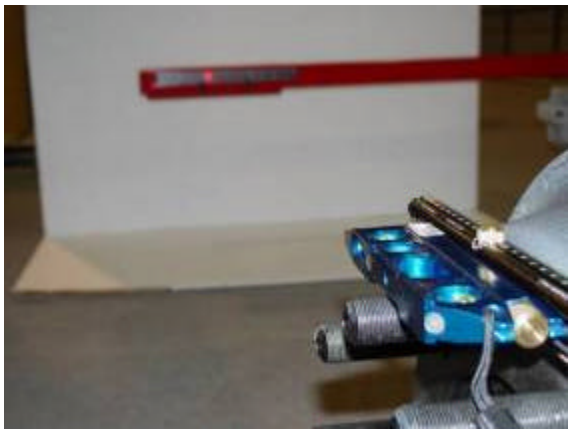
LASER AXLE ALIGNMENT

Use CAUTION!

- Lasers Can Be Dangerous to Eyes!
  - Don't Look Directly Into the Beam or Its Reflection.
  - Make Sure the Beam Is Not Directed Toward Another Person or Work Area.
  - Turn off When Not in Use.
- Attach Magnetic Laser Levels to Hub
- Aim at Target Scales
- Reading Should be Within 1/8"
- Adjust Axle Seat if Necessary
- Set Gauge into 5th Wheel Throat
- Attach Magnetic Laser Levels to Hub
- Aim at Target Scales
- Reading Should be Within 1/4"



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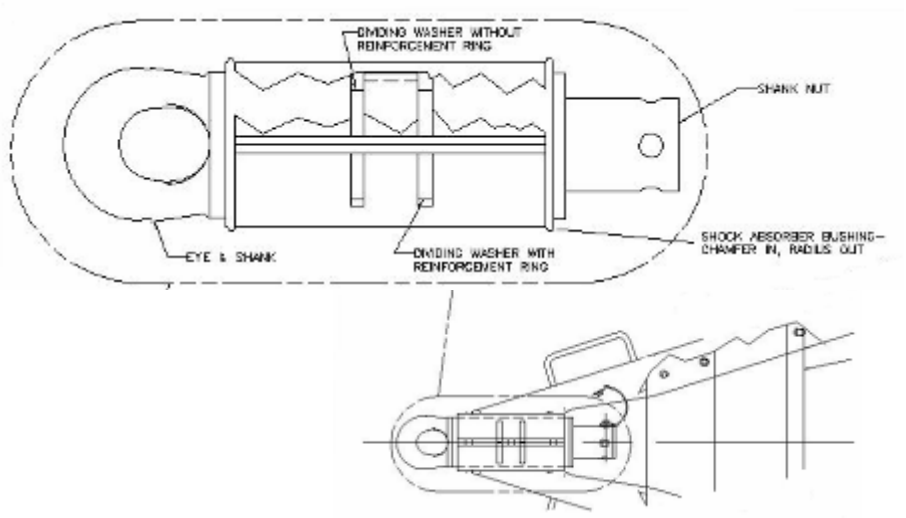
DRAWBAR EYE REMOVAL AND INSTALLATION PROCEDURE

1. Set brakes on unit.
2. Remove safety wire on shank nut.
3. Remove shank nut and shank washer.
4. Use forklift for hostler to pull against drawbar eye to remove it from the shock housing.
5. Lubricate the shank of the new drawbar eye with rubber lubricant or soapy water and install the shock housing. To completely install, use one of the following methods:
   - Set the brakes on the trailer. Use a forklift or hostler to push against the drawbar eye until it is seated on the shock absorber bushing.
   - Use a sledge hammer on the end of the drawbar eye until it is seated on the shock absorber bushing.
6. After the drawbar eye is in place, clean the threads on the shank and coat the threads with Never-Seez, pipe compound or another similar product.
7. Install the shank washer and thread the shank nut onto the shank.
8. Tighten the shank nut until three to four threads remain exposed inside the nut. Eye should be somewhat difficult to turn with two to three foot long pry bar.
9. Install a Silver Eagle safety wire on the shank nut to prevent it from backing off.
10. Periodically check the tightness of the shank nut and adjust as necessary.



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SILVER EAGLE FIFTH WHEEL OPERATION INSTRUCTIONS

➢ COUPLING

Make sure jaw is locked open
and trailer is at proper height.

Back dolly slowly under trailer until jaw locks
kingpin and handle moves into the fifth wheel.

➢ UNCOUPLING

With vehicle at rest in a relaxed condition
and landing gear down, (not being pushed together
or pulled apart). Pull fifth wheel handle outward and
upward to lock the fifth wheel open.

Pull dolly slowly out from under the trailer.

✓ NOTE

If the handle will not pull outward when the vehicle
is in a relaxed condition, use landing gear to raise trailer
and unload the dolly fifth wheel.

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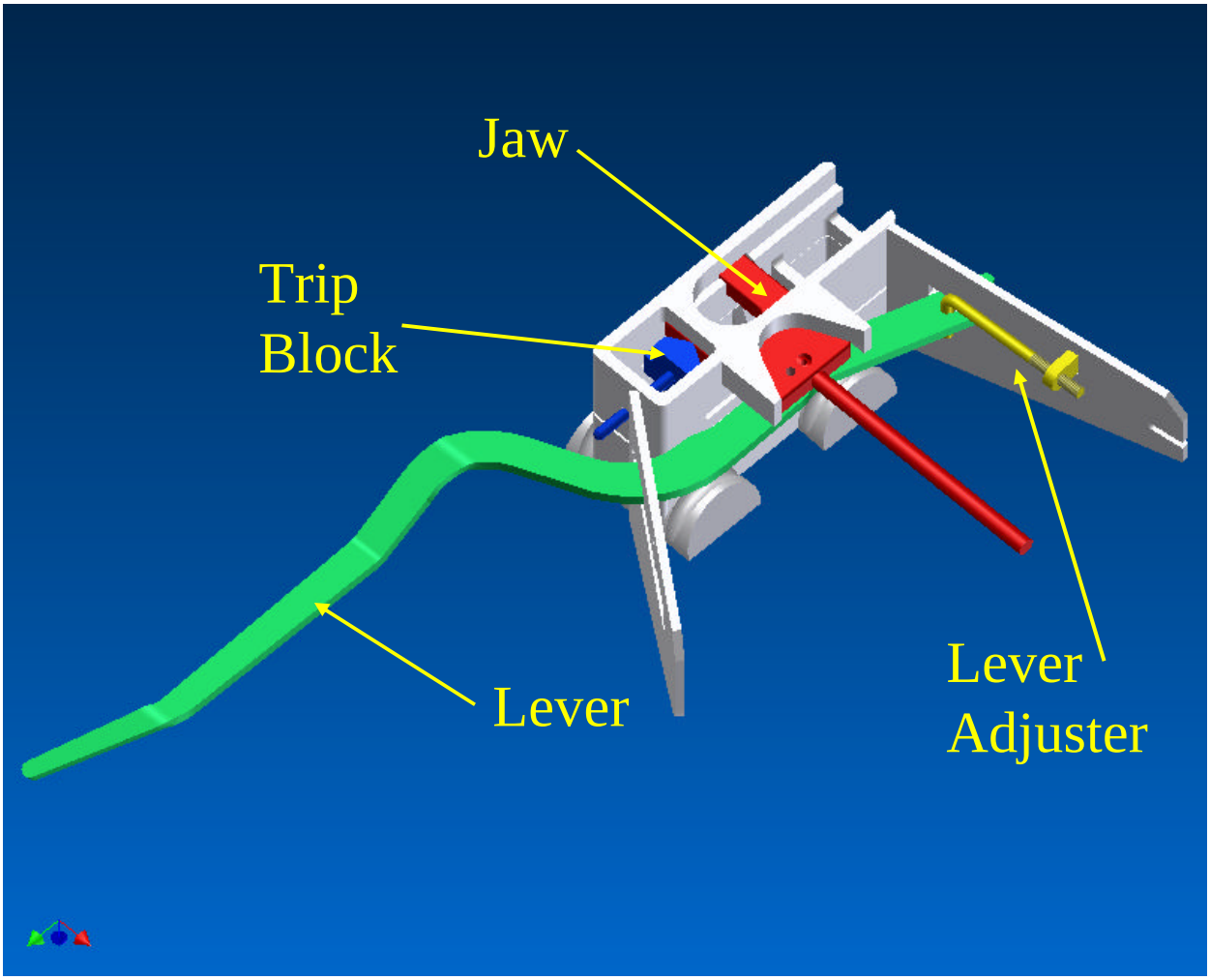
SILVER EAGLE FIFTH WHEEL
KEY PARTS



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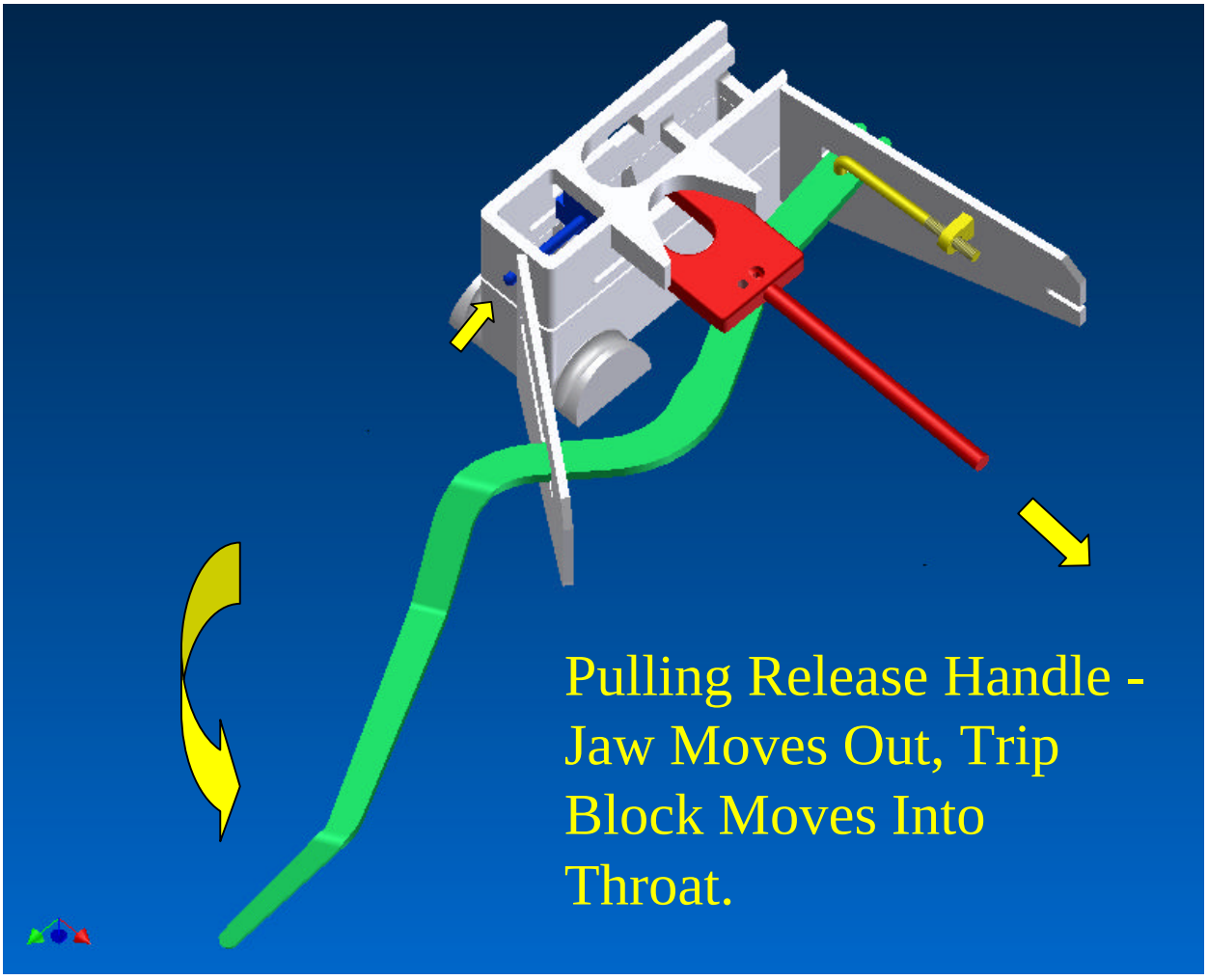

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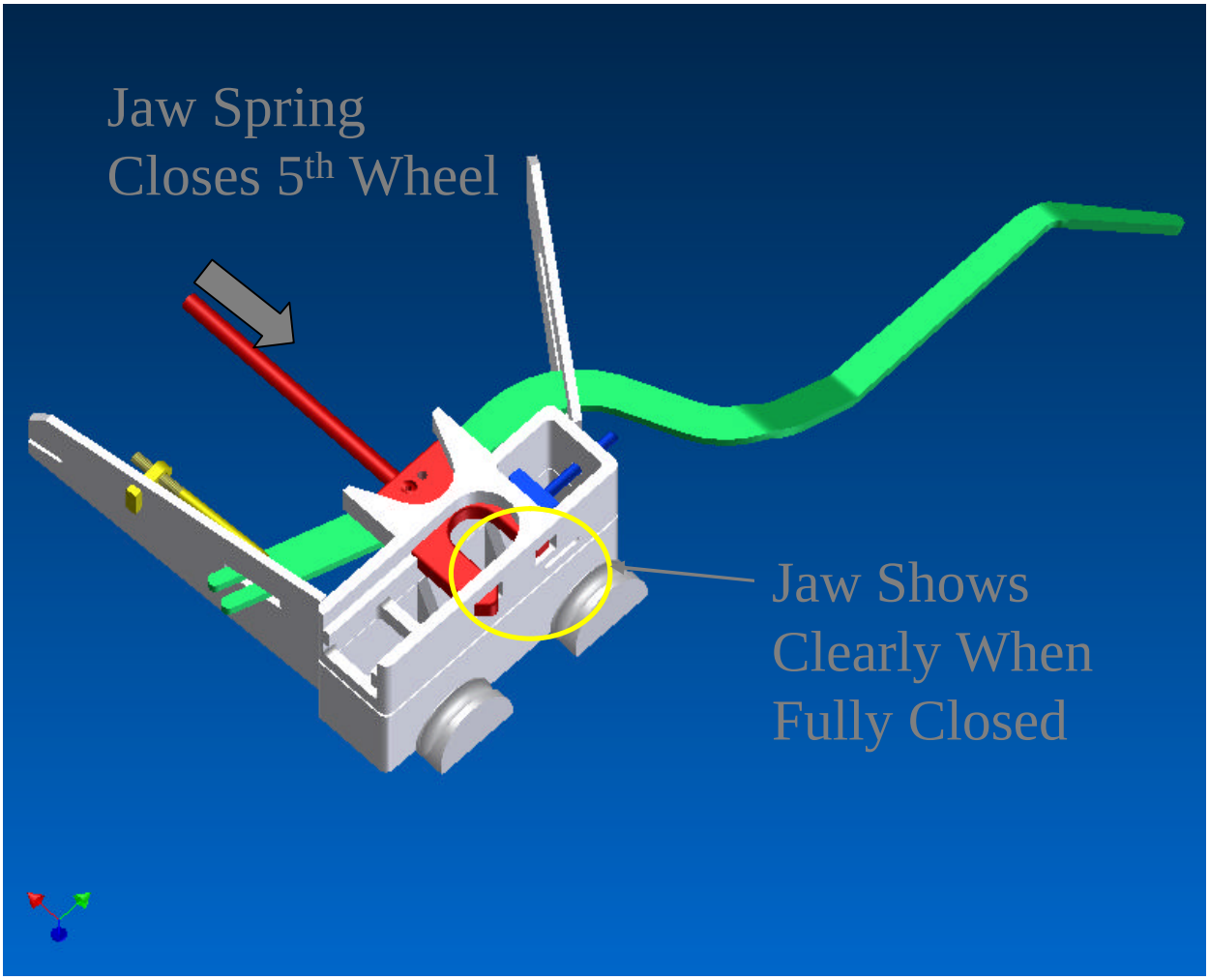
SILVER EAGLE FIFTH WHEEL
KEY PARTS



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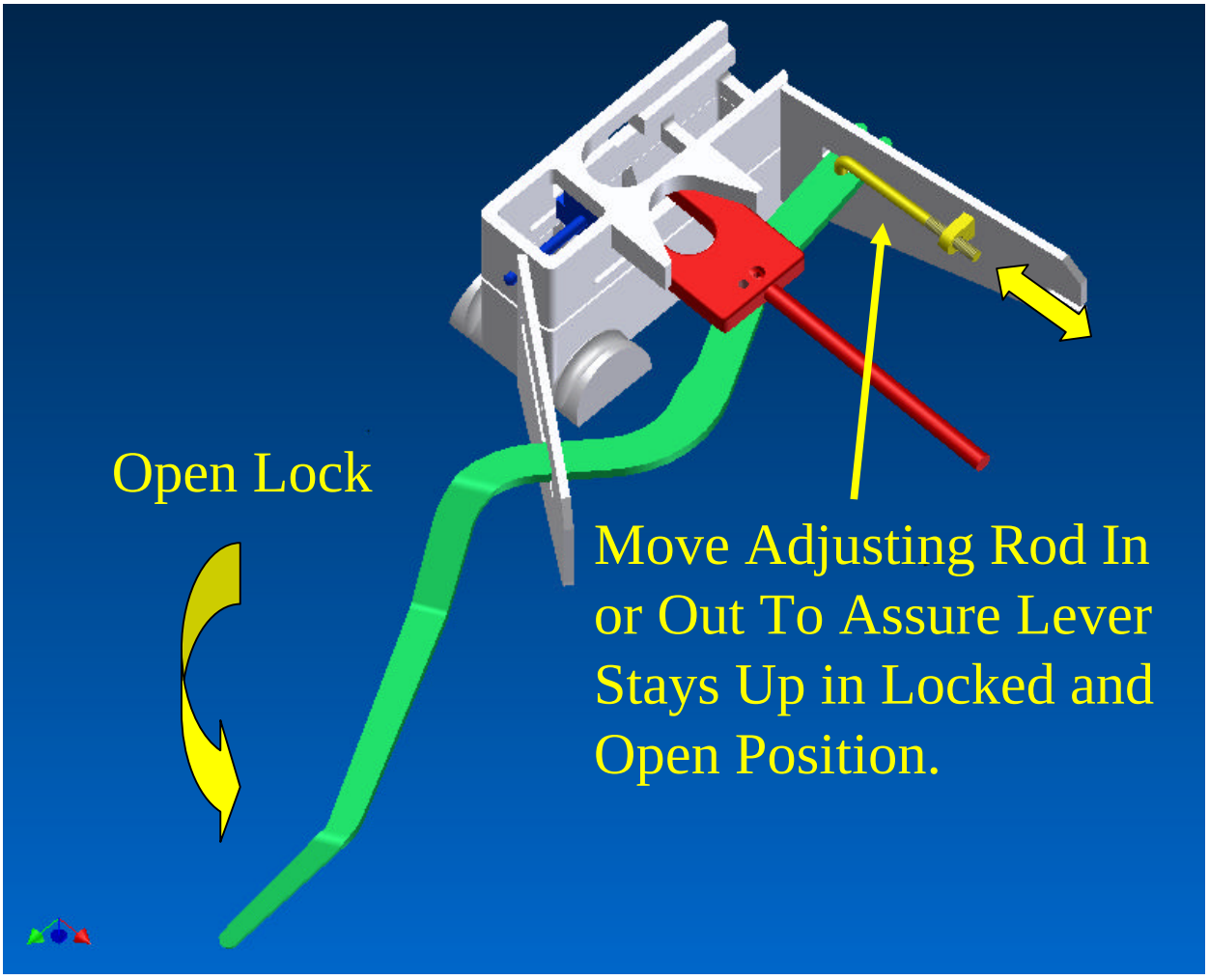
SILVER EAGLE FIFTH WHEEL
KEY PARTS



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SILVER EAGLE FIFTH WHEEL
CHECKED FROM FRONT

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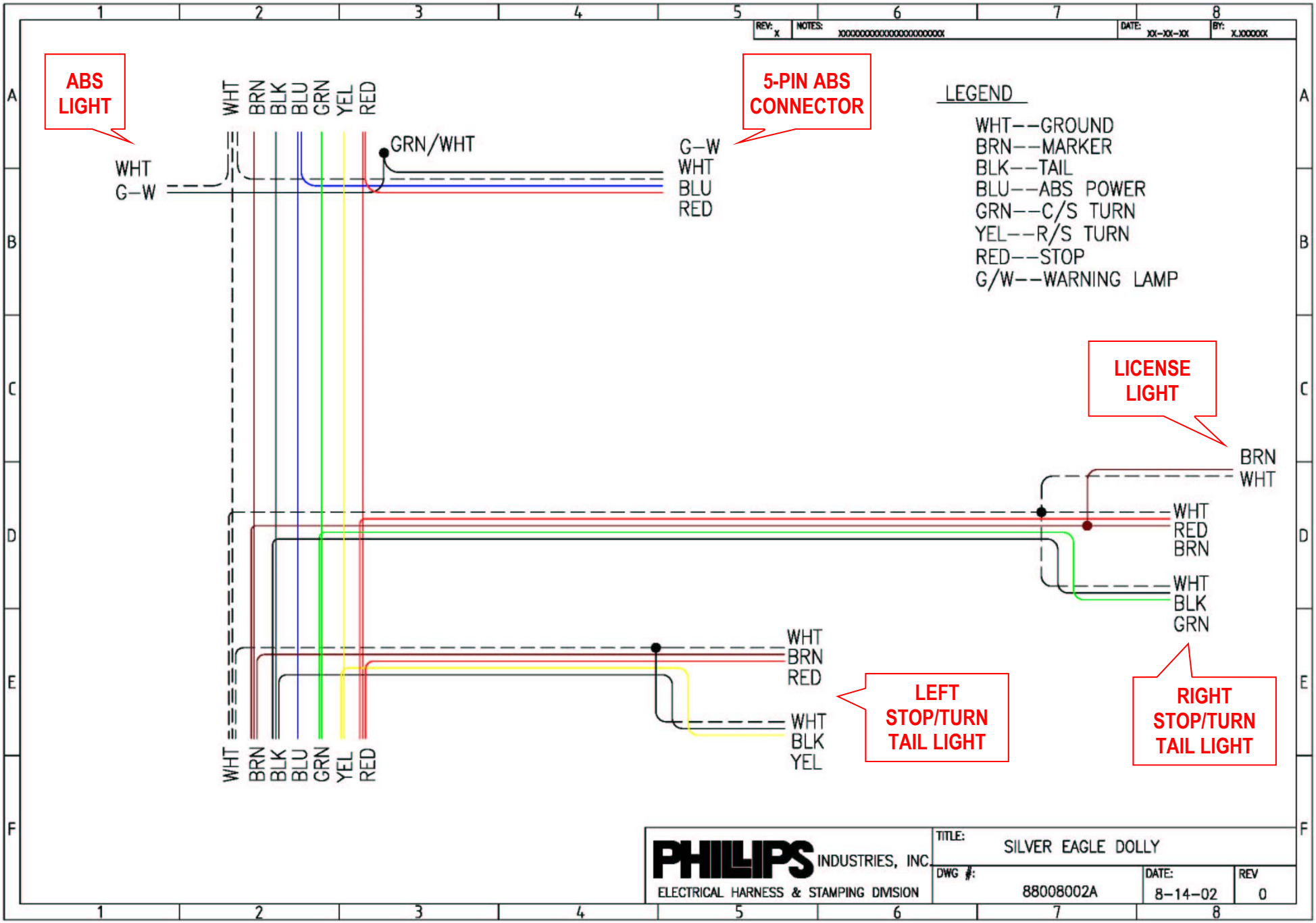
ABS LIGHT
5-PIN ABS CONNECTOR
WHT
BRN
BLK
BLU
GRN
YEL
RED
GRN/WHT
WHT
G–W
G–W
WHT
BLU
RED
LEGEND
WHT--GROUND
BRN--MARKER
BLK--TAIL
BLU--ABS POWER
GRN--C/S TURN
YEL--R/S TURN
RED--STOP
G/W--WARNING LAMP
LICENSE LIGHT
BRN
WHT
WHT
RED
BRN
WHT
BLK
GRN
WHT
BRN
RED
WHT
BLK
YEL
LEFT STOP/TURN TAIL LIGHT
RIGHT STOP/TURN TAIL LIGHT
PHILIPS INDUSTRIES, INC.
ELECTRICAL HARNESS & STAMPING DIVISION
TITLE:
SILVER EAGLE DOLLY
DWG #:
88008002A
DATE:
8–14–02
REV
0

PARTS LISTING

VA Dolly Service Training Kit
17666 VAST20W
Frame
Fifth Wheel & Suspension
Fifth Wheel Table Assembly
Air System
Electrical

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VA DOLLY SERVICE TRAINING TOOLS

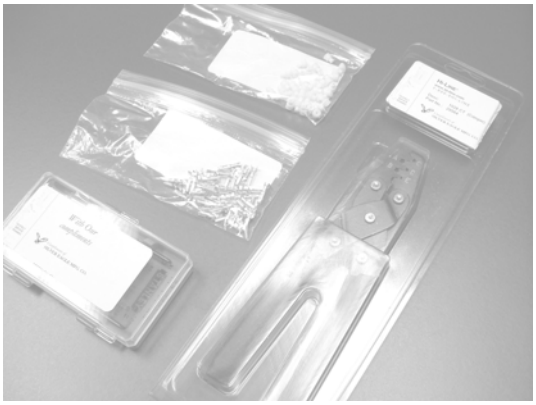
5th Wheel Tester
P/N: 15341

Eyewear Gauge
P/N: 18120

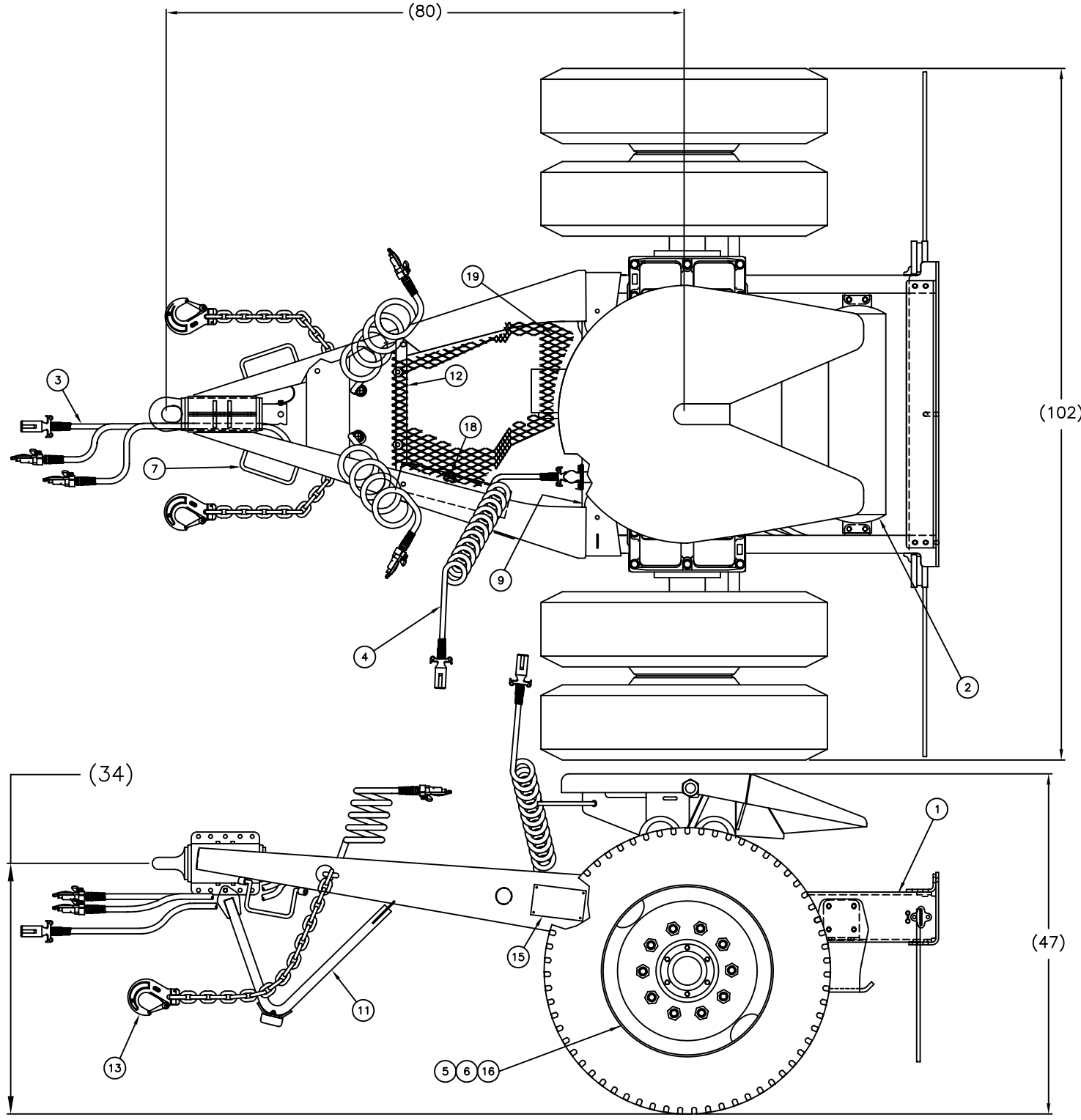
Drawbar & Eye Remover
P/N: 15314

Alignment Tool
P/N: 15343

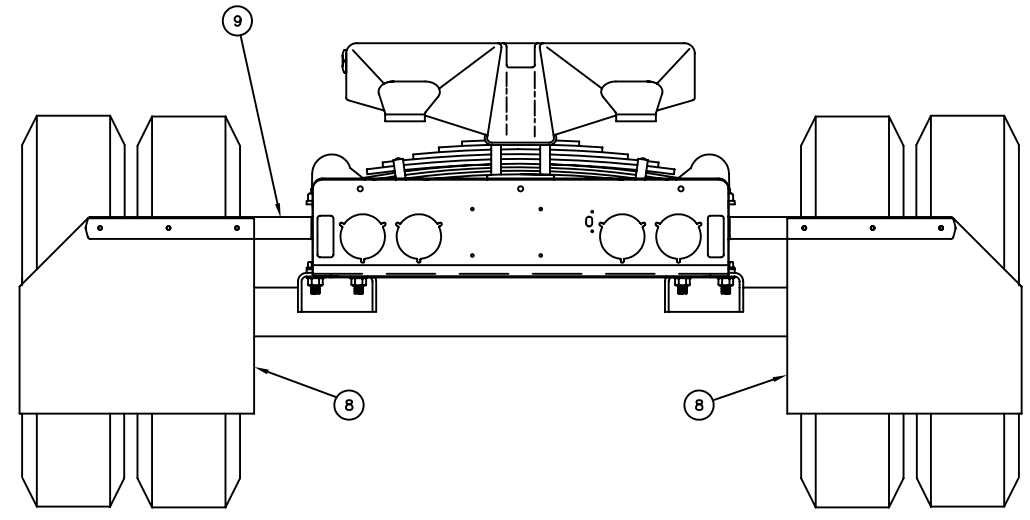
Laser
Levels (2 per kit)
(Class II)
P/N: 15352



- Wire Harness
  Repair Parts Available
  through HI-LINE



ITEM	QTY	PART No.	DWG No.	DESCRIPTION
–	–	17666	17666	DOLLY VAST20W 80DL 34HH 47FWH UPS FREIGHT GAL
1	1	17665	–	MAJOR ASSY VAST20W 14 X 27 X 80 UPS FREIGHT
2	1	17669	17669	AIR SYS ASSY HALDEX ABS ANTI BACK P/P VA
3	1	14713	–	ELEC ASSY 4–LT WYE HARNESS 3' EXT
4	1	10327	–	CABLE, 7–WAY COILED, 12' W/PLUGS GREEN ABS
5	4	17667	–	WHEEL 22.5X8.25, 10S–HP–5H, POWDER COAT BLK
6	4	16288	–	TIRE, 295/75R22.5 R195 LR G BRIDGESTONE 39.8
7	2	17757G	–	INSTALLATION, BOLT–ON HANDLE, GALV
8	1	17758	17758	FLAP 24WX20LX3/16 BLK, NO LOGO, ANTI–SAIL
8	1	18026	17758	FLAP 24WX20LX3/16 BLK, NO LOGO, ANTI–SAIL
9	1	15509	–	FLAP HANGER, DIRECT FLEX, BETTS, GALV
10	1	12524	–	MAJOR PAINT S–W GENESIS POLYURETHANE UPS GREY
11	1	10975G	98–328	SUPPORT LEG INSTALLATION, VA, GALV
12	1	11516G	99–025	VALVE PLATE INSTALLATION FOR NO JACK VA
13	2	12710	00–032	SAFETY CHAIN ASSY 1/2 RT U–BOLT W/5T CL HOOK
15	1	10978	98–330	INSTALLATION, DECALS/REFLECTORS/VIN PLATE
16	4	10448	–	VALVE STEM W/CAP STRAIGHT STD
17	1	10932	–	PROTECTIVE & TIE WRAP REQUIRMENTS, VA DOLLY
18	1	13475G	–	GLADHAND HOLDER INSTALLATION, ROADSIDE VA
19	1	10732	98–245	Z BASKET INSTALLATION, VA



UPS FREIGHT 17666

DIMENSIONS IN INCHES

TOLERANCES
Fraction X/X ±
Decimal X.X ±
Decimal X.XX ±
Decimal X.XXX ±
Angular X° ±
Unless Specified

REV	DATE REL NO.	BY	CHK'D	REVISION
				–

Size: B | Scale: NTS
Date: 5/11/06
REL NO: –
Drawn by: GCW
CHECKED: GCW

SILVER EAGLE MANUFACTURING CO., INC.
5825 NE SKYPORT WAY Portland, Oregon 97218

TITLE: DOLLY VAST20W 80DL 34HH 47FWH UPS FREIGHT GAL

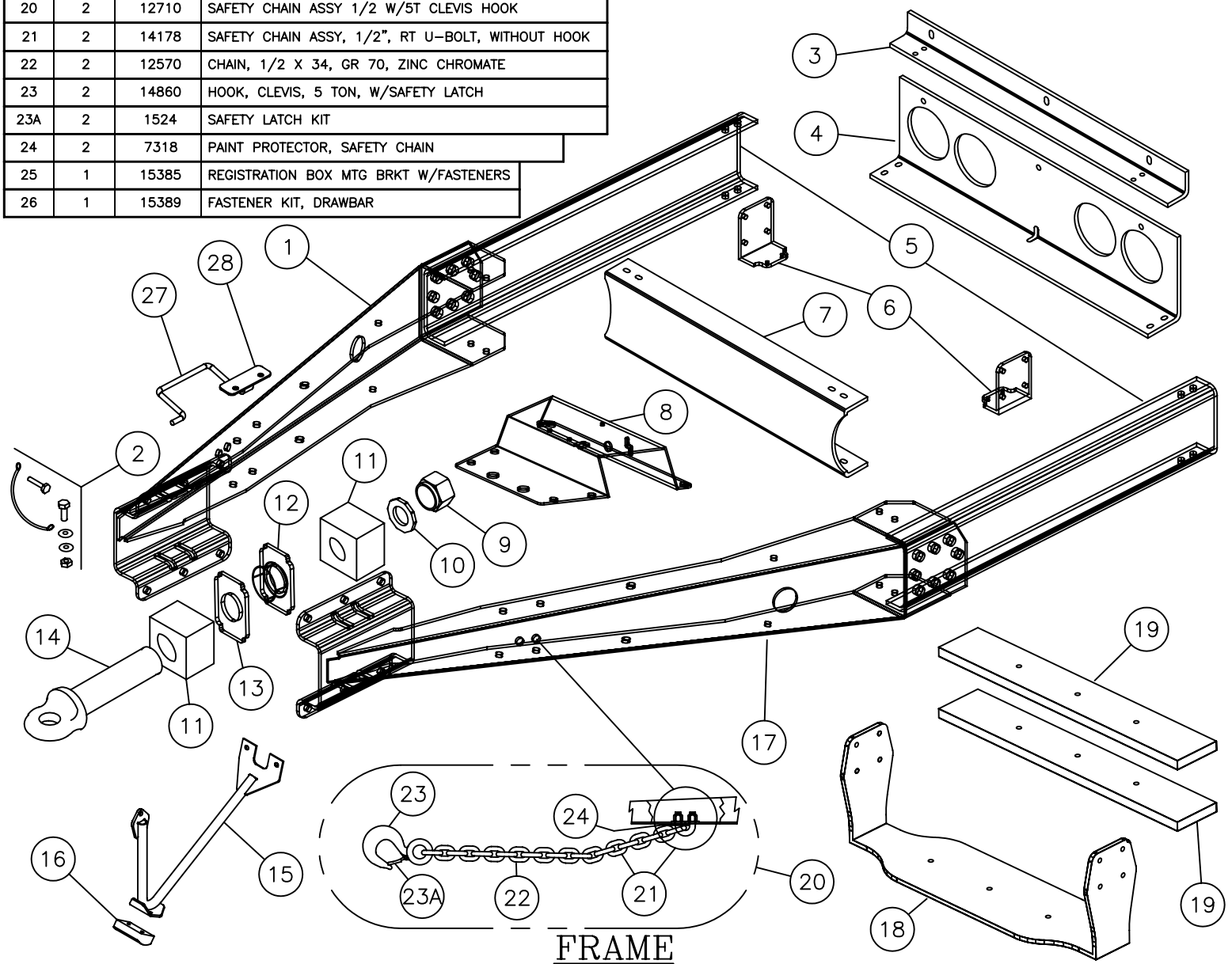
Sheets: 1 OF 1 | Drawing #: 17666 | Rev: ø

MODEL VAST-20W PART NUMBER 17666

FRAME ASSEMBLY			
ITEM	QTY	PART No.	DESCRIPTION
1	1	18066	DWB KIT, 36", CS, VA, UPS FREIGHT
2	1	11309	SAFETY WIRE ASSEMBLY/FASTENERS
3	1	11092G	ADAPTER, TAILPLATE
4	1	15416G	TAILPLATE WELDMENT
5	2	10416G	SIDE CHANNEL, 80", VA, GALV
6	2	13348G	AIR TANK MOUNTING BRACKET
7	1	11374G	CROSSMEMBER, 1-PC DWB
8	1	10996G	VALVE PLATE/FASTENERS
9	1	15315	NUT, SHANK, HEX
10	1	15660	WASHER, SHANK, DRAWBAR EYE, 1/2", HEX NUT
11	2	9520	BUSHING, SHOCK ABS, EYE & SHANK, RUBBER, VA
12	1	9714G	DIVIDER WELDMENT, SHOCK HOUSING, VA-DOLLY
13	1	9440G	DIVIDER, SHOCK HOUSING
14	1	1171	EYE & SHANK 3/8, HRDN
15	1	10975G	SUPPORT LEG ASSY WITH RUBBER PAD & FASTENERS
16	1	8808	PAD ONLY
17	1	18067	DWB KIT, 36", RS, VA, UPS FREIGHT
18	1	13456G	BALLAST HANGER W/FASTENERS
19	1	14868G	BALLAST/FASTENERS
20	2	12710	SAFETY CHAIN ASSY 1/2 W/5T CLEVIS HOOK
21	2	14178	SAFETY CHAIN ASSY, 1/2", RT U-BOLT, WITHOUT HOOK
22	2	12570	CHAIN, 1/2 X 34, GR 70, ZINC CHROMATE
23	2	14860	HOOK, CLEVIS, 5 TON, W/SAFETY LATCH
23A	2	1524	SAFETY LATCH KIT
24	2	7318	PAINT PROTECTOR, SAFETY CHAIN
25	1	15385	REGISTRATION BOX MTG BRKT W/FASTENERS
26	1	15389	FASTENER KIT, DRAWBAR

FRAME ASSEMBLY			
ITEM	QTY	PART No.	DESCRIPTION
27	2	5767G	HANDLE, DOLLY, HINGED, (UMDER-DWB), GALV
28	2	17756G	BRACKET, MOUNT, WLDMT, BOLT-ON HANDLE, GALV
29	1	15388	FASTENER KIT, TAILPLATE ASSY

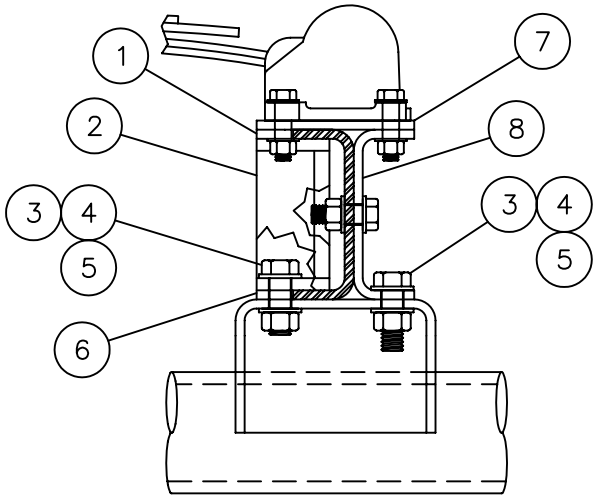
FRAME ACCESSORIES			
ITEM	QTY	PART No.	DESCRIPTION
31	1	15509	FLAP HANGER, DIRECT FLEX, BETTS, GALV
32	1	17758	FLAP 24WX20LX3/16 BLK, NO LOGO, ANTI-SAIL, CS
33	1	18026	FLAP 24WX20LX3/16 BLK, NO LOGO, ANTI-SAIL, RS



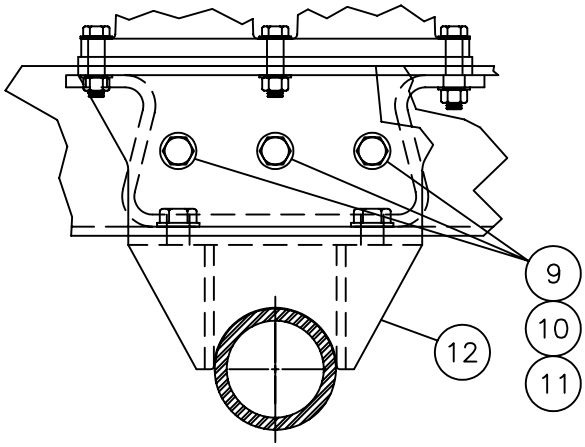
FRAME

MODEL VAST-20W PART NUMBER 17666

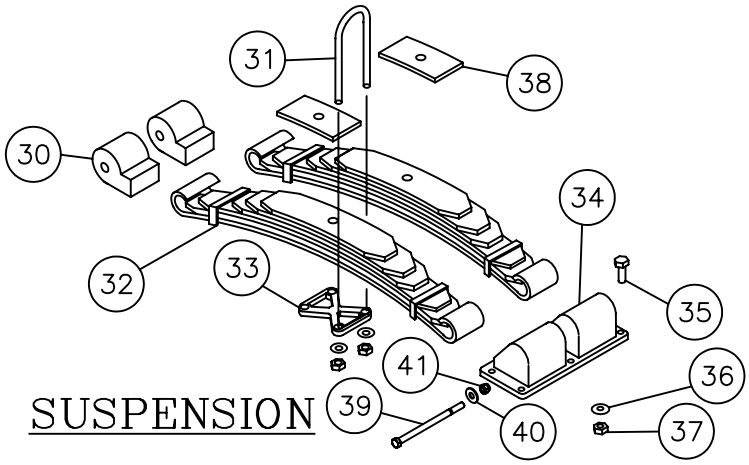
AXLE/FRAME ASSEMBLY			
ITEM	QTY	PART No.	DESCRIPTION
1	2	9437G	SPACER, UPPER, SIDE SUPPORT ASSY, VA-DOLLY
2	2	10168G	INNER SUPPORT, VA
3	8	9558	CAPSCREW, 7/8-14 UNF X 2 3/4, HX, GR 8, PLTD
4	8	9559	NUT, 7/8-14 UNF, HX, GR 8, PLTD
5	16	9485	WASHER, 7/8, FLAT, A325 (F436), HRDN, PLTD
6	2	10236G	SPACER, LOWER, SIDE SUPPORT ASSY, VA-DOLLY
7	2	9439G	SPRING PLATE, SIDE SUPPORT ASSY, VA-DOLLY
8	2	10167G	OUTER SUPPORT, VA
9	6	9481	CAPSCREW, 3/4-16 UNF X 2 1/4, HX, GR 8, PLTD
10	6	9483	NUT, 3/4-16 UNF, METAL LOCK, HX, GR 8, PLTD
11	12	3367	WASHER, 3/4, FLAT, F436, HRDN, PLTD
12	2	17658	WELDMENT, AXLE SEAT, 46", VA
FIFTH WHEEL			
15	1	13370	5TH WHEEL TABLE ASSY, LH RELEASE (ROADSIDE)
16	1	3432	TRIP BLOCK KIT, LH, W/SPRING & FASTENERS
17	2	8820	NUT, 1/2-13 UNC, TOP LOCK, JAM, HX, GR 5, PLTD
18	1	8944	JAW ASSY, HUCKED PUSHROD, LH
19	1	10056	LEVER, JAW, LH, SERIES 60
20	1	1150	WASHER, 1/2", FLAT, SAE, PLTD
21	1	1601	NUT, 1/2-13 UNC, HX, FIN, GR 5, PLTD
22	1	8368	SPRING, JAW, SERIES 10-60, E-COATED
23	1	4131	CAPSCREW, 1/2-13 UNC X 2 1/2, HX, GR 5, PLTD
24	1	10076	ANCHOR, LEVER ADJUSTMENT, 5TH WHEEL, FRONT PULL
25	1	1342	GUIDE, PUSHROD, SEMCO TABLE, 40-60
26	1	13381	LEVER BUSHING
27	1	13460	SECURITY SPRING FOR LEVER W/ POST AND FASTENERS
28	1	13462	LEVER ADJUSTER KIT
29	1	8535	LOCK TAB WASHER
SUSPENSION			
30	4	1204	RUBBERS, SPRING BOOT, PAIR
31	4	1645	U-BOLT ASSY, 1 X 4 X 8, RT, W/NUTS & WASHERS (2 per spring)
32	2	3539	SPRING ASSY, 7 LEAF W/LONG REBOUND
33	2	13461G	PRESSURE PLATE, 4", MULTI-USE (1 per spring)
34	2	1607	DOUBLE BOOT HOUSING, DUCTILE IRON A536
35	12	1691	CAPSCREW, 5/8-11 UNC X 2 1/2, HX, GR 5, PLTD
36	12	1172	WASHER, 5/8, FLAT, F436, HRDN, PLTD
37	12	1164	NUT, 5/8-11 UNC, METAL LOCK, HX, GR C, PLTD
38	2	7897	SPACER, SPRING LEAF, 7-3/4, ECOATED
39	2	15357	BOLT, 1/2-13 UNC, 6 3/8 LGTH, GR 8, BOOT HSG
40	2	3369	WASHER, 1/2", FLAT, WIDE, PLTD
41	2	1942	NUT, 1/2-13 UNC, METAL LOCK, HX, GR C, PLTD



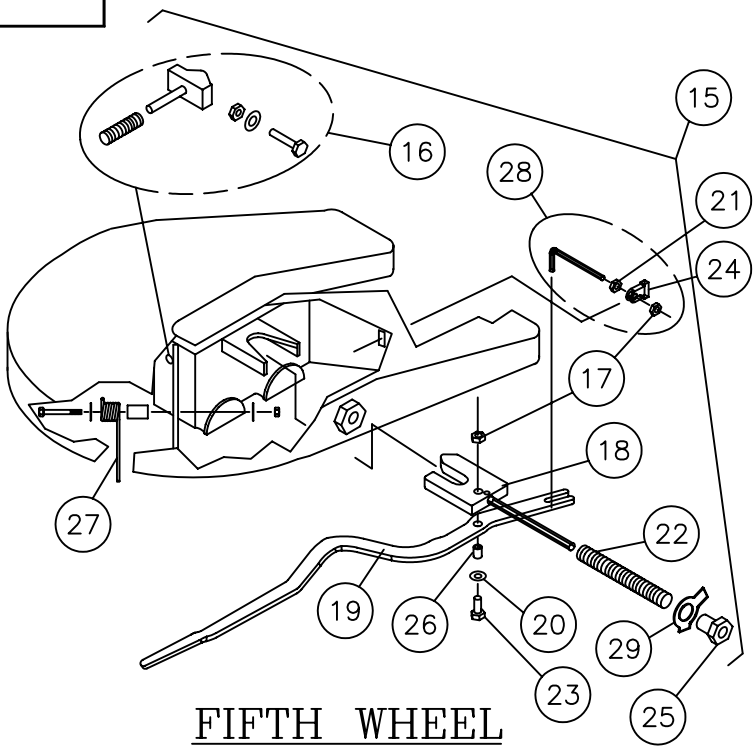
VIEW B-B



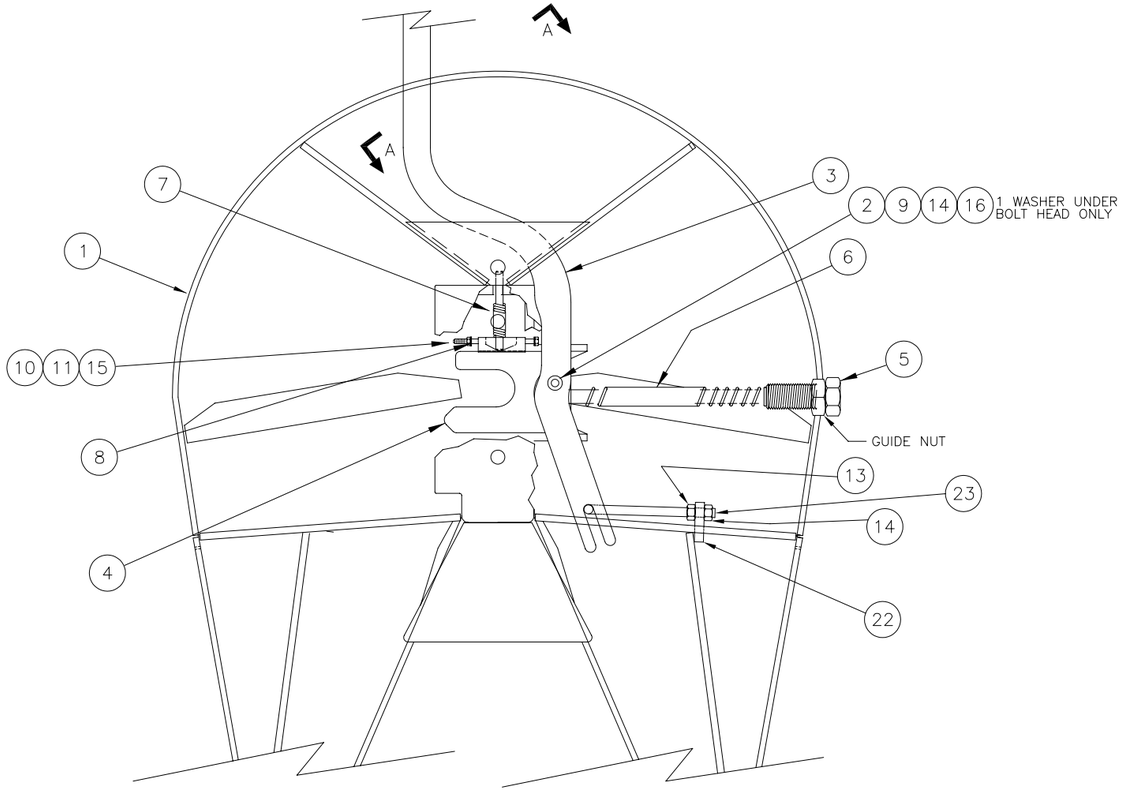
VIEW A-A



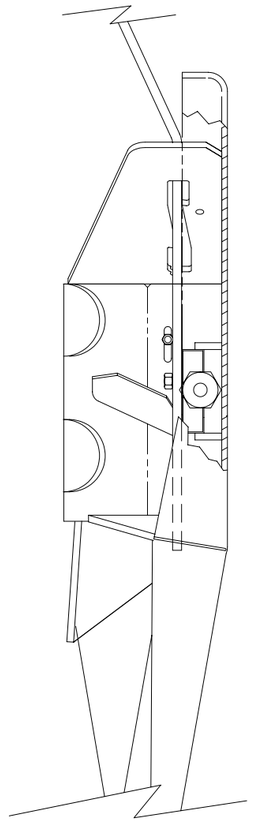
SUSPENSION



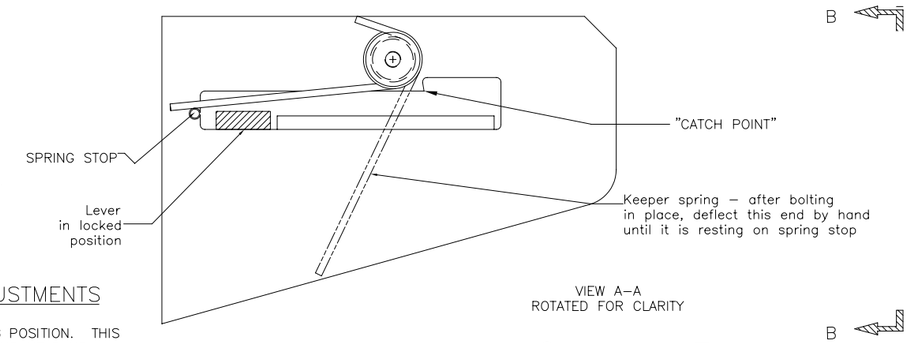
FIFTH WHEEL



BOTTOM VIEW

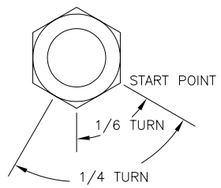


ITEM	QTY	PART No.	DWG No.	DESCRIPTION
——	——	13830	01–051	5th WHL ASSY, 10D, FRONT PULL, LH, STD
1		13371	00–333	5th WHEEL WELDMENT, STAMPED 5th WHEEL, LH
2	1	13381	———	BUSHING, DRILL, 1/2 ID X 3/4 X 3/4
3	1	10056	97–328	LEVER, 5TH WHEEL, FRONT PULL, LH
4	1	8944	96–162	JAW ASSY, HUCKED PUSH ROD, LH
5	1	1342	84–028	GUIDE, PUSH ROD, SEMCO TABLE, 40–60
6	1	8368	95–247	SPRING, JAW, SERIES 10–60, E–COATED, 12 3/8
7	1	1123	63–010	SPRING – TRIP BLOCK, SERIES 10–60
8	1	9640	97–093	TRIP BLOCK WLDMT, SERIES 30–60, LH
9	1	4131	———	CAPSCREW, 1/2–13 UNC X 2 1/2, GR 5, PLTD
10		1965	———	CAPSCREW, 3/8–16 UNC X 5, HX, GR 5, PLTD
11	1	2451	———	NUT, 3/8–16 UNC, METAL LOCK, HX, PLTD
13	2	1601	———	NUT, 1/2–13 UNC, HX, FIN, GR 5, PLTD
14	1	8820	———	NUT, 1/2–13 UNC, TOP LOCK, JAM, HX, GR 5, PLTD
15	2	1273	———	WASHER, 3/8, SAE, PLTD
16	1	1150	———	WASHER, 1/2, FLAT, SAE, PLTD
17	1 OZ	5917	———	GREASE, WHEEL BEARING, MOBIL, SYNTHETIC
18	1	4107	———	CAPSCREW, 3/8–16 UNC X 3–1/4, HX, GR 5, PLTD
19	2	11259	———	WASHER, 3/8, 1–1/2" MIN OD, FENDER, THICK, PLTD
20	1	11419	98–475	SPRING, KEEPER, LEVER, 5TH WHL, FRONT PULL, RS
21	1	11260	98–479	POST, KEEPER SPING, LEVER 5TH WHL, FRONT PULL
22	2	10076	97–344	ANCHOR, LEVER ADJUSTMENT, 5TH WHL, FRONT PULL
23	1	10077	97–345	ADJUSTER, LEVER, 5TH WHL, FRONT PULL



JAW/LEVER ASSEMBLY PROCEDURE

1. APPLY A LIBERAL AMOUNT OF BEARING GREASE (17) TO ROD OF TRIP BLOCK TO LUBRICATE FOR THE SPRING ACTION.
2. WITH SPRING (7) ON ROD OF TRIP BLOCK (8), INSERT TRIP BLOCK IN CENTER CASTING AS SHOWN ON BOTTOM VIEW OF 5th WHEEL ASSEMBLY.
3. APPLY ANTI–SIEZE TO THREADS OF 3/8 TRIP BLOCK BOLT (10).
4. INSERT ONE WASHER (15) ONTO TRIP BLOCK BOLT (10) AND INSERT BOLT THRU CENTER CASTING SLOTS AND TRIP BLOCK (8) AS SHOWN.
5. ADD ANOTHER WASHER (15) ONTO END OF TRIP BLOCK BOLT. TIGHTEN LOCK NUT (11) ON BOLT LEAVING 1/16–3/32 CLEARANCE ALLOWING TRIP BLOCK TO TRAVEL WITHOUT BINDING.
6. PUSH TRIP BLOCK BACK WITH SUITABLE DEVICE (PIECE OF WOOD). WHILE HOLDING THE POSITION OF THE TRIP BLOCK AGAINST ITS SPRING FORCE, CLAMP IN PLACE ON TRIP BLOCK GUIDE ROD IN FRONT OF CENTER CASTING. USE VISE–GRIP OR OTHER SUITABLE MEANS.
7. INSTALL KEEPER SPRING (20) ON POST (21) AS SEEN IN VIEWS A–A AND B–B. USE LOCTITE 242 MEDIUM STRENGTH THREAD ADHESIVE ON CLEAN THREADS OF CAPCREW. BE SURE TO PUSH SPRING END ABOVE SPRING STOP BEFORE INSTALLING LEVER.
8. INSTALL (23) THE LEVER ADJUSTER (L–BOLT) & ADJUSTER ANCHOR (22) WITH NUT (13) & LOCKNUT (14). ADJUST THE NUTS SO THE VERTICAL ADJUSTER LEG POINTS DOWN & IS POSITIONED APPROX. 1/8" INBOARD OF THE CENTER OF THE HORIZONTAL SLOT ON THE GUSSET TO WHICH IT IS ATTACHED.
9. APPLY ANTI–SIEZE OR GREASE TO FORWARD & AFT SIDES OF JAW.
10. SLIDE JAW/PUSH ROD ASSEMBLY IN PLACE WITHOUT LEVER (3) OR SPRING (SEE BOTTOM VIEW OF 5th WHEEL ASSEMBLY).
11. POSITION LEVER (3) AS SHOWN IN BOTTOM VIEW.
12. APPLY THREAD ADHESIVE TO CLEAN THREADS OF CAPSCREW (9) AND JAM NUT (14).
13. WITH THE BUSHING (2) IN LEVER, TIGHTEN CAPSCREW (9) INTO JAW (4) WITH ONE WASHER (16) BETWEEN THE CAPSCREW HEAD & THE LEVER. TIGHTEN THE CAPSCREW UNTIL THE WASHER IS CLAMPED AGAINST THE BUSHING.
14. TIGHTEN THE JAM NUT (14) 1/6–1/4 TURN ON THE END OF THE CAPSCREW PROTRUDING FROM THE JAW.

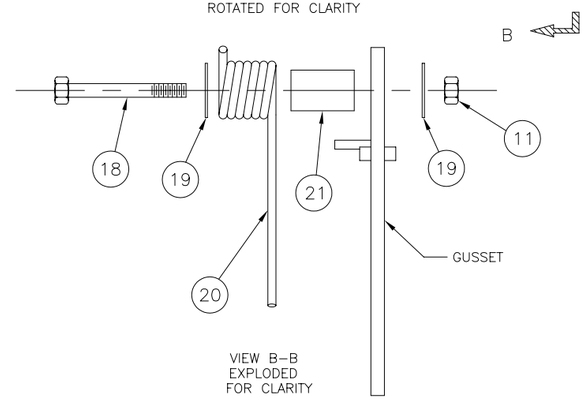


15. APPLY A LIBERAL AMOUNT OF BEARING GREASE (17) TO PUSHROD OF JAW ASSY (4) TO LUBRICATE SPRING ACTION. ATTEMPT TO PREVENT EXCESSIVE BUILDUP THAT MAY FALL OFF DURING SHIPPING. INSTALL JAW SO SMALL TINE PROTRUDES FROM OPPOSITE SIDE ABOUT 1/4".
17. SLIDE PUSH ROD SPRING (6) ON PUSH ROD OF THE JAW.
18. APPLY ANTI SIEZE TO THREADS OF PUSH ROD GUIDE (5) AND TURN UNTIL IT ALMOST REACHES THE JAW PUSH ROD.
19. PULL THE LEVER FAR ENOUGH THAT THE JAW PUSH ROD PROTRUDES INTO THE GUIDE AND TIGHTEN THE GUIDE (5) SECURELY AGAINST THE GUIDE NUT.

PERFORMANCE TESTING/ADJUSTMENTS

1. PULL THE LEVER INTO THE UNCOUPLING POSITION. THIS IS WHERE THE LEVER IS PULLED OUT AND HELD UP BY THE "CATCH POINT" INDICATED IN VIEW A–A. IF THE LEVER WON'T STAY UP, THE ADJUSTER NUTS ON THE ADJUSTER AT THE BACK END OF THE LEVER ARE PROBABLY SCREWED IN TOO FAR. BACK THEM OFF UNTIL LEVER WILL STAY ON THE CATCH POINT.
2. TEST THE 5TH WHEEL FOR PROPER COUPLING WITH A TEST KINGPIN. TEST WITH THE LEVER IN THE UNCOUPLING POSITION. IF IT DOESN'T RELEASE FROM THE "CATCH POINT", THEN THE ADJUSTER NUTS, 13 & 23, PROBABLY NEED TO BE SCREWED IN FURTHER.
3. WITH THE JAW CLOSED OR IN THE COUPLED POSITION, PICK THE LEVER UP AND OUT OF THE LOCKED POSITION. HOLD THE LEVER JUST SHY OF FALLING BACK INTO THE LOCKED POSITION. RELEASE THE LEVER TO ENSURE THAT IT PASSES FREELY INTO THE LOCKED POSITION.
4. WHEN 5TH WHEEL FUNCTIONS PROPERLY, TIGHTEN THE LEVER ADJUSTER LOCKNUT SECURELY

VIEW A–A
ROTATED FOR CLARITY



VIEW B–B
EXPLODED
FOR CLARITY

ALL DIMENSIONS ARE IN INCHES

TOLERANCES
Fraction X/X ±1/16
Decimal X.X ±0.1
Decimal X.XX ±0.03
Decimal X.XXX±0.010
Angular X° ±1 DEG
Unless Specified

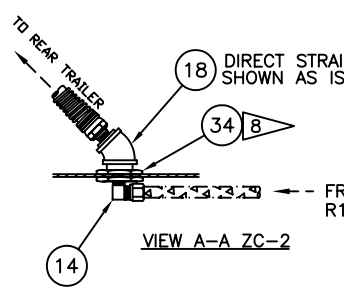
Rev	Date	By	Chk'd	Revision

Scale: NTS
Date: 2/11/01
Drawn by: STB
Chd by: STB

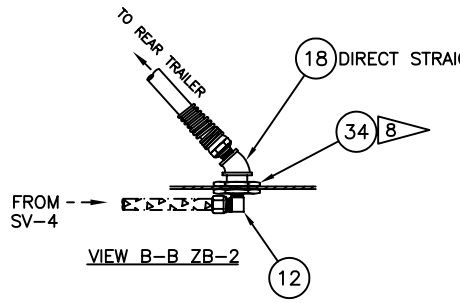
SILVER EAGLE MANUFACTURING CO.
5825 NE Skyport Way Portland, OR 97218

TITLE: 5th WHL TABLE ASSY, FRONT PULL, LH, STD

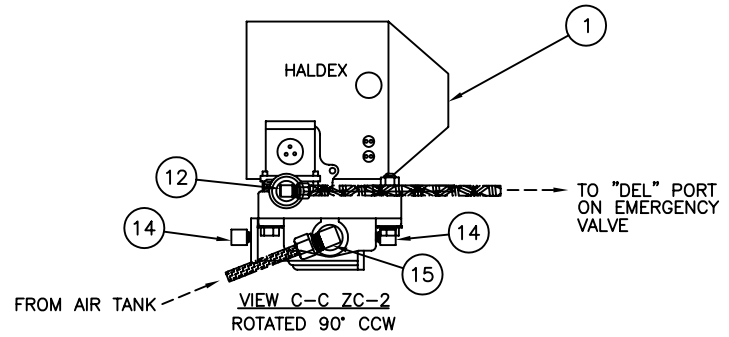
DRN: 01048 | Drawing # 01–051 | Rev. ø



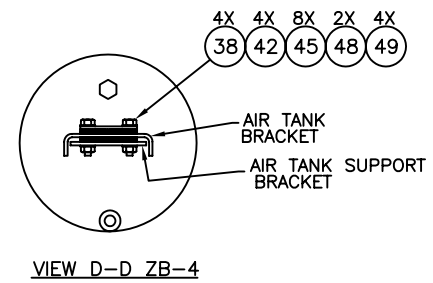
VIEW A–A ZC–2



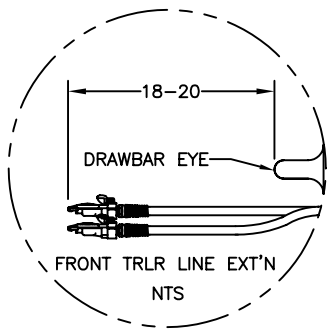
VIEW B–B ZB–2



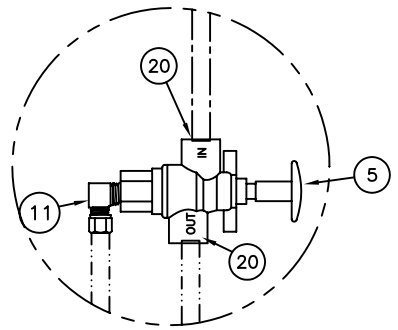
VIEW C–C ZC–2
ROTATED 90° CCW



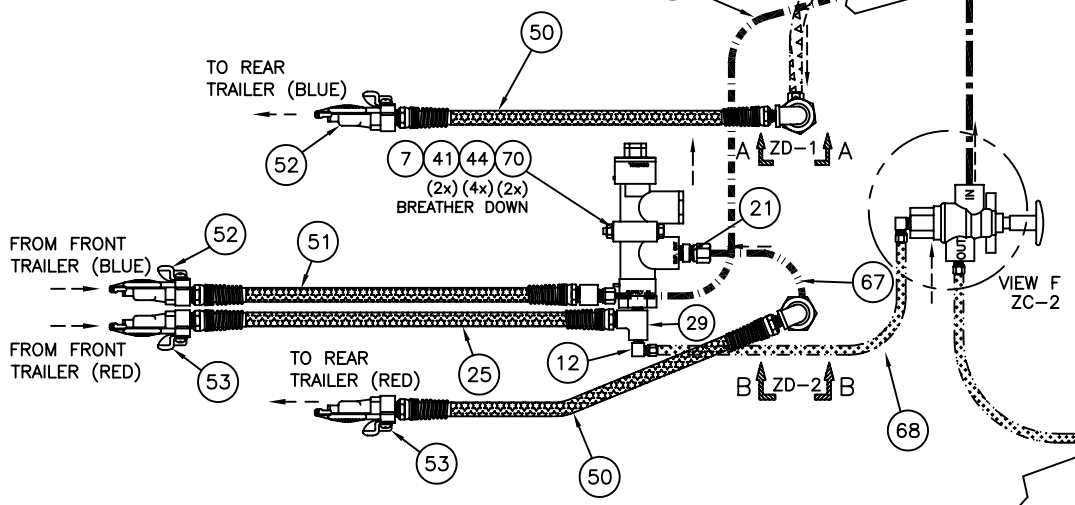
VIEW D–D ZB–4



FRONT TRLR LINE EXT'N
NTS



VIEW F ZB–2



VIEW F ZC–2

AIR SYSTEM OPTIONS & HOSE LENGTHS			
ITEM	P/N	DESC	LENGTH
54	2393	3/8 RED	37
55	1785	3/8 BLACK	47
56	2393	3/8 RED	49
57	2393	3/8 RED	14
58	2393	3/8 RED	40
59	3276	3/8 BLUE	50
60	3276	3/8 BLUE	9
61	3276	3/8 BLUE	20
62	2394	1/2 BLUE	29
63	1785	1/2 BLACK	80
64(2)	2394	1/2 BLUE	16
65	1785	3/8 BLACK	22
66	1786	1/2 BLACK	45
67	2393	3/8 RED	19
68	2393	3/8 RED	12

NOTES

1. ALL DIMENSIONS ARE IN INCHES
2. THE TOLERANCE ON ALL HOSE LENGTHS IS ±1/2"
4. BRAKE APPLY TIME TO BE UNDER .55 SEC.
5. ROUTING OF AIR LINES ARE SHOWN AS SUCH FOR CLARITY ONLY.
6. USE PIPE JOINT SEALANT ON ALL AIR PRESSURIZED JOINTS UNLESS FITTING COMES WITH SEALANT PRE–APPLIED

7 ORIENT PR–3 VALVE WITH BRASS POINTING UP.

8 USE LOC–TITE COMPOUND OR EQUIVALENT ON BULKHEAD NUTS.

AIR LINE KEY

- BLACK RUBBER LINES
- BLUE TUBING–CONTROL–SERVICE
- RED TUBING–SUPPLY–EMERGENCY
- BLACK TUBING–SUPPLY FROM TANK
- INDICATES DIRECTION OF AIR FLOW

TOLERANCES
Fraction X/X ±1/16
Decimal X.X ±0.1
Decimal X.XX ±0.06
Decimal X.XXX ±0.030
Angular X° ±1 DEG
Unless Specified

Rev	Date	By	Chk'd	Revision
A	8/16/06	JDW	GCW	CORRECTED BRASS COMPONENTS PER MFG

Scale NTS
Date 7/19/06
Drawn by: JDW
Engineer: GCW

SILVER EAGLE MANUFACTURING CO., INC.
5825 NE SKYPORT WAY Portland, Oregon 97218

TITLE
AIR SYS ASSY HALDEX ABS ANTI BACK P/P VA

DRN:
SHEET 1 OF 2
Drawing # 17669
Rev. A

ITEM	QTY	PART No.	DESCRIPTION
48	2	7420	RETAINING PLATE, ISO–PAD, AIR RESERVOIR
49	4	7419	ISO–PAD, AIR RESERVOIR
50	1	17711	HOSE, AIR, COILED 12', RED/BLUE, PHILATRON
51	1	6213	HOSE, AIR, 3/8 X 49, RUBBER, 3/8 X 1/2 CONN
52	2	1533	GLADHAND, SERV., W/FULL FACE SEAL, PAINTED BLUE
53	2	1548	GLADHAND, EMER., W/FULL FACE SEAL, PAINTED RED
54	1	5639	NIPPLE, HX RED, 1/2 NPT–M X 3/8 NPT–M, STL
55	1	1842	PLUG, CSK HX, 1/2 NPT–M, STL, GALV
56	1	1825	NIPPLE, HX RED, 3/8 NPT–M X 1/4 NPT–M, BR
63	114	1785	TUBING, NYLON, AIRBRAKE, 3/8", BLACK
70	2	5491	CAPSCREW, 1/4–20 UNC X 2–1/4, HX, GR 5 PLTD
–	1	8913	AIR RES, SIDE DRN 1425 CI
–	1	13610	ELBOW, 90, 3/8T X 1/4 NPT–F, BR
–	1	4478	GLADHAND, SERV., W/STD FULL–FACE SEAL
–	1	6181	PAINT GAVLON, BLUE
–	1	1744	PAINT GAVLON, OSHA RED
–	1	4479	GLADHAND, EMER., W/STD FULL–FACE SEAL
–	1	1775	VALVE, DRAIN, LEVER, 150 PSI, 1/4" NPT–M
–	125	1786	TUBING, NYLON, AIRBRAKE, 1/2, BLACK
–	171	2393	TUBING, NYLON, AIRBRAKE, 3/8", RED
–	45	2394	TUBING, NYLON, AIRBRAKE, 1/2", BLUE
–	72	3276	TUBING, NYLON, AIRBRAKE, 3/8", BLUE
–	3.375	9058	BAR–STRIP, 1/8 X 1–1/4, HR, ASTM A36
–	2	3509	NUT, 3/8–24 UNF, HX, NYL INS, GR 5, PLTD

ITEM	QTY	PART No.	DWG No.	DESCRIPTION
——	——	17669	17669	AIR SYS ASSY HALDEX ABS ANTI BACK P/P VA
1	1	16423	———	VALVE, ABS ECU, PLC SELECT, HALDEX
2	1	10224	———	VALVE, RELAY, (FAST AIR & BALANCING) MIDLAND
3	1	16424	———	VALVE, CHECK/PRESSURE PROTECTION, HALDEX
4	1	16425	———	VALVE, PRESSURE PROTECTION, HALDEX
5	1	16428	———	VALVE, PUSH–PULL, HOSTLING, HALDEX
6	1	9858	———	VALVE, EMERGENCY CONTROL 110376 SEALCO
7	1	16893	———	VALVE, SEALCO ANTI BACK CHARGE
8	2	16470	———	CABLE, ABS SENSOR EXT, 6 FT, HALDEX
9	1	2997	———	ELBOW, ST, 90, 1/4 NPT–M X 1/4 NPT–F, BR
10	1	4713	———	ELBOW, 90, 3/8T X 1/2 NPT–M, BR
11	5	1804	———	ELBOW, 90, 3/8T X 1/4 NPT–M, BR
12	4	1805	———	ELBOW, 90, 3/8T X 3/8 NPT–M, BR
14	4	1806	———	ELBOW, 90, 1/2T X 3/8 NPT–M, BR
15	1	1807	———	ELBOW, 90, 1/2T X 1/2 NPT–M, BR.
16	1	9145	———	ELBOW, 90, 1/2T X 1/2 NPT–F, BR.
17	3	1810	———	ELBOW, 45, 3/8T X 3/8 NPT–M, BR
18	2	2846	———	ELBOW, 45, 1/2 NPT–F, GALV
19	2	1811	———	ELBOW, 45, 1/2T X 3/8 NPT–M,BR.
20	1	1816	———	CONNECTOR, 3/8T X 1/4 NPT–M, BR.
21	1	1817	———	CONNECTOR, 3/8T X 3/8 NPT–M, BR.
22	1	1819	———	CONNECTOR, 1/2T X 3/8 NPT–M, BR
23	2	1808	———	TEE, MALE RUN, 3/8T X 1/4 NPT–M, BR.
24	1	1812	———	ELBOW, 45, 1/2T X 1/2 NPT–M, BR
25	1	6107	———	HOSE AIR, 3/8x49, RUBBER, 3/8 X 1/2 CONN
26	1	1839	———	PLUG, CSK HX, 1/4 NPT–M, STL, GALV
27	5	1840	———	PLUG, CSK HX, 3/8 NPT–M, STL, GALV
28	1	1843	———	PLUG, CSK HX, 3/4 NPT–M, STL, GALV
29	1	10725	———	TEE, MALE RUN, 3/8 NPT, BR
30	1	1798	———	BUSHING, 3/4 NPT–M X 3/8 NPT–F, HX, STL, GALV
31	1	9147	———	ELBOW, 45, 1/2T X 1/2 NPT–M, BR
32	1	10688	———	CONNECTOR, 3/8T X 1/4 NPT–F, BR
33	1	5856	———	TEE MALE BRANCH 3/8T x 1/4 NPT–M, BR
34	2	1181	———	FITTING, BULKHEAD, BR
35	1	13390	———	AIR RES SIDE DRN MIDWEST 1425 CI PFS
36	2	8311	———	CAPSCREW, 1/4–20 UNC X 2 3/4, HX, GR 5, PLTD
37	4	1322	———	CAPSCREW, 5/16–18 UNC X 1, HX, GR 5, PLTD
38	4	7901	———	CAPSCREW, 5/16–18 UNC X 1 3/4, HX, GR 8, PLTD
39	1	3538	———	CAPSCREW, 5/16–18 UNC X 2 1/2, HX, GR 5, PLTD
40	2	2379	———	CAPSCREW, 3/8–16 UNC X 1–1/4, HX, GR 5, PLTD
41	4	1401	———	NUT, 1/4–20 UNC, METAL LOCK, HX, GR C, PLTD
42	9	1646	———	NUT, 5/16–18 UNC, NYL INS, HX, PLTD
43	2	1390	———	NUT, 3/8–18 UNC, NYL INS, GR5, HX, PLTD
44	8	1374	———	WASHER, 1/4, SAE, PLTD
45	18	1454	———	WASHER, 5/16, SAE, PLTD
46	6	1273	———	WASHER, 3/8, SAE, PLTD
47	2	1809	———	ELBOW, 45, 3/8T X 1/4 NPT–M, BR

TOLERANCES
Fraction X/X ±1/16
Decimal X.X ±0.1
Decimal X.XX ±0.06
Decimal X.XXX ±0.030
Angular X° ±1 DEG
Unless Specified

Rev	Date	By	Chk'd	Revision
A	8/16/06	JDW	GCW	ADDED 1809

Scale NTS
Date 7/19/06
Drawn by: JDW
Engineer: GCW

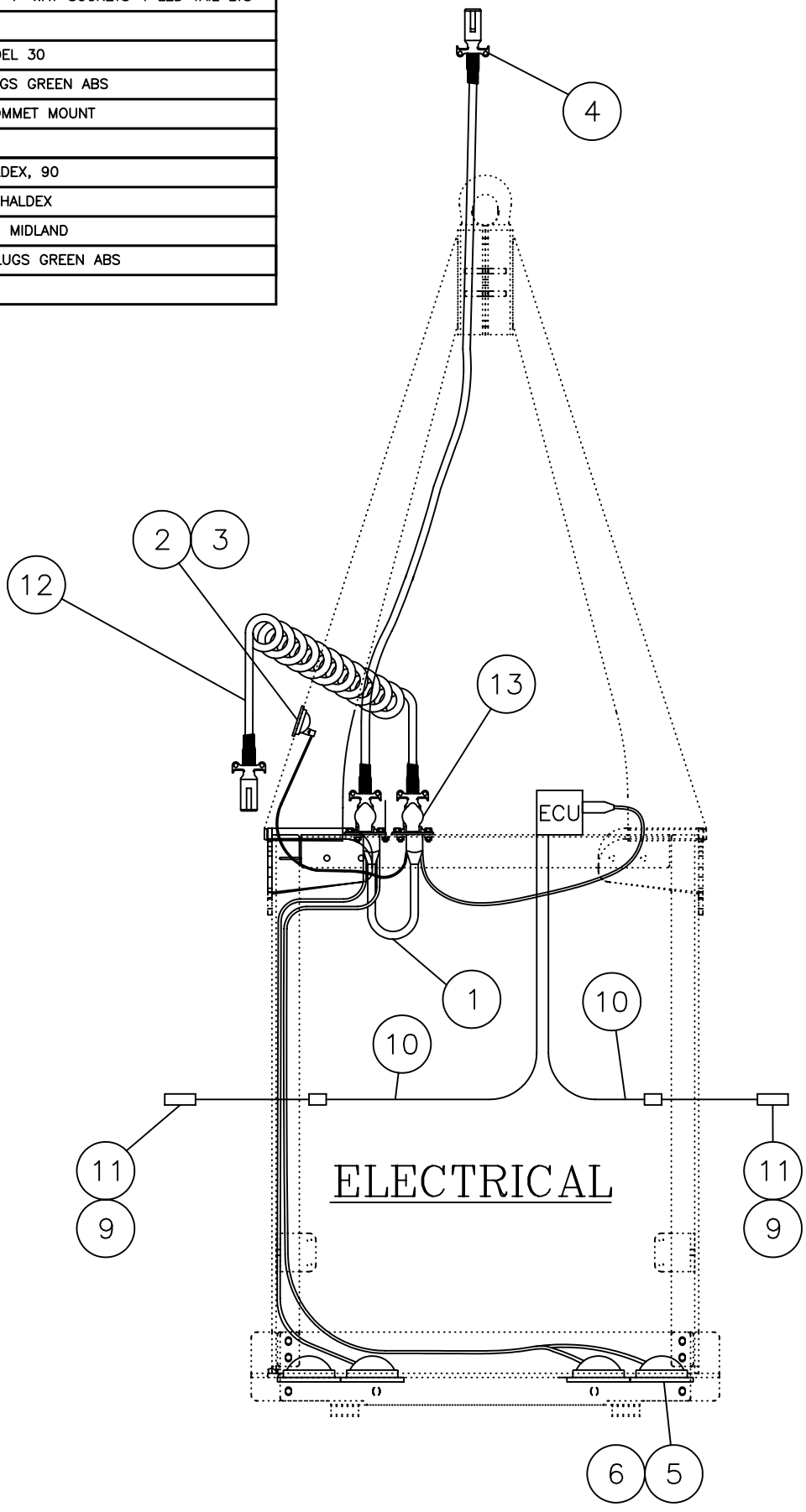
SILVER EAGLE MANUFACTURING CO., INC.
5825 NE SKYPORT WAY Portland, Oregon 97218

TITLE
AIR SYS ASSY HALDEX ABS ANTI BACK P/P VA

DRN:
SHEET 2 OF 2
Drawing # 17669
Rev. ø

MODEL VAST-20W PART NUMBER 17666

ELECTRICAL			
ITEM	QTY	PART No.	DESCRIPTION
1	1	14880	ELECTRICAL HARNESS, 2 FLANGED 7-WAY SOCKETS 4 LED TAIL LTS
2	1	9562	LENS, AMBER, TRUCKLITE, ABS
3	1	9563	GROMMET, LAMP, TRUCKLITE, MODEL 30
4	1	12746	CABLE 7-WAY STRAIGHT 9'W/PLUGS GREEN ABS
5	4	18097	LAMP, RED, LED, TRUCKLITE, GROMMET MOUNT
6	1	6266	GROMMET, LAMP, TRUCKLITE
9	2	17445	SENSOR ABS, 1.5 FT CABLE, HALDEX, 90
10	2	16470	CABLE, ABS SENSOR EXT, 6 FT, HALDEX
11	2	10317	CLIP ABS WHEEL SPEED SENSOR, MIDLAND
12	1	10327	CABLE, 7-WAY COILED, 12' W/PLUGS GREEN ABS
13	2	9415	PLUG, 7-WAY, STA-DRY SOCKET



WELDING

Welding & Hot-Dip Galvanizing

(503 281-0727 - 800) 547-6792
5825 NE Skyport Way - Portland, OR 97218
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WELDING

& HOT-DIP GALVANIZING

American Galvanizers Association
Protecting Steel for Generations

6881 South Holly Circle, Suite 108
Englewood, Colorado 80112
Hotline 800-468-7732
Fax 720-554-0909
www.galvanizeit.org
aga@galvanizeit.org

INTRODUCTION

As it becomes more common to specify hot-dip galvanizing (the metallurgical combination of zinc and steel) as the corrosion protection system for structural steel fabrications, it is essential to understand that considerations for the galvanizing of welded black steel or for welding on galvanized steel must be integrated into the overall structural fabrication design. Welding before and after galvanizing is common; the requirements are relatively simple for a designer to implement, resulting in superior corrosion protection.

HOT-DIP GALVANIZING FOR CORROSION PREVENTION

The galvanizing process has existed for more than 250 years and has been a mainstay of North American industry since the 1890s. Galvanizing is used throughout various markets to provide steel with unmatched protection from the ravages of corrosion. A wide range of steel products – from reinforcing steel to playground equipment to professional sports stadiums to the artistic expression of today's sculptors – benefit from galvanizing's superior corrosion prevention properties.

Galvanizing's primary component is zinc. This vital substance is silvery blue-gray in color and makes up an estimated 0.004% of the earth's crust, ranking 25th in order of abundance. It is essential for the growth and development of almost all life. Between 1.4 and 2.3 grams of zinc are found in the average adult, and the World Health Organization has recommended a daily intake of 15 milligrams. Numerous consumer products, including cold remedies, sunscreens, diaper creams, and nutritional supplements, contain beneficial amounts of zinc, primarily in the form of zinc oxide.

Even though galvanized steel is blue-gray, it also can be "green." The zinc and galvanizing industries work to promote sustainable development by enhancing zinc's contribution to society and ensuring that its production and use are in harmony with the natural environment and the needs of society, now and in the future.

Zinc, as it is used in galvanizing, is a healthy metal, completely recyclable. The energy used to smelt zinc is inversely related to the amount of zinc recycled. Galvanizing delivers incredible value in terms of protecting our infrastructure. Less steel is consumed and fewer raw materials are needed because galvanizing makes steel structures, bridges, roads, and buildings last longer. Over time, galvanizing helps maintain steel fabrications' structural integrity: galvanized structures are safer.

Additionally, because galvanized steel requires no maintenance for decades, its use in public construction is an efficient use of our taxes. Selecting galvanized steel for private projects makes a significant contribution to a company's profitability.

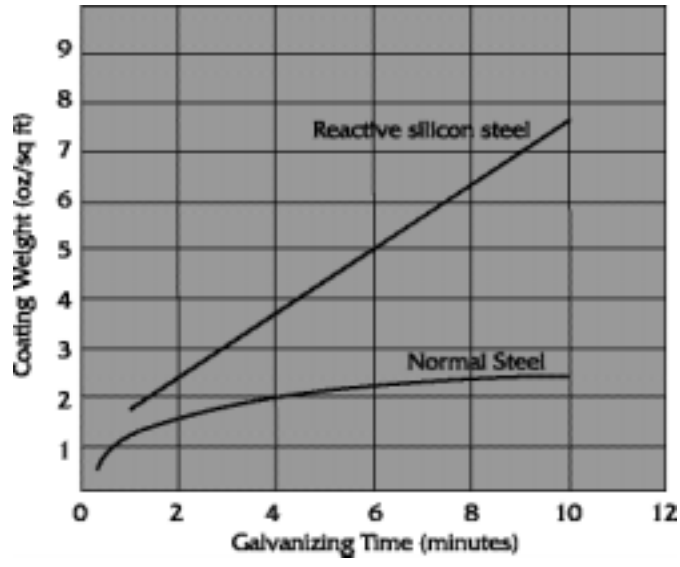
WELDING BEFORE HOT-DIP GALVANIZING

To achieve a high-quality hot-dip galvanized coating on welded areas of fabrications, two important issues must be considered before galvanizing: chemical makeup of the weld metal and cleanliness of the weld area.

Weld Metal Chemistry

When there is a difference between the structural steel's chemistry and the weld filler material's chemistry, the galvanized coating on the weld can be thicker than the coating on the structural piece. The major difference between the weld metal and the structural steel is the amount of silicon in the weld rod. Excessive silicon in the steel or weld filler material can accelerate the growth of the hot-dip galvanized coating. Because some weld electrode metal contains nearly 1% silicon, the difference between the coating thickness on the weld metal and structural steel can be significant. Excessive silicon in the weld material to be galvanized causes an accelerated formation of the iron and zinc inter-

Figure 1



metallic layers that make up the hot-dip galvanized coating, greatly increasing coating weight (see Figure 1). When the fabricated structure is immersed in the zinc bath long enough to achieve a coating that meets the minimum thickness of the galvanizing

standards (such as American Society of Testing and Materials [ASTM] A 123/A 123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products), the coating on the high-silicon weld metal can be two- to five-times the thickness of the surrounding coating. This thick coating on the weld detracts from the appearance of the fabricated structure and increases the possibility of the zinc coating's becoming damaged in the weld area.

For typical welding processes, such as shielded metal arc welding (SMAW), submerged arc welding (SAW) and flux-cored arc welding (FCAW), there are weld rod materials that will not cause excessively thick coatings. Figure 2 indicates the material and chemistry for several welding rods that yield good coating appearance and thickness.

Figure 2

Welding Process	Weld Rod Material	Silicon Content
SMAW	Jetweld 2 (E6027)	0.25%
	Fleetwood 35 LS (E6011)	0.10%
	Fleetwood 7 (E6012)	0.30%
SAW	L60-860 (F6A2-EL12)	0.22%
	L61-80 (F7A2-EM12K)	0.35%
FCAW	NR-203NiC+ (E71T8-K2)	0.04%
	NR-311 (E70T-7)	0.07%

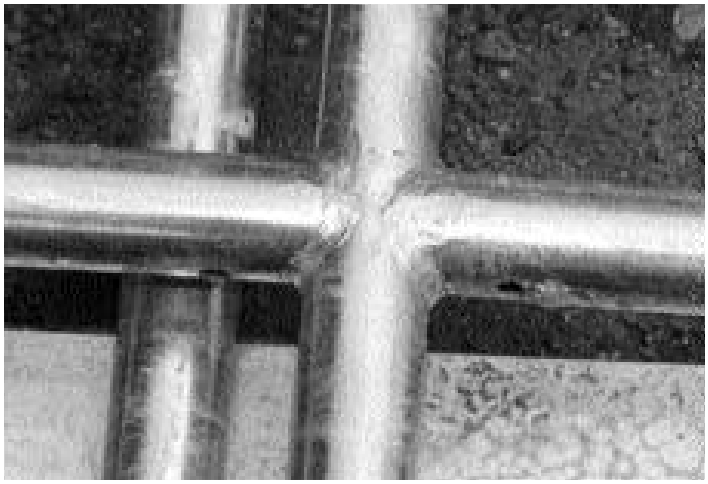
Weld Cleanliness

When welded structures are hot-dip galvanized, the weld area's cleanliness significantly affects the quality and appearance of the galvanized coating around the weld (see Figure 3). If a coated electrode is used during welding, all welding flux must be removed prior to galvanizing or the zinc coating will not adhere to the weld area (see Figure 4). Because weld flux and slag are insoluble in the chemical cleaning solutions used in the galvanizing process, they must be removed by other methods. Slag and flux must be removed by wire brush, flame-cleaning, chipping with a pick, grinding or abrasive blast-cleaning.

Design Considerations

On assemblies with contacting surfaces having a gap of less than 3/32" (2.5 mm), a full seal-weld must be used on all edges, depending on the size of the overlapped area. Zinc's viscosity prevents it from entering any space smaller than 3/32" (2.5 mm), resulting in ungalvanized surfaces (see Figure 5). Ungalvanized surfaces in tight spaces will corrode and bleed iron oxide onto the surrounding galvanized surfaces, making for an unsightly appearance.

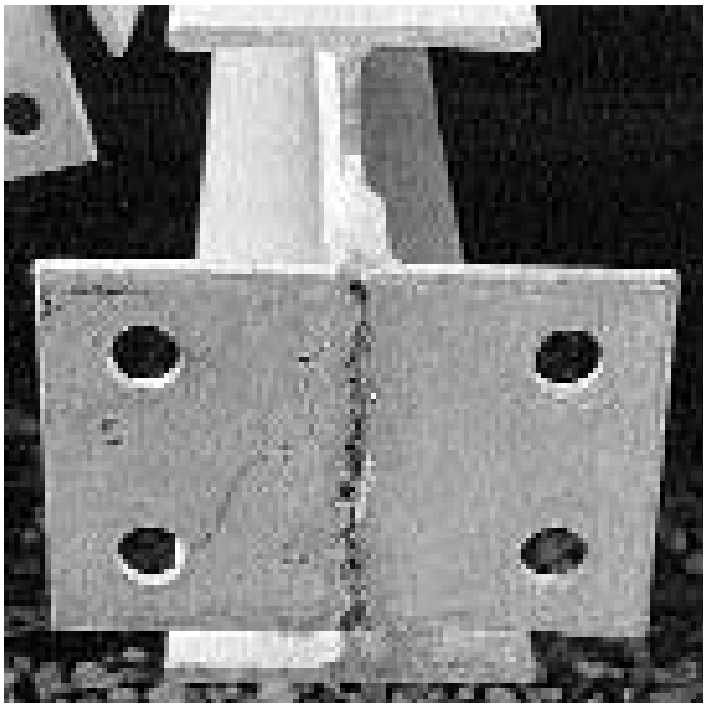
Figure 3



Cleaning solutions have lower viscosities, allowing them to enter these small gaps. Cleaning solution salts can be retained in these tight areas. Humidity encountered weeks or months later may wet these

Figure 4

Figure 5



salts and cause iron-oxide weeping. A second design consideration is to use equal or nearly equal thickness of assembly pieces, with symmetrical welds.

During galvanizing, the assembly is heated to the molten zinc bath temperature – more than 815 F (435 C) – and then cools to ambient temperature. When welded pieces of dissimilar thickness are galvanized, one of the pieces will often have a high stress induced in the fabrication process and/or by the galvanizing temperature changes. If the stress is high enough, distortion of the assembly or, in extreme cases, a fracture of the weld or of the stressed piece in the assembly can occur.Galvanizing welded fabrications is a common method of protecting a structure from corrosion. A high-quality hot-dip galvanized coating, even over welded areas, is achieved by properly selecting a weld metal, thoroughly cleaning the weld area, and using good design practices.

WELDING AFTER HOT-DIP GALVANIZING

All commonly practiced welding and cutting techniques can be used on galvanized steel (see American Welding Society's [AWS] specification D-19.0, *Welding Zinc Coated Steel*). Welding on galvanized steel is usually necessary if the final structure is too large to be dipped in a galvanizing bath or for structures that must be welded in the field.

Preparation of Weld Area

AWS D-19.0, *Welding Zinc Coated Steel*, calls for welds to be made on steel that is free of zinc in the area to be welded. Thus, for galvanized structural components of a fabrication, the zinc coating should be removed at least one to four inches (2.5-10 cm) from either side of the intended weld zone and on both sides of the workpiece. Grinding back the zinc coating is the preferred and most common method; burning the zinc away or pushing back the molten zinc from the weld area also are effective.

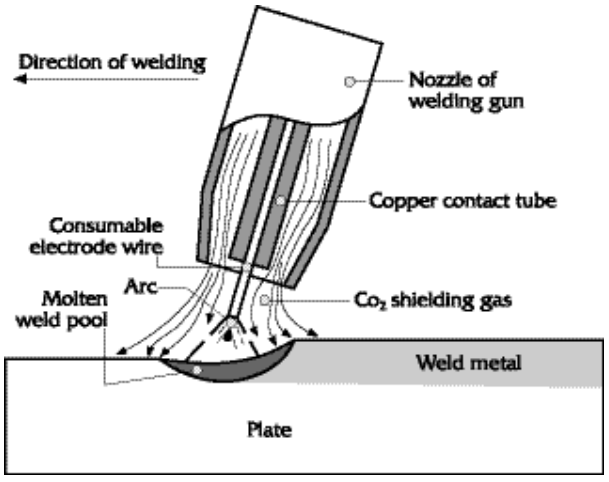
Weld Metal Chemistry

Because the galvanizing has already taken place, selection of weld material is less critical. Most of the materials used for touchup of the weld area will adhere and cover the weld and any damaged area around the weld (see "Touch-up of Weld Area").

Welding Methods

Four methods of manual/semi-automatic welding are detailed below. More flexible than resistance or laser welding, which usually are in-line processes on galvanized sheet, all four manual/semi-automatic methods benefit from the removal of zinc from the areas to be welded, but it is not an absolute requirement.

Figure 6 - Diagrammatic Illustration of CO_2 Welding



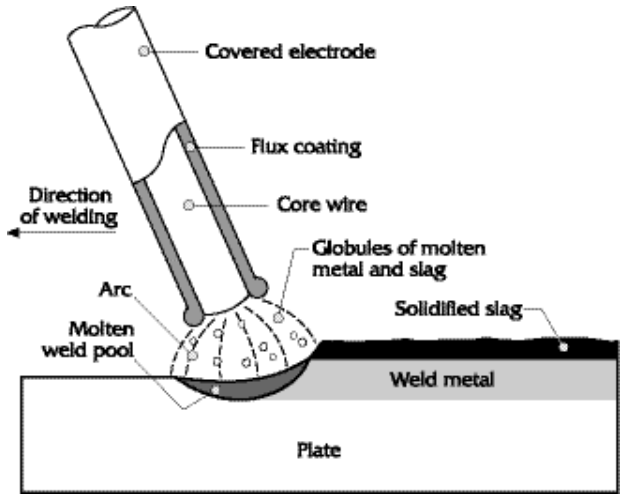
1. Gas Metal Arc – Particularly suited to welding of thinner materials, gas metal arc welding, (GMAW) also known as CO_2, is a convenient and versatile semi-automatic welding process (see Figure 6 on the previous page). The presence of the zinc coating has no effect on weld mechanical properties, although it may produce some appearance changes due to weld spatter. Arc stability is excellent and generally unaffected by the galvanized coating. There may be a reduction in welding speed because the galvanized coating must be burned off ahead of the weld. The use of a 100% CO_2 weld shield gas is acceptable for galvanized steel. There are no advantages to using more expensive shielding gas combinations. Penetration of the weld in zinc-coated steels is less than for uncoated steels. Therefore, slightly wider gaps must be provided for butt-welds.

The major difference between welding zinc-coated steel and welding uncoated steel using the GMAW process is the need for higher heat input to remove the zinc from the weld pool and lower welding speeds to burn off as much of the zinc coating at the weld area as possible.

Typical welding conditions for CO_2 welding of butt-joints on batch galvanized steel are available in AWS D19.0, Tables 5.5 through 5.12.

2. Shielded Metal Arc – This most common of the manual processes uses flux-covered electrodes. The conditions necessary for SMAW are similar to those used on uncoated steel. However, the speed of the welding may be slower because the angle of the electrode is reduced to about 30º and a whipping motion of the electrode back and forth is required to move the molten zinc pool away from the weld (see Figure 7).

Figure 7 - Diagrammatic Illustration of Shielded Metal-Arc Welding



The major difference between welding zinc-coated steel and welding uncoated steel using the SMAW process is that the root opening must be increased to give full weld penetration. The amount of spatter formed when SMAW is used is slightly higher than for welding on uncoated steel.

Typical SMAW conditions for the root pass in butt-welds on batch galvanized steel are available in AWS D19.0, Tables 6.2 through 6.5.

SMAW is recommended for galvanized steels of 1/2” (33 mm) thickness or greater galvanized steel pieces. In general, SMAW can use the same procedures for galvanized steel as for uncoated steel, although the following should be noted:

- The electrode should be applied slower than normal, with a whipping action that moves the electrode forward along the seam in the direction of the weld and then back into the molten zinc pool.
- Weaving and multiple weld beads should be avoided, as should excessive heat injection into the joint. Excess heat may damage the adjacent zinc coating.
- A short arc length is recommended for all positions to give better control of the weld pool and to prevent either intermittent excessive penetration or undercutting.

- Slightly wider gaps are required in butt-joints in order to have complete penetration.
- Grinding off edges prior to welding give the best quality weld joint. It also reduces fuming from the galvanized coating. Welding procedures will then be the same as for uncoated steel.

Electrodes similar to those used for arc welding uncoated steel may be used. The major difference when SMAW on galvanized steel compared to uncoated steel is the need for higher heat input to remove the zinc from the weld pool and lower welding speed to burn off as much of the zinc from the leading edge of the pool. This may result in greater fluidity of the slag and increased splatter.

3. Oxyacetylene – Preparation for oxyacetylene fusion welding is similar to that for welding uncoated steel. Because low travel speed is necessary to bring the joint edges to the fusion temperature, the extra heat causes the zinc coating to be affected over a much greater area than other welding processes. Best results are obtained when the filler rod is moved back and forth, producing a ripple weld.

4. Friction – Friction welding is generally used for making butt-welds in which one component of circular cross-section is rotated relative to and in contact with another component to produce heat at the interface. Once sufficient heat is generated, the relative rotation of the parts is stopped and pressure is increased to complete the weld. Friction welding is often used for attaching shear connectors to steel beams for the anchoring of concrete in concrete/steel structures. Flat-ended studs, whether uncoated or galvanized, cannot be welded to galvanized plate because the zinc coating's alloy layers appear to act as a low friction-bearing surface and insufficient heat is developed for welding. This may be circumvented by using pointed studs with a point having a 120º angle. Conditions for welding pointed studs are available in AWS D19.0.

TOUCH-UP OF WELD AREA

Any welding process on galvanized surfaces destroys the zinc coating on and around the weld area. Restoration of the area should be performed in accordance with ASTM A 780, *Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings*, which specifies the use of paints containing zinc dust, zinc-based solders or sprayed zinc. All touchup and repair methods are capable of building a protective layer to the thickness required by ASTM A 780.

The restored area of the zinc coating will have no affect on the overall lifetime of the part. Repair materials and their coating thickness have been chosen to give comparable lifetimes to the coating minimums required by ASTM A 123/A 123M, *Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*. There may be some visual differences between the original hot-dip galvanized coating and the restored area, but, over time, the natural weathering of the galvanized coating and the repair material yield a similar appearance.

QUALITY OF WELDED JOINTS

It is recommended in AWS D19.0 to remove all zinc from the weld area prior to welding because burning through the zinc slows the welding process, generates zinc fumes (see "Safety & Health," on the next page) and creates an unsightly burn area around the weld.

However, as studies performed by the International Lead Zinc Research Organization (ILZRO) have shown, the tensile, bend and impact properties of welds on galvanized steel are equivalent to the properties of welds on uncoated steel.

Fracture Toughness

Tests establish that the fracture toughness properties of welds are unaffected by the presence of galvanized coatings.

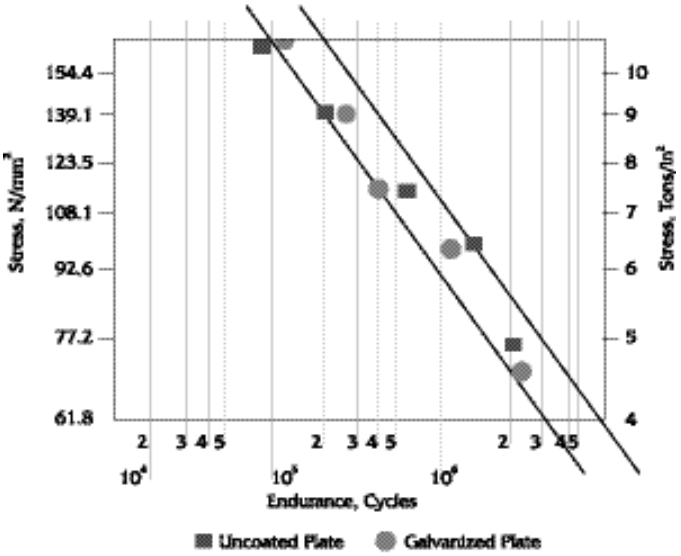
Fatigue Strength

The fatigue strength of arc welds on galvanized steel is equivalent to welds on uncoated steel made by CO2 welding as shown in Figure 8.

Porosity

The extent of weld porosity is a function of heat input and the solidification rate of the weld metal. Not always possible to eliminate, porosity affects the fatigue strength and cracking tendencies of welds.

Figure 8 - SN Curves Showing Fatigue Tests on Cruciform Joints



GMAW short-circuiting arc welds on uncoated and galvanized 1/2-inch Lloyds Grade A steel; AWS E60S-3 Filler wire.

When welds are subject to fatigue loading, welds on galvanized steel should be made oversized to reduce the influence of any weld metal porosity. When evaluating the effect of porosity on the fatigue strength of a fillet weld, it is necessary to consider both the function of the joint and the weld size. When a fillet weld on galvanized steel is large enough relative toplate thickness to fail by fatigue from the toe of the weld in the same manner as in uncoated steel, the presence of porosity in the weld does not reduce the fatigue strength of the joint. Where the dimensions of the weld are just large enough to cause fatigue failure from the toe in a sound weld, a weld containing porosity at the root may fail preferentially through the throat of the weld.

Intergranular cracking of fillet welds containing porosity, sometimes referred to as zinc penetrator cracking, does not significantly affect the strength of non-critical joints. For more critical stress applications, it is advisable to carry out procedural tests on materials and samples.

SAFETY & HEALTH

All welding processes produce fumes and gases to a greater or lesser extent. Manufacturers and welders must identify the hazards associated with welding coated and uncoated steel and workers must be trained to maintain work practices within Occupational Safety and Health Administration (OSHA) regulations. In general, welding on steel with the zinc coating ground back away from the weld area will produce lead and zinc oxide emissions below OSHA permissible exposure limits (PELs) for zinc and lead. When welding directly on galvanized steel is unavoidable, PELs may be exceeded and every precaution, including high-velocity circulating fans with filters, air respirators and fume-extraction systems suggested by AWS, should be employed.

Fumes from welding galvanized steel can contain zinc, iron and lead. Fume composition typically depends on the composition of materials used, as well as the heat applied by the particular welding process. In any event, good ventilation minimizes the amount of exposure to fumes. Prior to welding on any metal, consult ANSI/ASC Z-49.1, *Safety In Welding, Cutting and Allied Processes*, which contains information on the protection of personnel and the general area, ventilation and fire prevention.

SUMMARY

With proper preparation of the weld area, selection of a suitable welding material and process, and careful touch-up of the weld area, welding on galvanized steel provides an excellent product for use in myriad applications, from bridges, towers, and grating to handrail, trusses and guardrail.