



U.S. Department
Of Transportation
**Federal Highway
Administration**

400 Seventh St., S.W.
Washington, D.C. 20590

September 5, 1996

Refer to: HNG-14/SS-65

Philip C. Lewis, P.E.
Southwestern Pipe, Inc.
P.O. Box 2002
Houston, Texas 77252-2002

Dear Mr. Lewis:

This is in response to your letter of July 1 requesting the Federal Highway Administration's (FHWA) acceptance of your company's POZ-LOC Slip-base System. Accompanying your letter were copies of the June 1996 Texas Transportation Institute report titled the "National Cooperative Highway Research Program (NCHRP) Report 350 Testing of the Southwest Pipe Sign Support," a film of the crash testing, and installation instructions for the system. Your letter is a follow up to your original letter of October 12, 1995, which transmitted a report of full-scale automobile testing conducted on a prototype base by the Texas Transportation Institute (TTI) dated September 1995. Included with the earlier letter was a video of the tests and information from TTI regarding the acceptability of your slip-base system with other sizes of posts. Additional information on testing of a similar breakaway system was sent by Mr. Roger Bligh of TTI.

1. Introduction

Requirements for breakaway supports are those in the American Association of State Highway and Transportation Officials (AASHTO), Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. These specifications have been recognized by the FHWA. The testing was done in conformance with the guidelines in the NCHRP Report Number 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features.

2. Prototype Testing

The prototype used in the first series of tests was fabricated from ASTM A36 steel. It was similar to the triangular, three-bolt slip-base support tested by TTI for the State of Texas. The principal difference between the two designs is in the means of attaching the pipe support to the upper slip plate. In the Texas design a pipe support is welded to the slip plate. In your design the pipe passes through a stabilizing riser, which is integral with the upper slip plate, and a hole in the slip plate. The pipe is prevented from pulling

out of the slip plate by a split-ring collar that is clamped on the end of the pipe by tightening a bolt through the split in the collar. The collar fits into a recess in the slip plate and projects slightly into the space between the upper and lower slip plates. This projection keeps the facing surfaces of the slip plates apart, much as interface washers, which have been eliminated in your design, do in the Texas design. The two tests on the prototype that you sponsored, plus two additional tests conducted on the Texas design, are summarized in the table below. The cars used in all four test were 820kg.

Test Number	405481-1 (POZ-LOC)	405481-2 (POZ-LOC)	419714-3 (Texas)	419714-4 (Texas)
Sign Post Dimensions	NPS* 2 ½ “, Schedule 10 73 mm OD, 3.0 mm wall	NPS* 2 ½ “, Schedule 10 73 mm OD, 3.0 mm wall	NPS* 3“, Schedule 40 89 mm OD, 7.0 mm wall	NPS* 3“, Schedule 40 89 mm OD, 7.0 mm wall
Breakaway Device	POZ-LOC 3 bolt slip-base assembly**	POZ-LOC 3 bolt slip-base assembly**	Texas 3-bolt slip-base **	Texas 3-bolt slip- base **
Keeper Plate	30 gage (0.40 mm)	30 gage (0.40 mm)	30 gage (0.40 mm)	30 gage (0.40 mm)
Foundation	Concrete foundation *** in strong soil	Concrete foundation *** in strong soil	(Mounted to rigid test frame)	(Mounted to rigid test frame)
Impact Speed	35.43 km/h	103.24 km/h	34.8 km/h	103.0 km/h
Vehicle Delta V	0.80m/s	1.62 m/s	1.28 m/s	2.17 m/s
Occupant Impact	0.69 m/s	0.59 m/s	(no contact)	1.1 m/s
Stub Height	76 mm	76 mm	****	****

* Nominal Pipe Size.

** Three 15.9-mm x 63.5-mm long high strength bolts were tightened to a torque of 51.5 N.m.

*** The concrete foundations for the POZ-LOC tests were 305 mm in diameter and 1067 mm in depth.

**** The anchor plate was mounted less than 100 mm above the test frame.

The results of the POZ-LOC prototype tests met the change in velocity and stub height requirements adopted by the FHWA. However, we concluded that testing on the machined prototype was not representative of the production castings that you intend to market. We requested additional testing which was conducted by TTI.

3. Production Model Testing

Drawings of the production model POZ-LOC breakaway slip-base system are enclosed. The 820-kg auto tests on productions model slip-bases are summarized in the following table:

Test Number	405481-3	105481-4	405481-5
Sign Post Dimensions	73 mm OD, Schedule 10 3.0 mm wall	73 mm OD, Schedule 80 7.0 mm wall	73 mm OD, Schedule 80 7.0 mm wall
Number of Posts	One	Two	Two
Breakaway Device	POZ-LOC 3 bolt slip-base assembly**	POZ-LOC 3 bolt slip-base assembly**	POZ-LOC 3 bolt slip-base assembly**
Keeper Plate	30 gage (0.40 mm)	30 gage (0.40 mm)	30 gage (0.40 mm)
Foundation	Concrete foundation *** in strong soil	Concrete foundation *** in strong soil	Concrete foundation *** in strong soil
Impact Speed	34.8 km/h	34.3 km/h	102.3 km/h
Occupant Speed	0.4 m/s	0.83 m/s	1.93 m/s

Stub Height	75 mm	75 mm	75 mm
-------------	-------	-------	-------

** Three 15.9-mm x 63.5-mm long high strength bolts were tightened to a torque of 51.5 N-m.

***The concrete foundation for the POZ-LOC tests were 305-mm diameter, 1067-mm deep.

The test results of the production model slip-base meet the change in velocity and stub height requirements adopted by the FHWA. Therefore, your company's POZ-LOC slip-base breakaway system cast from ASTM A536 Grade65-45-12 ductile iron, using one or two 73-mm OD, steel pipe supports are acceptable for use on the national Highway System (NHS), when requested by a State.

4. Extrapolation of Results

You also requested acceptance of your breakaway slip-base using the same diameter posts with thicker walls. The tested schedule 10 pipe single support has the thinnest wall and is the one most likely to deform and cause the slip-base to seize. The tested schedule 80 pipe dual support has the thickest wall and was the most massive installation. Since the results of tests at both extremes met the breakaway criteria, we will consider schedule 10, 40, or 80 posts acceptable when used with the Poz-Loc slip-base.

5. Acceptance

The tested production model POZ-LOC three-bolt slip-base, installed in strong soil or in concrete, is acceptable for use on the NHS, when requested by a State, with one or two schedule 10, schedule 40 or schedule 80 NPS2 ½ inch (73-mm O.D.) steel pipes. Our acceptance is limited to the breakaway characteristics of the supports with your slip-base and does not cover their structural features. Presumably, you will supply potential users with sufficient information on structural design and installation requirements to ensure proper performance. We anticipate that the States will require certification from Southwestern Pipe that the hardware furnished will have essentially the same chemistry, mechanical properties and geometry as that used in the tests, and that it will meet the FHWA change in velocity requirements.

Sincerely yours,

Seppo I. Sillan, Acting Chief
Federal-Aid and Design Division

Enclosure

Geometric and Roadside Design Acceptance Letter SS-65

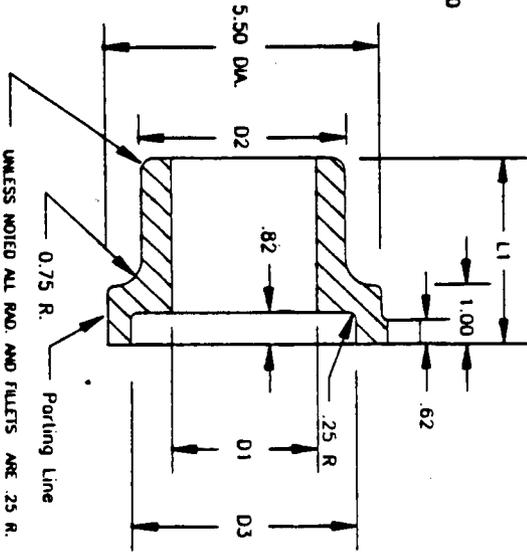
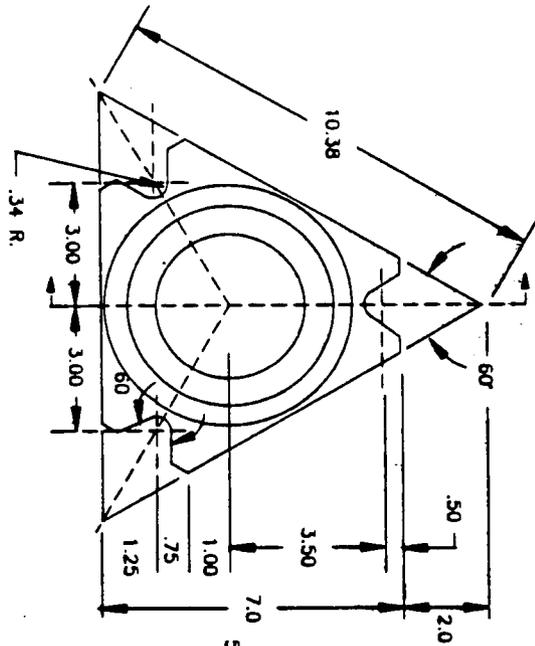
II. SLIP BASE DESIGN

The upper slip base assembly consists of an integral collar and triangular base plate that is cast from ASTM A536 Grade 65-45-12 ductile iron. The collar is formed by casting a 68.6-mm (2.7 in) hole through the part perpendicular to the base plate and then machining the hole to a final diameter of 74.4 mm (2.93 in). After machining, the base assembly is hot dip galvanized to ASTM A-153. Details of the upper slip base casting as supplies by the manufacturer are shown in figure 1. Machining and galvanizing details are shown in figure 2.

Erection of the slip base consists of slipping the upper slip base casting onto the end of a 73 mm (2.875 in) outside diameter (O.D.) steel pipe support. A 73-mm (2.875 in) zinc plated split ring shaft collar is tightened onto the end of the pipe support to keep the upper slip base unit from slipping off during an impact. The split shaft collar is recessed into a counterbore, which is cast into the bottom of the triangular plate. The counterbore is designed such that the split shaft collar extends approximately 1.4 mm (0.055 in) beyond the bottom of the upper base plate to provide separation between the slip plates. This separation, which is typically achieved through the use of an intermediate set of washers in more traditional slip base designs, reduces the contact area in the slip plane which helps minimize the frictional force that must be overcome to activate the base.

The upper slip base unit is bolted to the lower slip base unit using three 16 mm (0.625 in) diameter x 63.5 mm (2.5 in) long high strength bolts. High strength washers are used under both the head and nut of each bolt. The bolts are held in place by a keeper plate which is fabricated from 30 galvanized sheet steel. The lower slip base assembly consists of a 76 mm (3 in) diameter x 914 mm (36 in) long galvanized schedule 40 pipe stub welded to a 16-mm (0.62 in) thick steel triangular base plate having the same geometry as the upper plate. The pipe stub is embedded in a 305 mm (1 ft) diameter x 1067 mm (3 ft-6 in) deep concrete footing such that the top face of the lower triangular slip plate extends no more than 102 mm (4 in) above the ground. A schematic of the slip base assembly is shown in figure 3. Details of the shaft collar, keeper plate, and stub post, as supplied by the manufacturer are shown in figures 4 through 6, respectively. Installation instructions, as supplied by the manufacturer, are presented in Appendix A.

SIZE	PART NO. (LBS)	D1	D2	D3	L1
2"	SB-250-C (10.5)	2.70	4.00	4.75	3.75



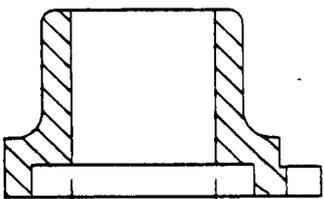
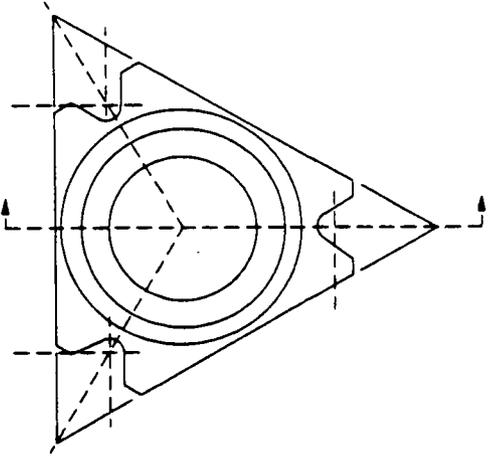
MATL: ASTM A-536 GRADE 65-45-12 DUCTILE IRON

Unless Noted: Tolerances per ASTM A-536		Southwestern Pipe, Inc. SLIPBASE CASTING	
P. Lewis 04/15/96	Dwg No. A	Part No. NTS	Date SKET

Figure 1. Upper slip base casting.

SIZE	PART NO. (LBS)	D1					
27"	SB-250-C (10.0)	2.93					

REVISIONS			
NO.	REV.	DESCRIPTION	APPROVED



D1 - BEFORE GALVANIZING
 BORE DIA PERPENDICULAR
 TO BASE PLANE

NOTE: AFTER MACHINING, HOT DIP GALVANIZE
 TO ASTM A-153 SPECIFICATION
 CLEAN ID BORE AND COUNTERBORE AFTER
 GALVANIZING TO REMOVE EXCESS ZINC

Unless Noted:
 Tolerances:
 XXX +/- 0.010

Southwestern Pipe, Inc.
 SLIPBASE MACHINING DETAIL

P. Lewis
 05/01/95

SIZE	FORM NO.	DRG NO.	REV
A			
SCALE	SHEET		
NIS			

Figure 2. Slip base machining detail.

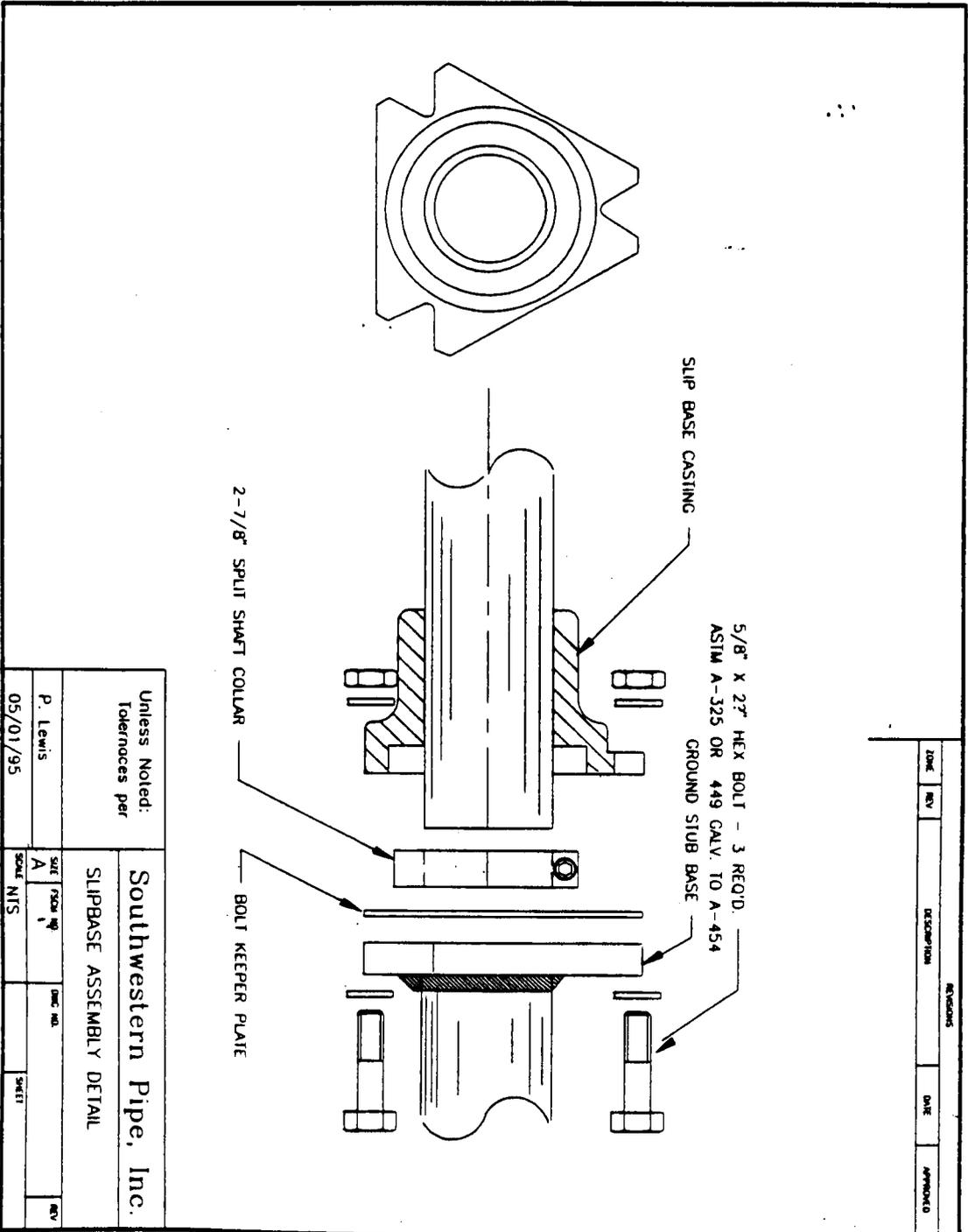


Figure 3. Slip base assembly detail.

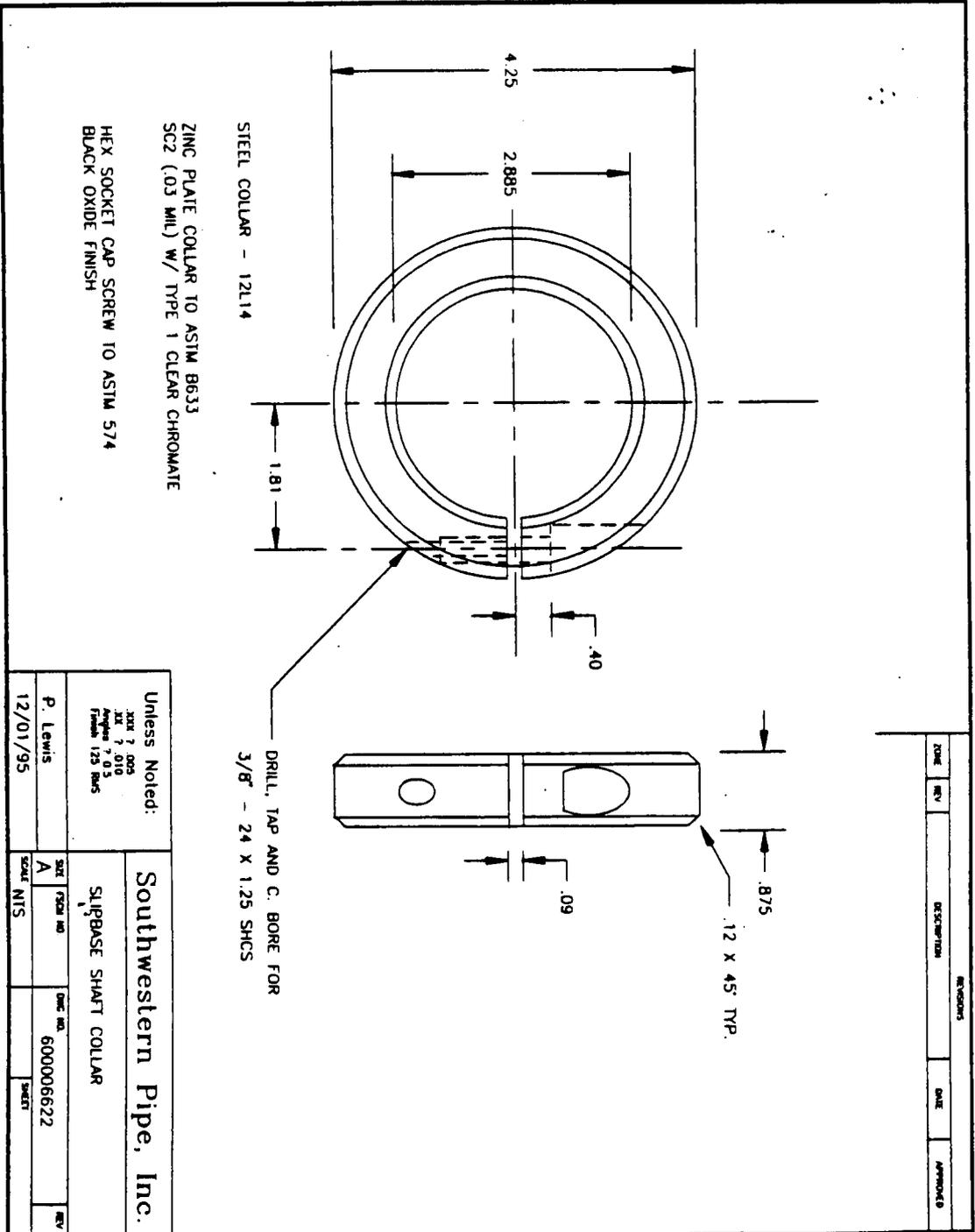
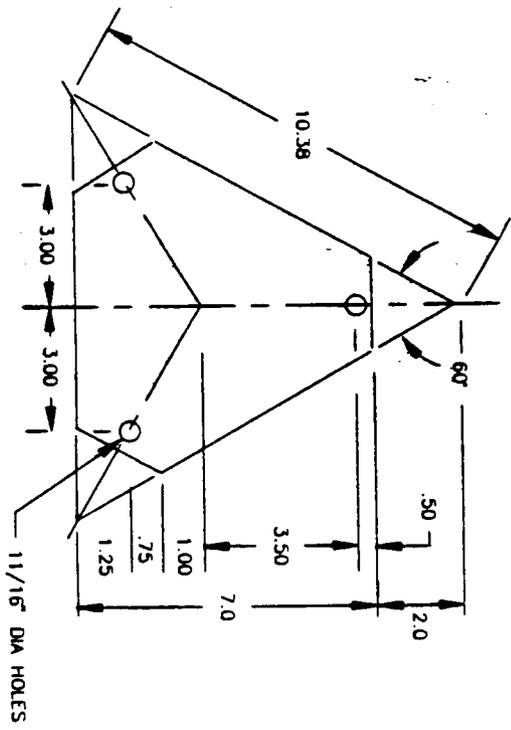


Figure 4. Slip base shaft collar.

STAMP BOLT KEEPER PLATE SPACER FROM GALVANIZED SHEET
 ASTM A-563 G-90 COATING

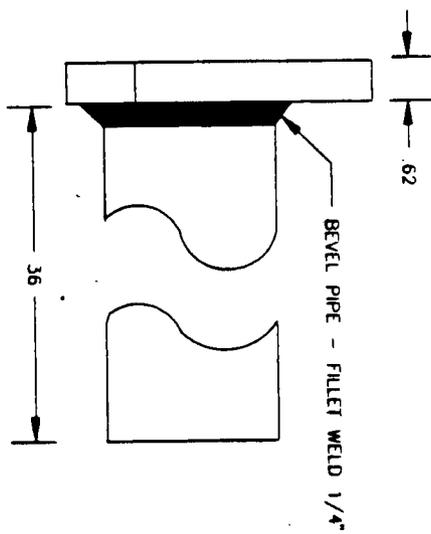
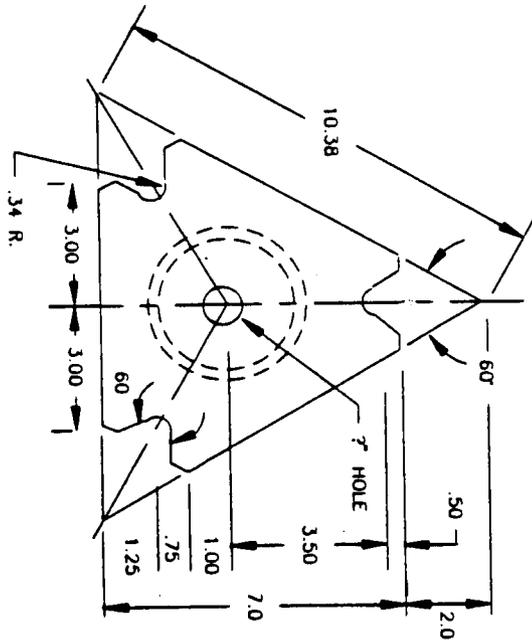


Unless Noted: Tolerances per ASTM A-536		Southwestern Pipe, Inc. SLIPBASE BOLT KEEPER PLATE	
P. Lewis 05/01/95	SIZE FROM INCH A	DWG. NO.	SCALE NTS

DATE	REV	DESCRIPTION	DATE	APPROVED

Figure 5. Bolt Keeper Plate.

BASE PLATE 5/8" ASTM A-36, 441 OR 572 STEEL PLATE
 PIPE STUB 3" NOMINAL SCHEDULE 40, ASTM A-53 GRB
 FABRICATE AND GALVANIZE TO ASTM A-153



REVISIONS			
ZONE	REV	DESCRIPTION	DATE

Unless Noted: Tolerances Per ASTM A-536		Southwestern Pipe, Inc. SLIPBASE STUB POST	
P. Lewis 05/01/95	SIZE A	FROM NO. 1	DATE 05/01/95
SCALE NTS		SHEET 1	REV

Figure 6. Slip base stub post.