



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

1200 New Jersey Ave., SE
Washington, D.C. 20590

September 9, 2011

In Reply Refer To:
HSST/LS-74

Mr. Joseph M. Bowman, P.E.
Director of research and Development
Hapco Aluminum Pole Products
26252 Hillman Highway
Abington, VA 24210

Dear Mr. Bowman:

This letter is in response to your requests for the Federal Highway Administration (FHWA) acceptance of specific Hapco roadside safety systems for use on the National Highway System (NHS).

Name of system:	Various breakaway bases and decorative covers for lighting and luminaire support posts as described below
Type of system:	Breakaway Hardware/Decorative Covers for Various Lighting Poles and Luminaire Supports
Test Level:	NCHRP Report 350 Test Level 3 (Pendulum Testing)
Testing conducted by:	Texas Transportation Institute for Hapco
Date of requests:	December 21 and 28, 2010
Request acknowledged:	December 22, 2010

You requested that we find five (5) breakaway post designs and three (3) decorative base covers used with previously-accepted breakaway post designs acceptable for use on the NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Requirements

Roadside safety devices should meet the guidelines contained in the National Cooperative Highway Research Program (NCHRP) Report 350 if tested prior to December 31, 2010, and the American Association of State Highway and Transportation Officials' (AASHTO) Manual for Assessing Safety Hardware (MASH) if tested after that date. Requirements for breakaway supports are contained in the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals.

Decision

The Hapco designs/configurations shown in the Test Summary below were tested by TTI and found acceptable as indicated. In four cases, design modifications were made to the hardware initially used in failed tests and the tests were repeated with successful results.

FHWA:HSSI:NArtimovichr:ms:x61331:8/22/11
File: s://directory folder/HSSI/Artimovich/LS74_HAPCO.dotx
cc: HSSI (NArtimovich)

Test Summary

Hapco TTI Breakaway Device Tests October – November 2010

Drawing	TTI Test	Test Date	Results	Device
B18836	P15	10/6/2010	Fail	67238A coupling
B18836	P16	10/6/2010	Pass	67238A coupling
B18859	P17	10/6/2010	Pass	67238A coupling
Sample-515	P18	10/7/2010	Fail	18357 casting assembly
Sample-513	P19	10/7/2010	Fail	17642 casting assembly
Sample-514	P20	10/7/2010	Pass	25089 (13172 casting with machined groove)
Sample-512	P21	10/7/2010	Pass	Hapco Energy Transfer Profile with 2-pc decorative cover at impact point w/nylon fasteners for use with previously accepted breakaway devices
Sample-511	P22	10/7/2010	Pass	Hapco 2-piece decorative cover below impact point w/nylon fasteners for use with previously accepted breakaway devices
Sample-510	P23	10/7/2010	Fail	Hapco 2-piece decorative cover below impact point w/nylon fasteners for use with previously accepted breakaway devices
Sample-515	P24	11/23/2010	Pass	25090 (18357 casting assembly modified with machined groove)
Sample-513	P25	11/23/2010	Pass	25088 (17642 casting assembly modified with machined groove)
Sample-510	P26	11/23/2010	Pass	Hapco 2-piece decorative cover below impact point w/nylon fasteners for use with previously accepted breakaway devices
19880	P27	11/23/2010	Pass	Hapco Modular t-base assemble using 15190 corner casting
19881	P28	11/23/2010	Pass	Hapco Modular t-base assemble using 15190 corner casting

Test Descriptions

TTI Tests P15, 16, and 17: These tests were run using HAPCO's modified breakaway coupling 67238A (Enclosure 1). Test P15 was not successful because the post did not breakaway and the occupant impact velocity was 10.5 m/s, well over the allowable maximum of 5 m/s. It was determined the failure was caused by improper installation. Specifically, there was no gap left between the breakaway couplings and the foundation/support base. This deficiency was corrected and drawings B18836 and B18859 (Enclosures 1A and 1B) were revised to show the required gap. Test P16, using a tapered aluminum pole with a 55-foot mounting height, resulted in an occupant impact velocity of 3.3 m/s. Test P17, using a tapered aluminum pole with a 50-foot mounting height, resulted in an occupant impact velocity of 3.2 m/s. The calculated high

speed changes in velocity were reported to be 3.6 m/s and 2.4 m/s for Tests P16 and P17, respectively.

TTI Tests P18 and 24: Test P18 was run using HAPCO's Decorative Pedestal (18357) to support its Sample-515 lighting pole. This test produced an occupant impact velocity of 5.4 m/s, slightly above the maximum value allowed. The Pedestal was modified by drilling two 6 millimeters (0.25-inch) holes 19 millimeters (0.75 inches) above the base and 146 millimeters (5.75 inches) apart. These holes were connected by a 3 millimeters (0.125 inch) slot to create a shear plan when the base is impacted by a vehicle. The modified design is designated as part 25090 and is shown as Enclosure 2. Test P24 was a test of the modified design with the tapered aluminum tube shown in Enclosure 2A. The low-speed occupant impact velocity was reported to be 3.6 m/s and the calculated high-speed OIV was reported to be 2.4 m/s.

TTI Tests P19 and 25: Test P19 was run using HAPCO's Decorative Pedestal (17642) to support its Sample-513 lighting pole. This test resulted in an unacceptable low-speed OIV of 5.9 m/s. The Pedestal was modified by drilling two 6 millimeters (0.25-inch) holes 22 millimeters (0.875 inches) above the base and 152 millimeters (6 inches) apart. These holes were connected by a 3 millimeters (0.125 inch) slot to create a shear plan when the base is impacted by a vehicle. The modified design is designated as part 25088 and is shown as Enclosure 3. Test P25 was a test of the modified design with the tapered aluminum tube shown in Enclosure 3A. The low-speed occupant impact velocity was reported to be 5.0 m/s and the calculated high-speed OIV was reported to be 2.6 m/s.

TTI Test P20: Test P20 was run on HAPCO's Sample-514 lighting pole supported by a Decorative Pedestal made from 356-T6 aluminum and modified from the previously-accepted part 13172 to add a machined groove. The modified design, part 25089, is shown as Enclosure 4 and the tested set-up is Enclosure 4A. Upon impact with the pendulum, the pole separated from the base. Although this separation is not desirable, the test video showed that the sheared pole continued to move away from the impact point and thus was not likely to impact the windshield of a vehicle in an actual crash. The reported OIV was 3.1 m/s and the calculated high-speed value was 3.1 m/s

TTI Test P21: This test was conducted to verify acceptable crash performance of a decorative base cover installed over a previously-accepted breakaway design. This cover is a two-piece cast aluminum design bolted together with 10-millimeters (0.375 inch) nylon hex screws and nuts to ensure separation of the two halves in a crash. The reported low-speed OIV was 2.9 m/s and the calculated high-speed value was 1.4 m/s. The tested set-up with pole Sample-512 is shown in Enclosure 5.

TTI Test P22: This test was also conducted to verify acceptable crash performance of a decorative base cover installed over a previously-accepted breakaway design. This cover is a two-piece cast aluminum design bolted together with 10-millimeters (0.375 inch) nylon hex screws and nuts to ensure separation of the two halves in a crash. The reported low-speed OIV was 3.3 m/s and the calculated high-speed value was 1.8 m/s. The tested set-up with pole Sample-511 is shown in Enclosure 6.

TTI Tests P23 and 26: Test P23 was conducted to verify acceptable crash performance of a decorative base cover installed over a previously-accepted breakaway design. This cover was also a two-piece aluminum design bolted together with 10-millimeters (0.375 inch) nylon hex screws and nuts to ensure separation of the two halves in a crash. The test failed with a reported low-speed OIV of 6.0 m/s. Post-impact analysis indicated that the previously-accepted breakaway base failed to yield as designed because of an oversized fillet weld. This error was corrected and the system was re-tested under test P26. In the second test, the reported low-speed OIV was 2.9 m/s and the calculated high-speed value was 1.7 m/s. The tested set-up with pole Sample-510 is shown in Enclosure 7. Note #3 was added to this drawing to address the aforementioned weld problem.

TTI Tests P27 and 28: Both of these tests used HAPCO's Modular T-base Assembly as shown in Enclosures 8 and 8A. Test P27 used a 55-foot luminaire mounting height as shown in Enclosure 8B and Test P28 shown in Enclosure 8C used a similar set-up, but with a 50-foot mounting height. For Test P27, the low-speed actual and high-speed calculated OIV values were 4.5 m/s and 4.4 m/s, respectively. For Test P28, these values were 4.8 m/s and 3.3 m/s, respectively. Although both test installations used a 14.5-inch bolt circle, you requested the Modular T-base be accepted for use with bolt circles from 10 inches to 17.5 inches. For a traditional cast aluminum transformer base, FHWA acceptance is limited to the largest diameter bolt circle that was actually tested. However, in your design, each "leg" of the breakaway structure functions independently of the remaining three. Therefore, a bolt "circle" ranging from 10 inches to 17.5 inches is acceptable.

Crash Testing

Pendulum testing was conducted on the test articles described above by the Texas Transportation Institute (TTI) at their outdoor pendulum testing facility. All tests were conducted according to NCHRP 350 test designation 3-60. The FHWA accepts pendulum tests as surrogates for this low-speed small car test. The FHWA also allows the results of the high speed tests to be estimated using data from the low-speed pendulum test in combination with an analytical extrapolation method described in the FHWA memorandum "Identifying Acceptable Highway Safety Features" dated on July 25, 1997.

Findings

For all eight test articles, the low speed test results and the high speed test extrapolation analysis resulted in change in velocity values less than the upper limit of 5.0 m/s.

It should be noted that the pole, luminaire arm, and clamshell base covers must meet the conditions and limitations of TRANSPO Industries breakaway couplings identified in FHWA acceptance letter LS-45B particularly the followings:

- All supports shall be mounted to a structural concrete foundation that will not move in the soil if the support is struck by a vehicle.
- Luminaire mounting height should not exceed 15.7 meters (55 feet).
- Mass of pole, mast arm, luminaire and other hardware above the couplings shall not exceed 454 kg (1000 lbs.).

Therefore, the systems described above and detailed in the enclosed drawings are acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency.

Please note the following standard provisions that apply to FHWA letters of acceptance:

- This acceptance is limited to the crashworthiness characteristics of the tested features and does not cover their structural features, such as resistance to wind loads.
- Any design or material changes that may adversely influence the crashworthiness of the Dent system will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number LS-74 and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- The Hapco products identified above are patented products and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

Michael S. Griffith
Office of Safety Technologies
Office of Safety

Enclosures



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of Transportation

**Federal Highway
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1200 New Jersey Ave., SE
Washington, D.C. 20590

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Findings

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It should be noted that the pole, luminaire arm, and clamshell base covers must meet the conditions and limitations of TRANSPO Industries breakaway couplings identified in FHWA acceptance letter LS-45B particularly the followings:

- All supports shall be mounted to a structural concrete foundation that will not move in the soil if the support is struck by a vehicle.
- Luminaire mounting height should not exceed 15.7 meters (55 feet).
- Mass of pole, mast arm, luminaire and other hardware above the couplings shall not exceed 454 kg (1000 lbs.).

Therefore, the systems described above and detailed in the enclosed drawings are acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency.

Please note the following standard provisions that apply to FHWA letters of acceptance:

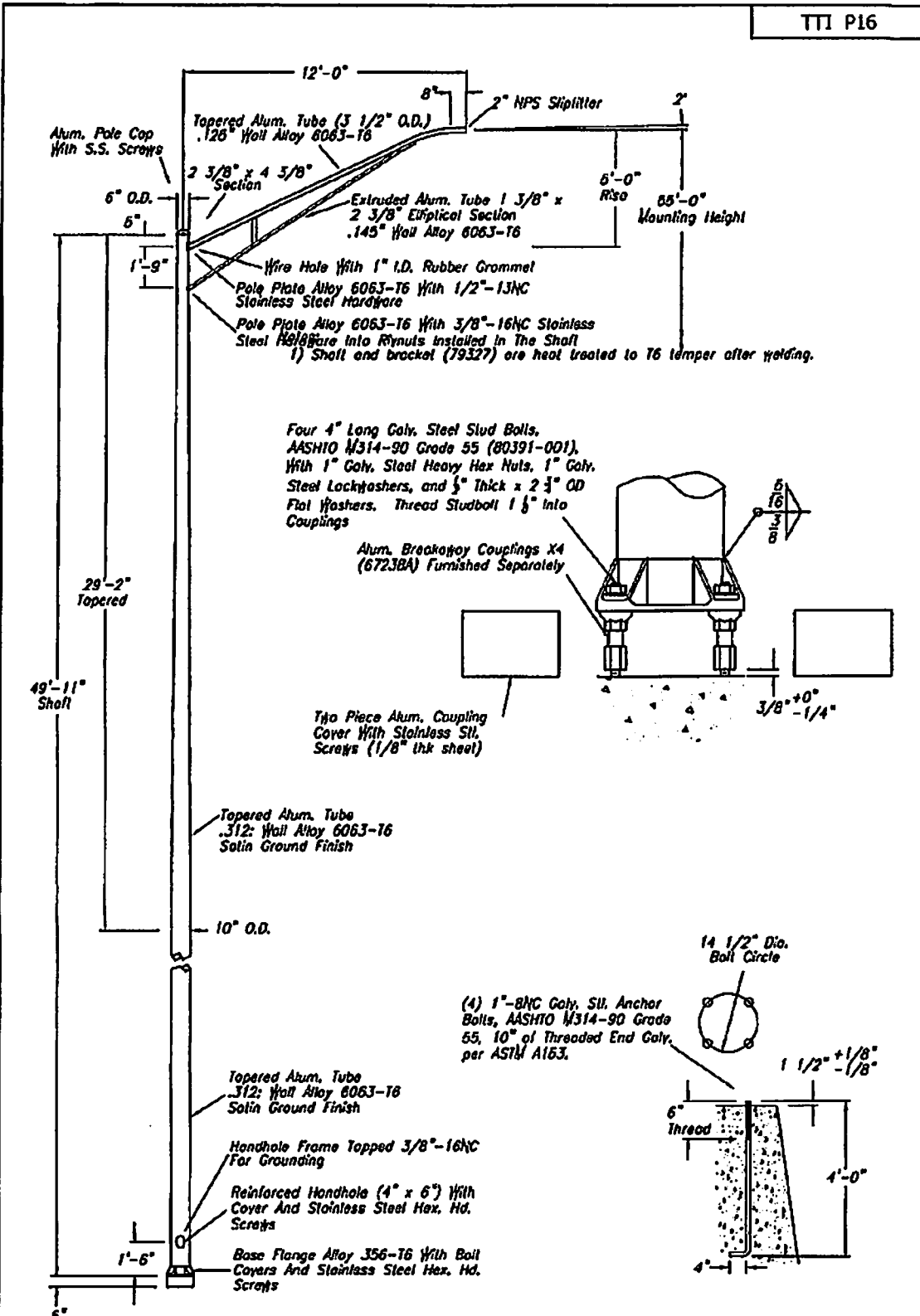
- This acceptance is limited to the crashworthiness characteristics of the tested features and does not cover their structural features, such as resistance to wind loads.
- Any design or material changes that may adversely influence the crashworthiness of the Dent system will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number LS-74 and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- The Hapco products identified above are patented products and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,



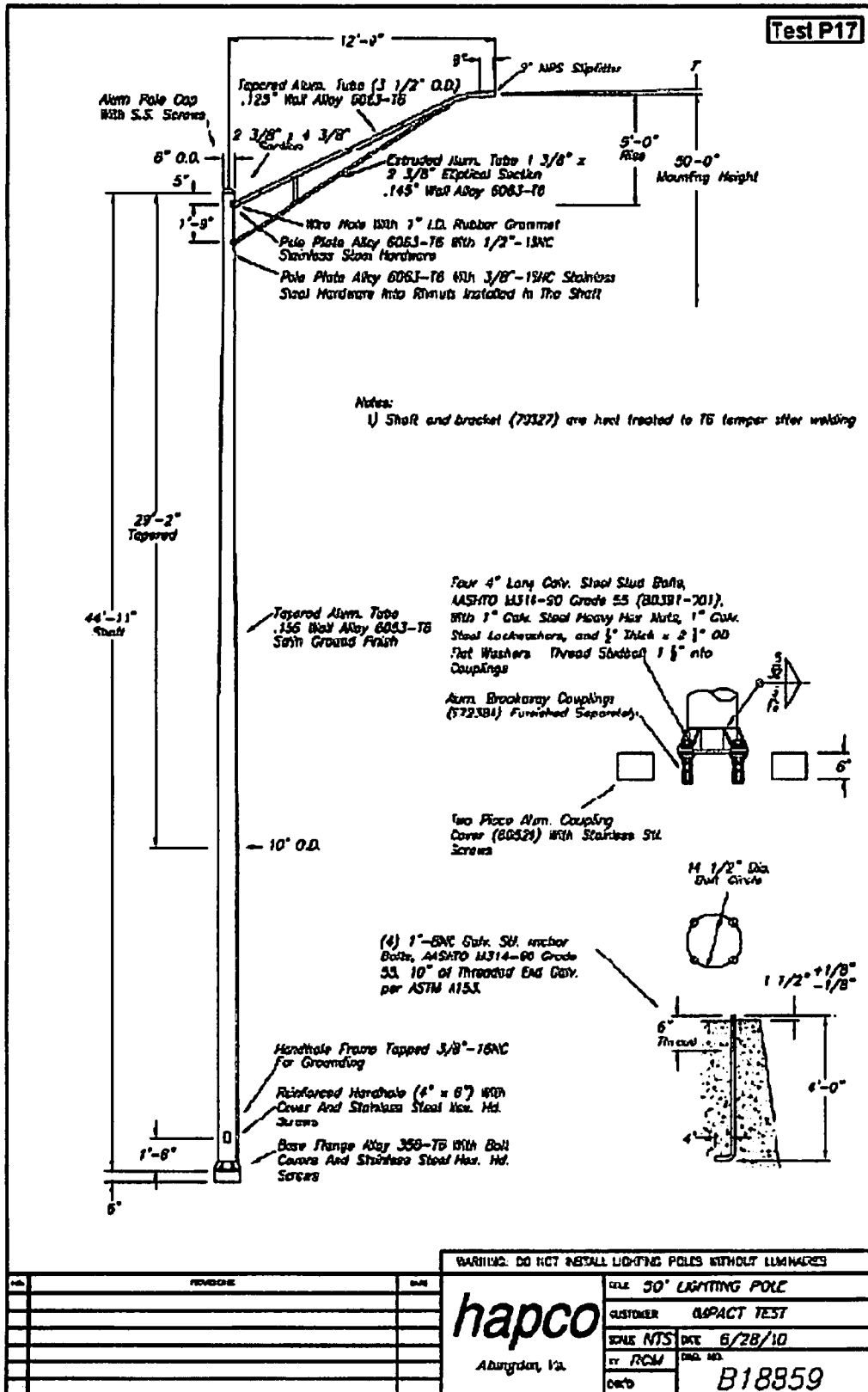
Michael S. Griffith
Office of Safety Technologies
Office of Safety

Enclosures

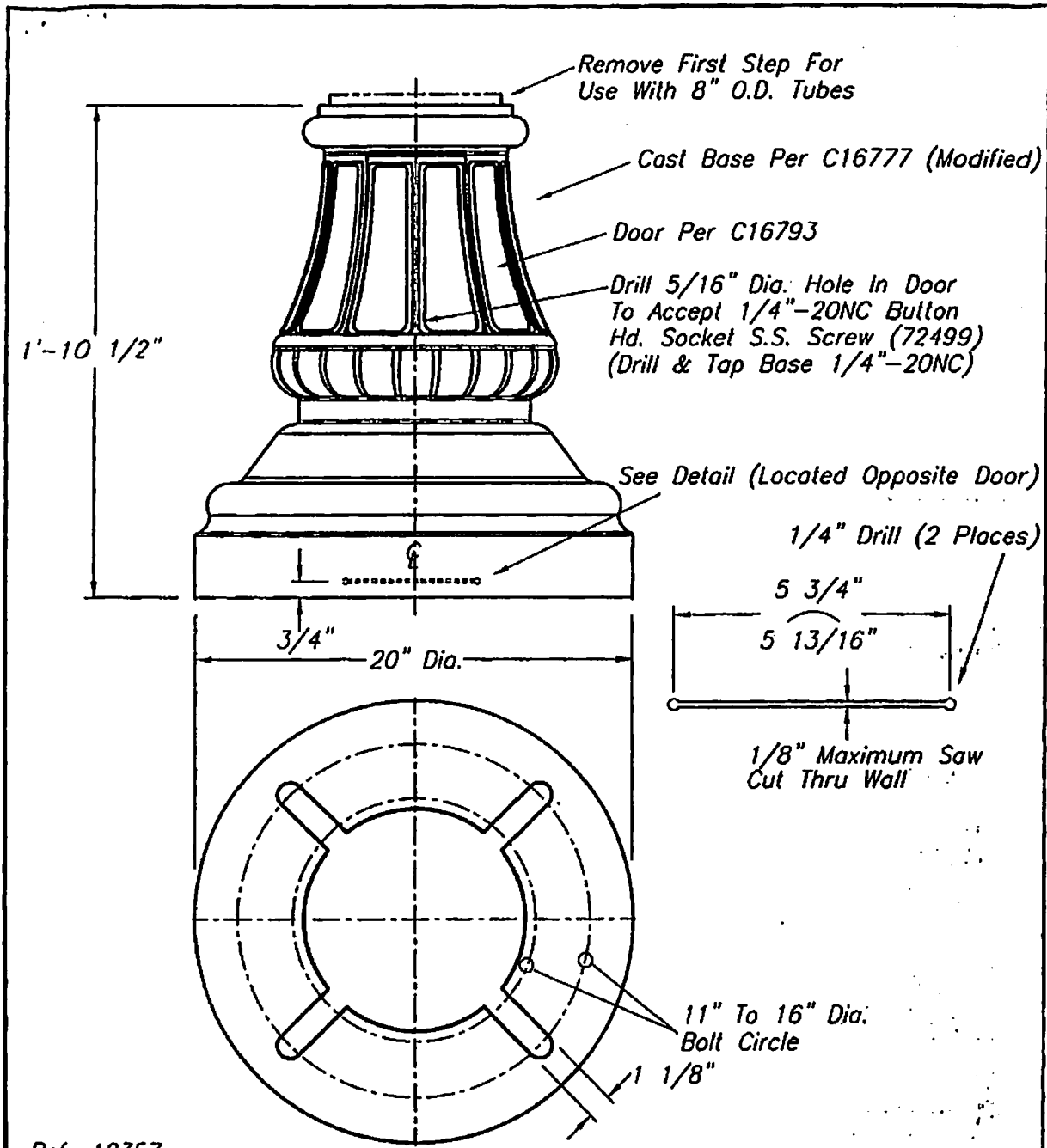


B18836

WARNING: DO NOT INSTALL LIGHTING POLES WITHOUT LUMINAIRES	
REVISED	DATE
1 Added foundation gap to coupling-anchorage bolt placement	11/10
TITLE 55' LIGHTING POLE	
CUSTOMER IMPACT TEST	
SCALE NTS	DATE 6/25/10
BY RCM	DRG. NO.
CHKD	B18836



Enclosure 1B



Ref. 18357

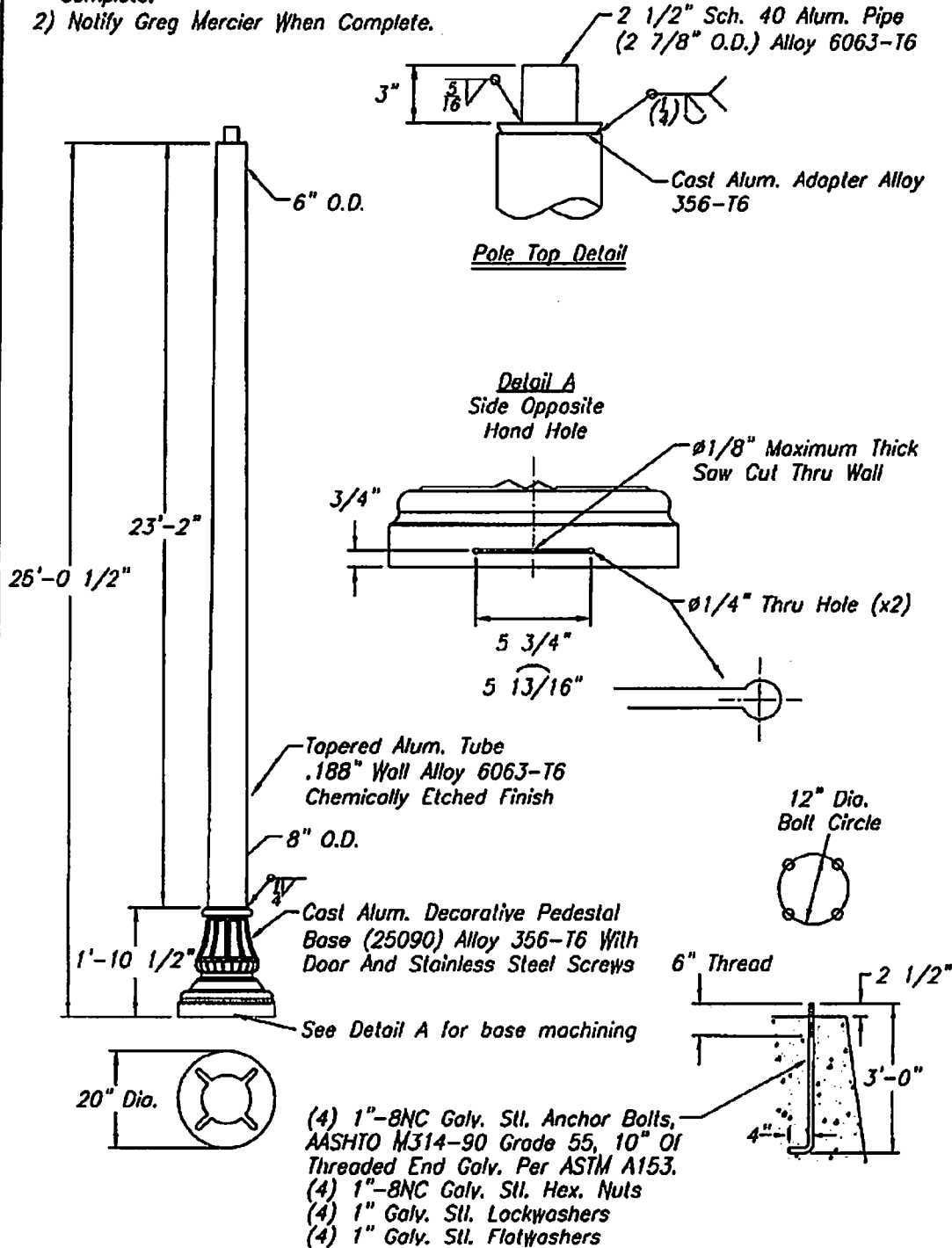
NO.	REVISIONS	DATE	TITLE
			BASE ASSEMBLY FOR 8"OD
			CUSTOMER
			SCALE 6 DATE 12/28/2010
			BY LW DWG. NO.
			CHK'D A25090

hapco
Abingdon, Va.

TTI P24

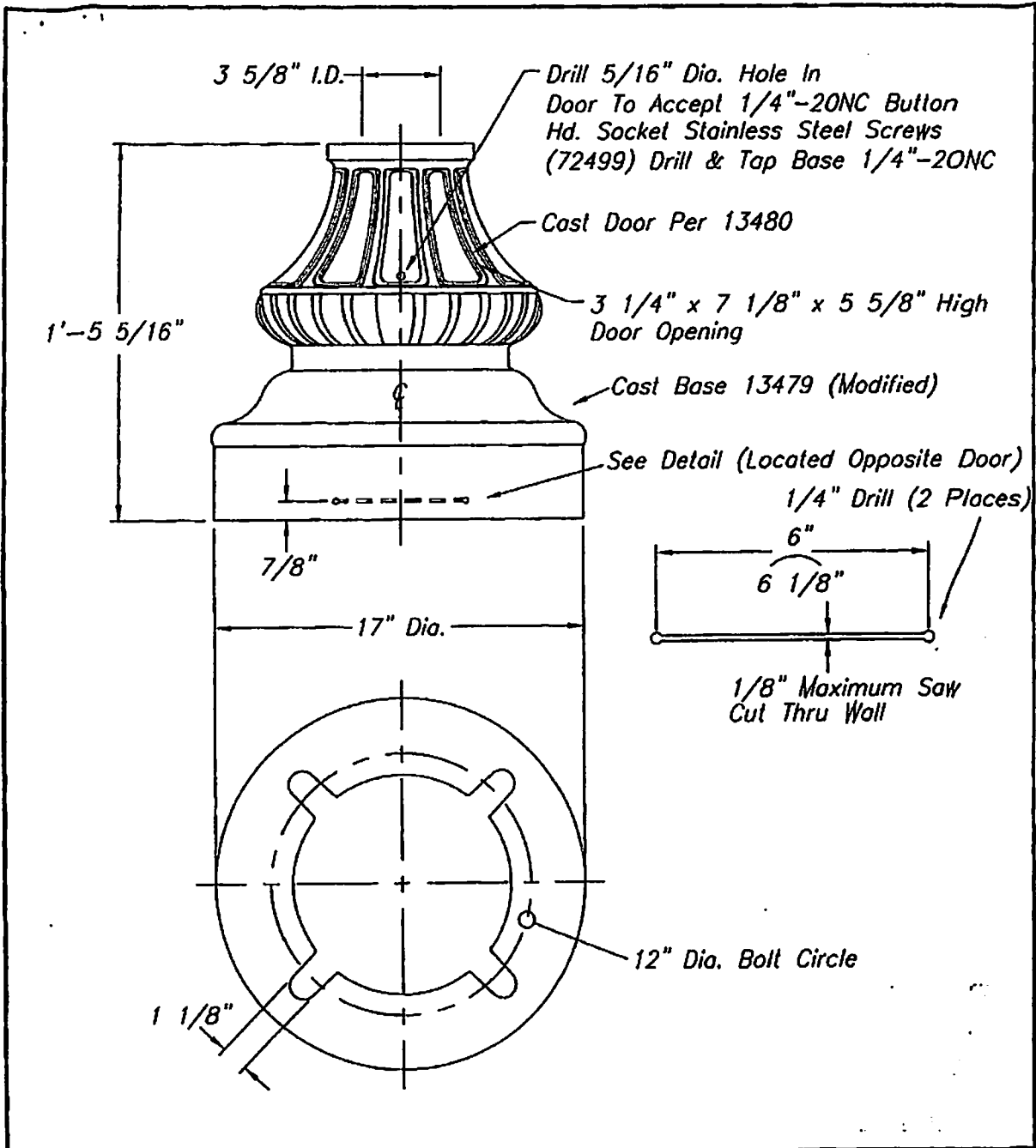
NOTES:

- 1) Please Move Sample To Test Lab When Complete.
- 2) Notify Greg Mercier When Complete.



SAMPLE-515

<p>WARNING: DO NOT INSTALL LIGHTING POLES WITHOUT LUMNAIRES</p>		
<p>REVISED</p>		<p>DATE</p>
1	added saw cut detail to assist breakaway	1/10
2	Base Was 18357 (LW)	12/10
<p>hapco Abingdon, Va.</p>		
<p>TITLE BREAKAWAY TEST POLE</p>		
<p>CUSTOMER</p>		
SCALE 24	DATE 03/30/2010	
BY TMB	DRG. NO.	
CHG	SAMPLE-515	



No.	REVISIONS	DATE	TITLE	
			BASE ASSEMBLY	
			CUSTOMER	
			SCALE 6	DATE 12/28/2010
			BY LW	DRG. NO.
			CHK'D	A25088

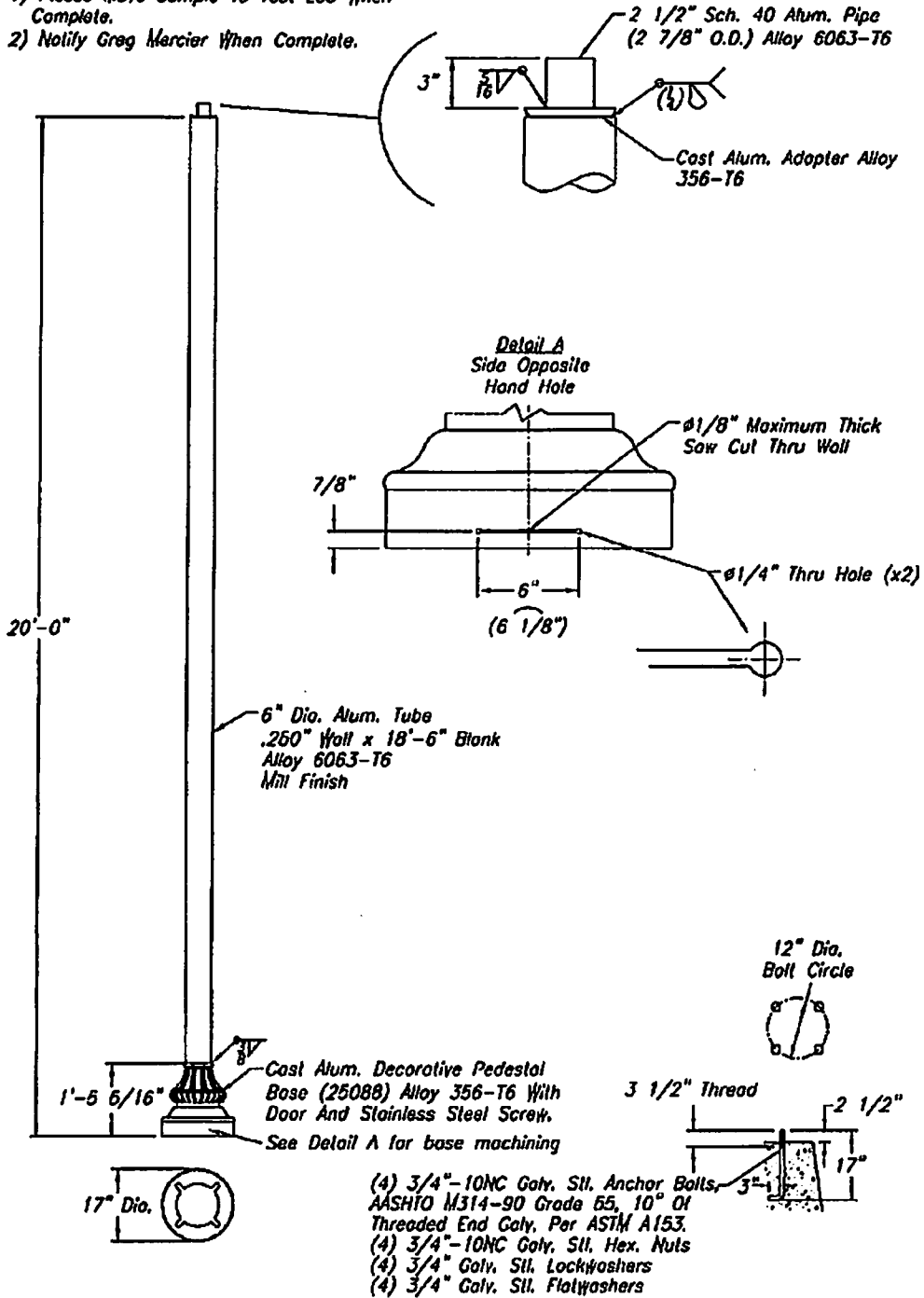
hapco
Abingdon, Va.

Enclosure 3

TTI P25

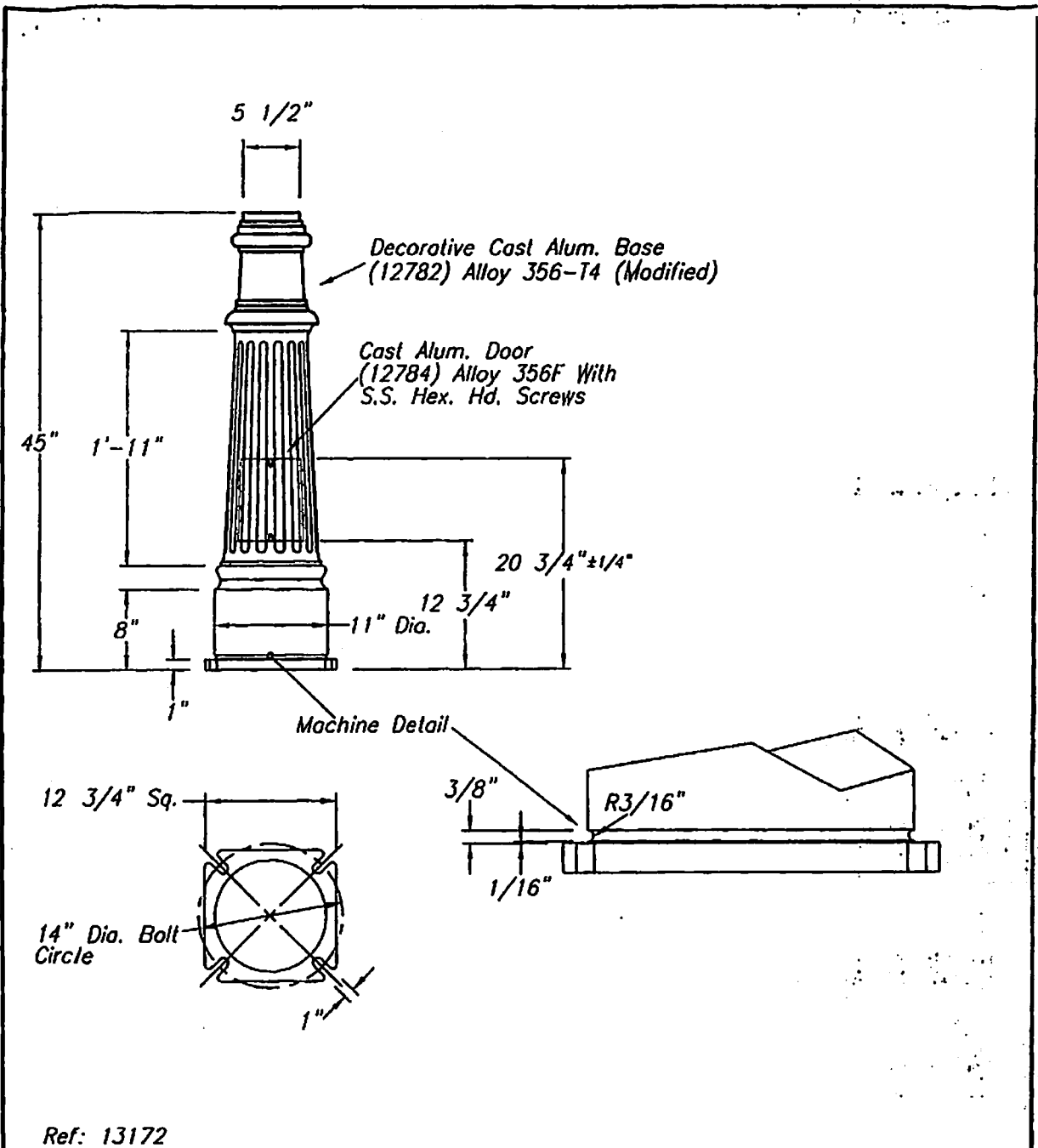
NOTES:

- 1) Please Move Sample To Test Lab When Complete.
- 2) Notify Greg Marcier When Complete.



SAMPLE-513

WARNING: DO NOT INSTALL LIGHTING POLES WITHOUT LUMINAIRES		
REVISES		DATE
1	added saw cut detail to assist breakaway	11/10
2	Base Was 17642 (LW)	02/10
hapco		
Abingdon, Va.		
TYPE BREAKAWAY TEST POLE		
CUSTOMER		
SCALE 24	DATE 03/29/2010	
BY TND	DRG. NO.	
CHKD	SAMPLE-513	

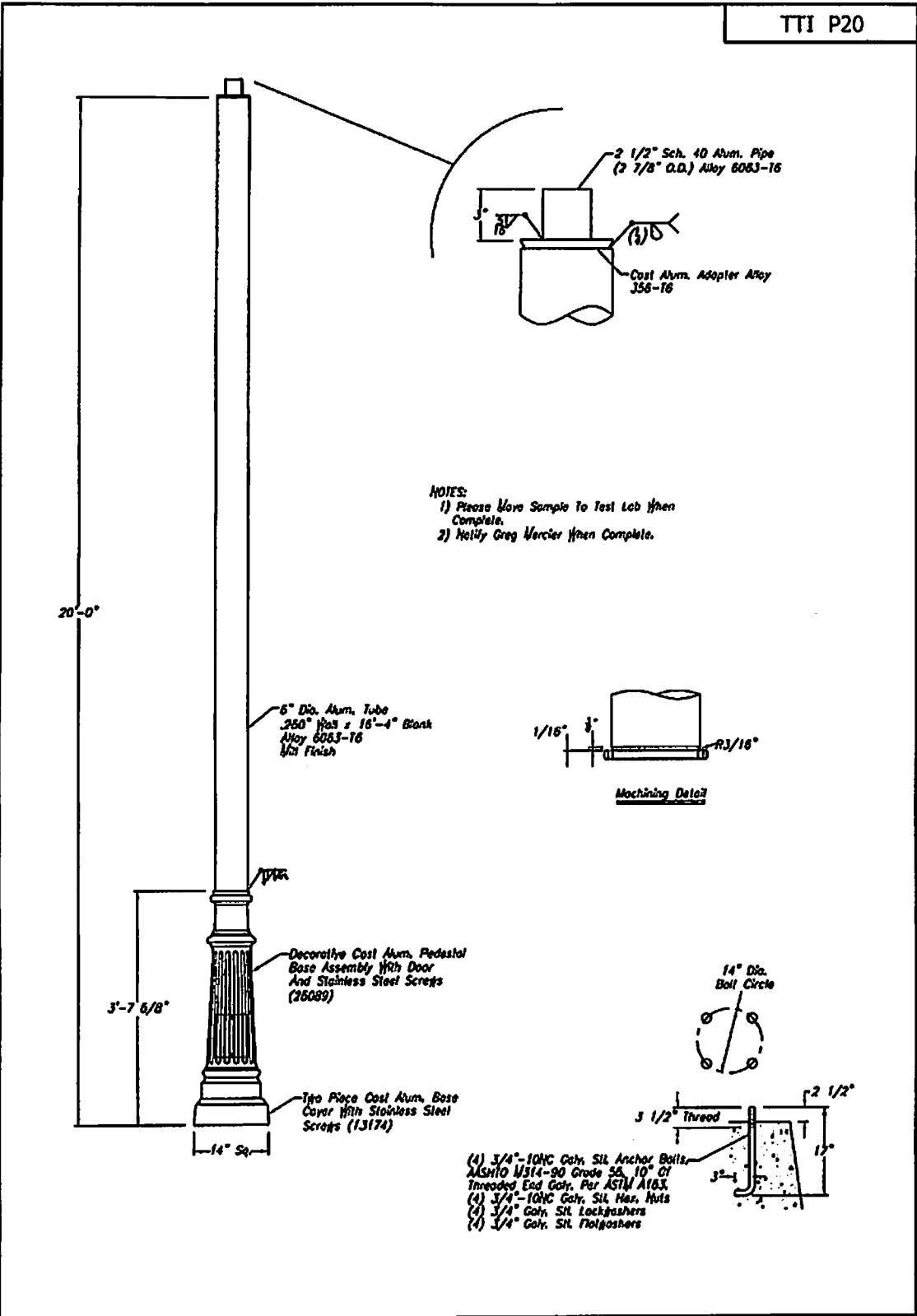


NO.	REVISIONS	DATE

hapco
Abingdon, Va.

TITLE HOMWOOD BASE ASSEMBLY	
CUSTOMER	
SCALE 12	DATE 12/28/2010
BY LW	DWG. NO.
CHK'D	A25089

Enclosure 4



NOTES:
 1) Please Move Sample To Test Lab When Complete.
 2) Notify Greg Mercier When Complete.

SAMPLE-514

WARNING: DO NOT INSTALL LIGHTING POLES WITHOUT LUMINAIRES

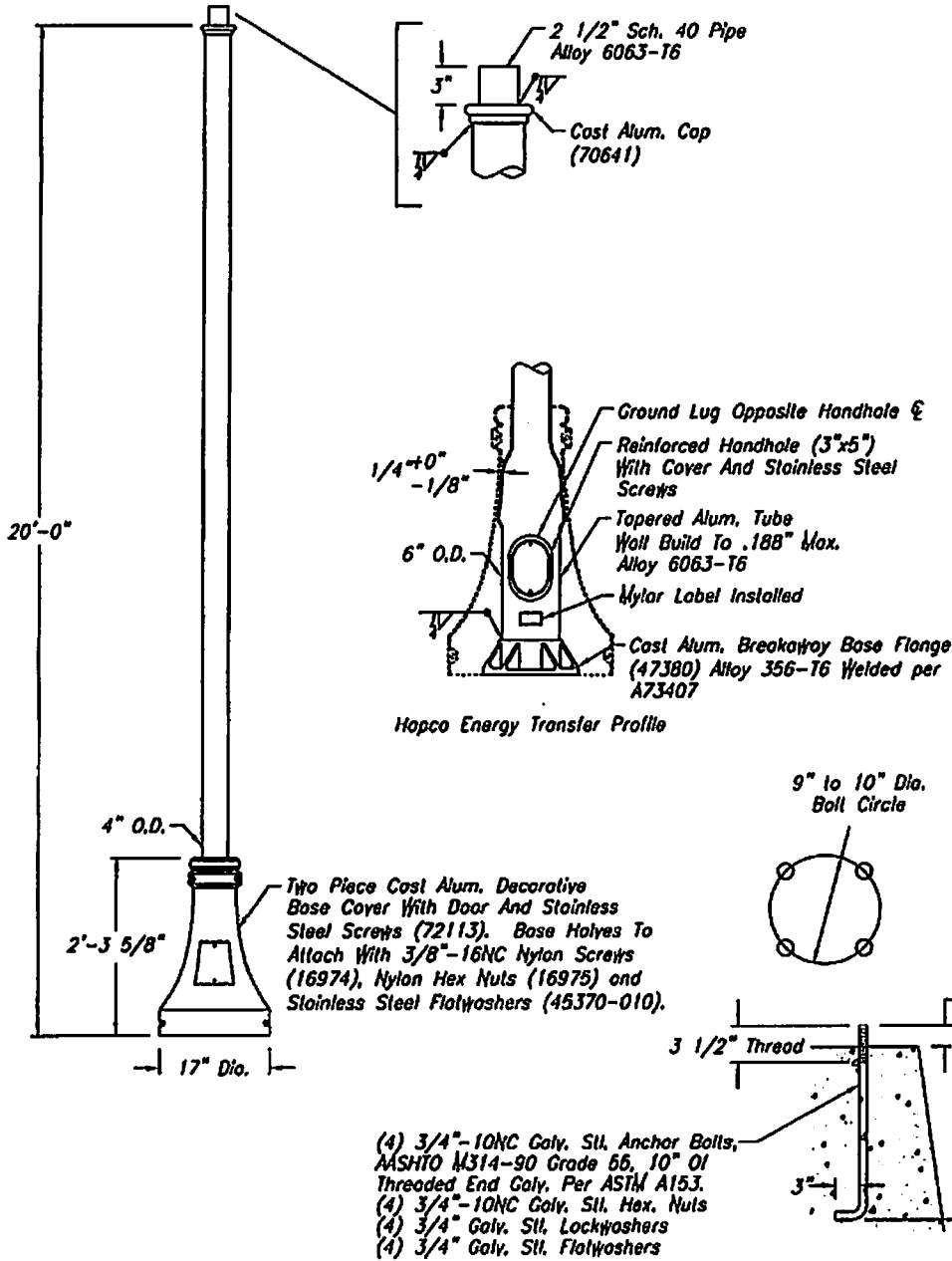
No.	REVISIONS	DATE
1	Breakaway Groove detail added for clarity. GM	12/10
2	Was 13172 Base (1W)	12/10

hapco
 Abingdon, Va.

TITLE BREAKAWAY TEST POLE	
CUSTOMER	
SCALE 16	DATE 03/29/2010
BY TNB	CHKD
SAMPLE-514	

TTI P21

Note:
Dimensional Location Of Spun Section
Of Shaft Is Critical In Order For Pole
To Meet Breakaway Requirement.



SAMPLE-512

Ref: Sample-505

WARNING: DO NOT INSTALL LIGHTING POLES WITHOUT LUMINAIRES

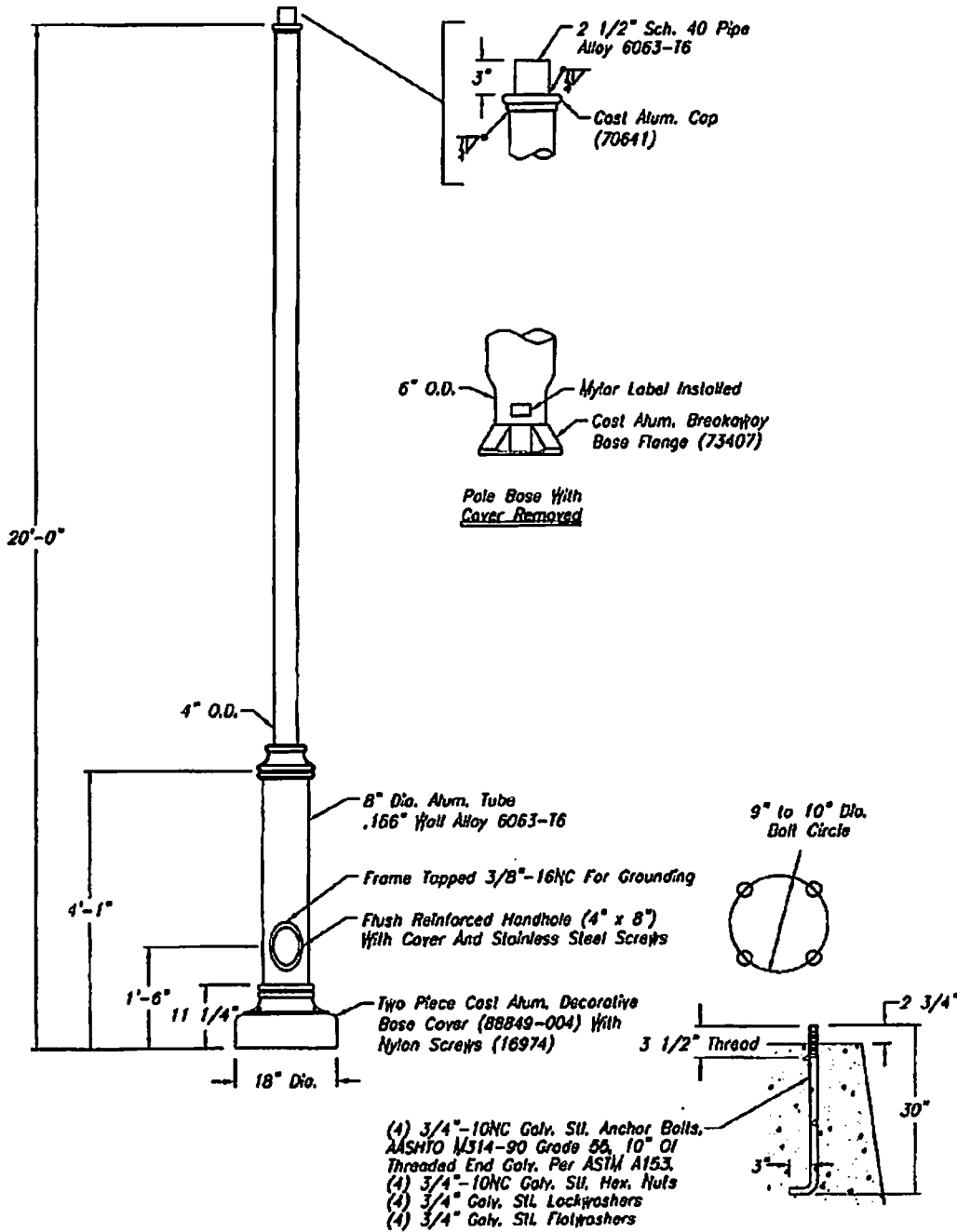
NO.	REVISIONS	DATE
1	Profile Detail now includes clearance tolerances	12/10

hapco
Abingdon, Va.

TITLE BREAKAWAY TEST POLE	
CUSTOMER	
SCALE 16	DATE 03/29/2010
BY TNB	DRG. NO.
CHKD	SAMPLE-512

NOTES: IMPORTANT

- 1) Spin Tube To Minimize Thinning Of The Wall Over The Bottom 7" Of The Tube.
- 2) Do Not Sand Bottom 7" of shaft.
- 3) Please Move Sample To Test Lab When Complete.
- 4) Base Weld to be Inspected by Q.C. 1st and 5th piece
- 5) On Breakaway Weld Procedure Do Not Exceed 1/4" Fluct Weld.



SAMPLE-511

Ref: Sample-482

WARNING: DO NOT INSTALL LIGHTING POLES WITHOUT LUMINAIRES

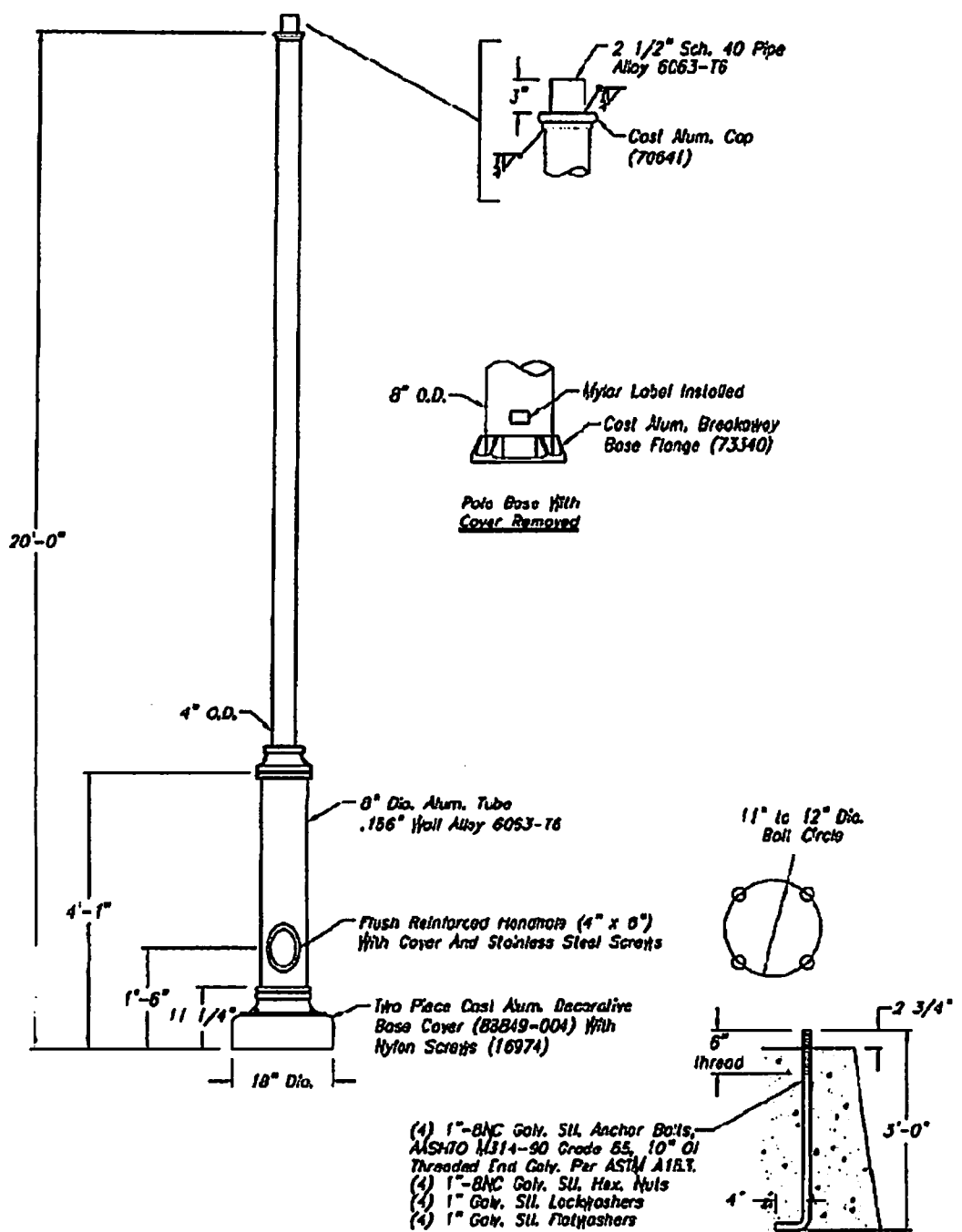
NO.	REVISIONS	DATE
1	Revised wall thick, and base screws	GM 4/10

 Abingdon, Va.	TITLE BREAKAWAY TEST POLE	
	CUSTOMER	
	SCALE 16	DATE 03/29/2010
	BY TNB	DWG. NO. SAMPLE-511

TTI P26

NOTES: IMPORTANT

- 1) Please Make Sample To Test Lab When Complete.
- 2) Base Weld to be inspected by Q.C. 1st place
- 3) ON BREAKAWAY WELD PROCEDURE DO NOT EXCEED 1/4" FILLET WELD.



SAMPLE-510

WARNING: DO NOT INSTALL LIGHTING POLES WITHOUT LUMINAIRES

NO.	REVISIONS	DATE
1	Rounded wall thick. and base screws	GM 4/10
2	Added 89122 Part NOT in BOM	GM 8/10
3	Emphasised Note #3 and updated routing	GM 11/10

hapco
Abingdon, Va.

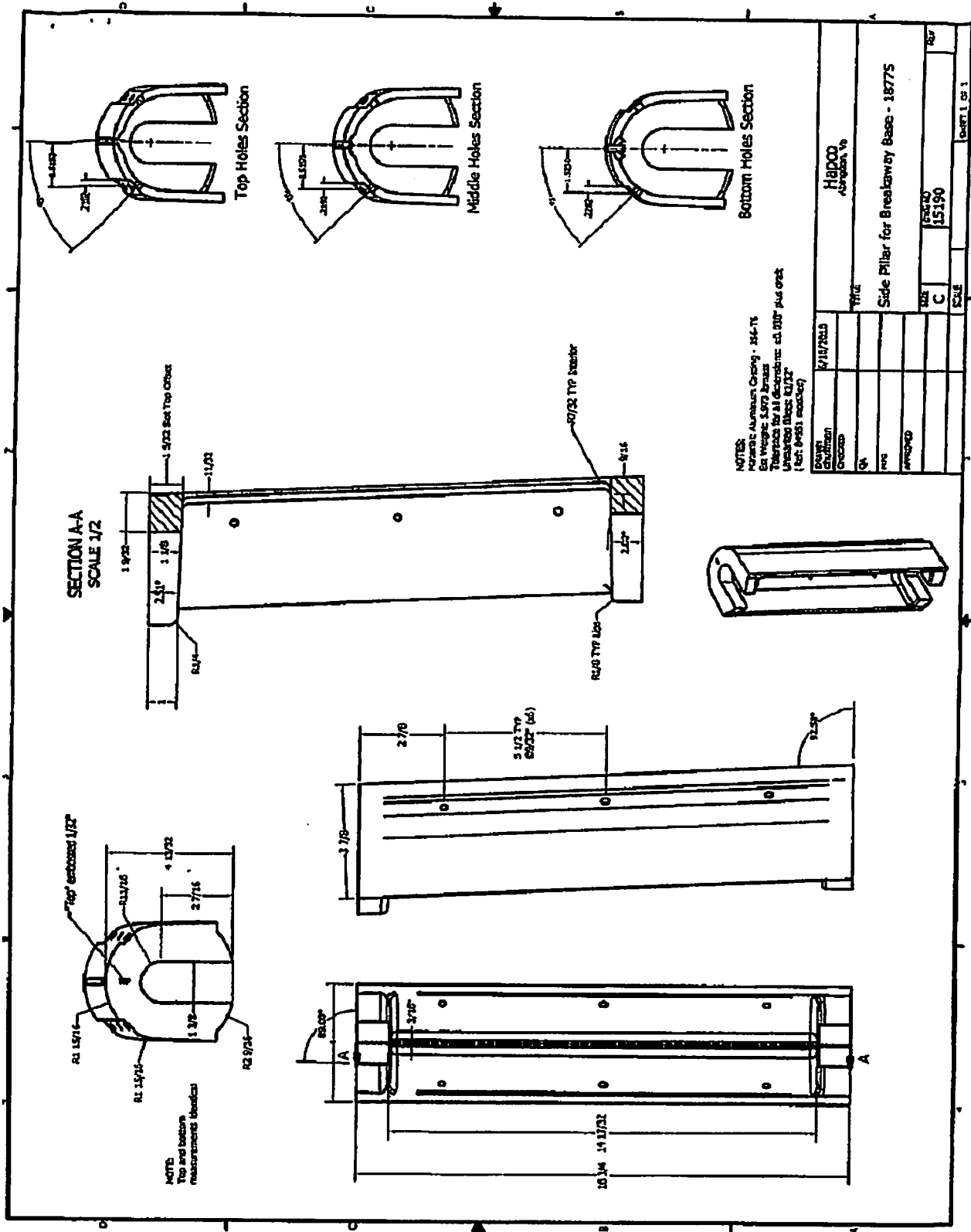
TITLE BREAKAWAY TEST POLE

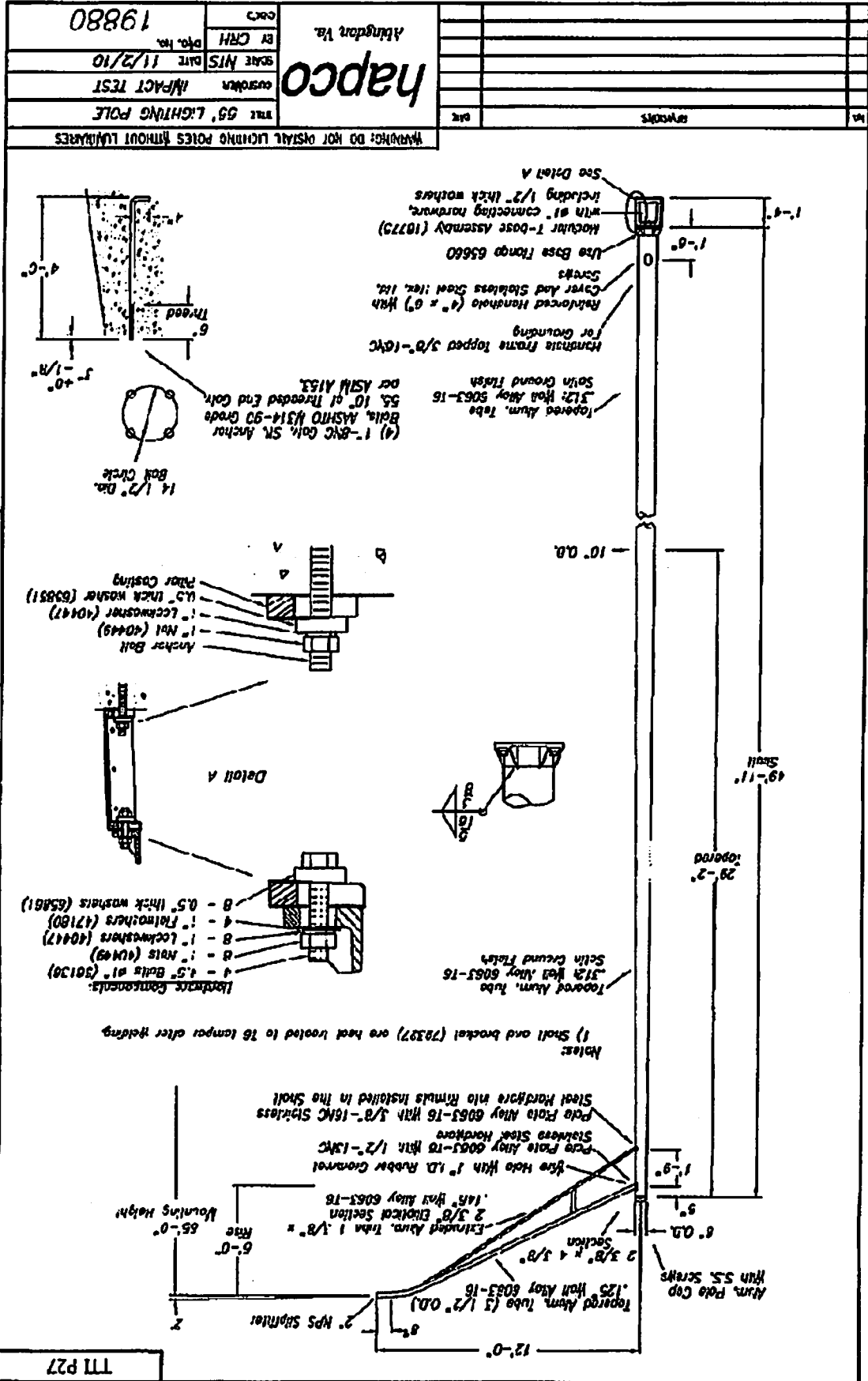
customer

SCALE 1/8" = 1'-0" DATE 03/29/2010

BY TNB LTR. NO. SAMPLE-510

CHKD

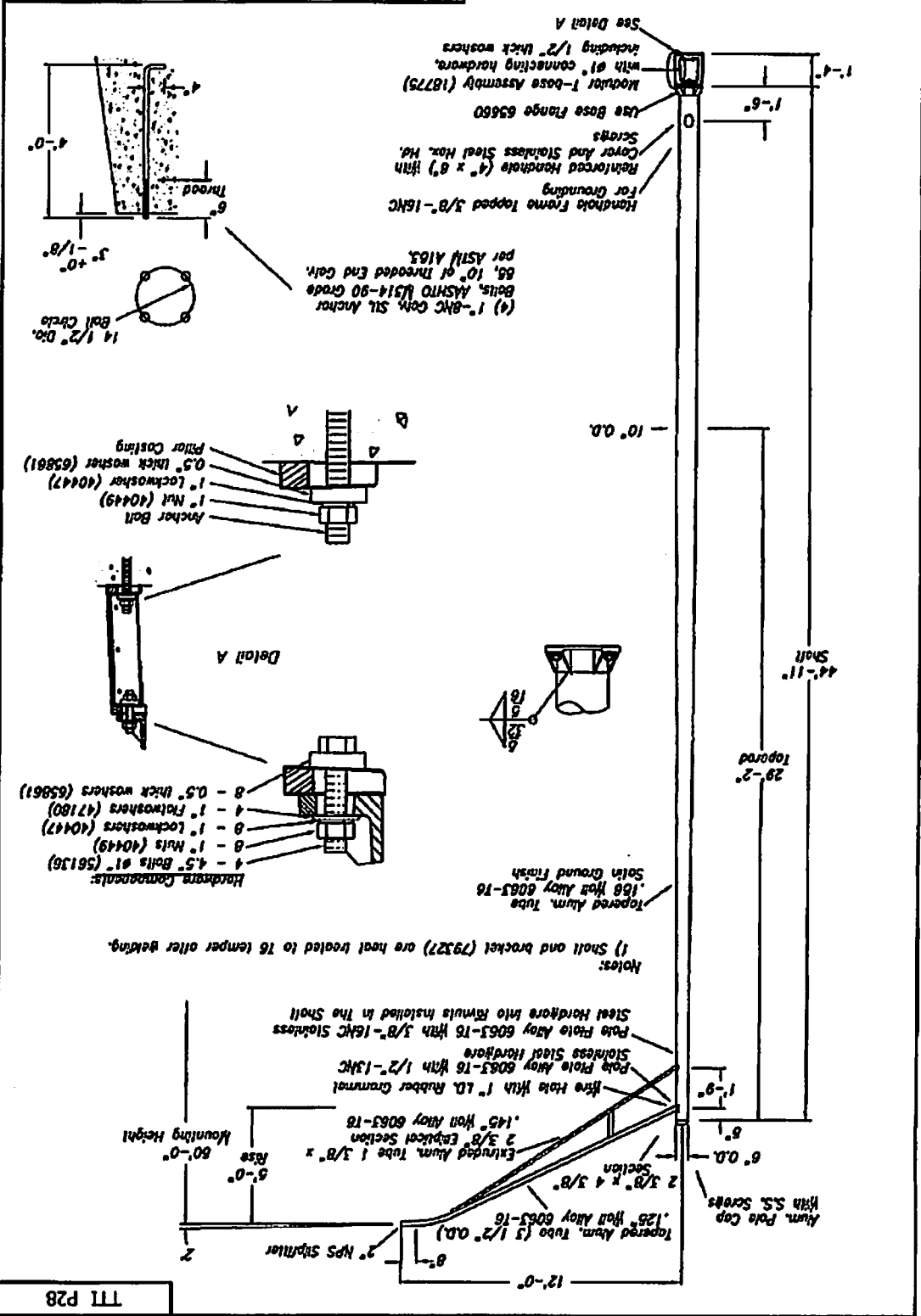




19880

T11 P27

19881	19881	19881	19881	19881	19881
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19881	19881	19881	19881	19881	19881
19881	19881	19881	19881	19881	19881



19881

T11 P28