



P.O. Box 447 – 160 E Pond, Romeo, MI. 48065
Phone (586) 752-4527 Fax (586) 752-0896

TOOLING STANDARDS AND MACHINE SPECIFICATIONS

DOCUMENT #END 001

REVISION LEVEL: A9

**DISTRIBUTION LIST OF TOOLING STANDARDS AND MACHINE
SPECIFICATION MANUALS**

| <u>MANUAL NO.</u> | <u>ISSUED TO</u> | <u>REVISION DATE</u> | <u>DATE ISSUED</u> |
|--------------------------|-------------------------|-----------------------------|---------------------------|
| 1 | Dir of Engineering | 06/10/04 | 06/15/04 |
| 2 | Engineering | 06/10/04 | 06/15/04 |
| 3 | Tool Room Supvsr | 06/10/04 | 06/15/04 |
| 4 | Library | 06/10/04 | 06/15/04 |
| 5 | St. Clair Mold Dsgn | 06/10/04 | 06/15/04 |



**P.O. BOX 447
160 EAST POND DRIVE
ROMEO, MI 48065**

TABLE OF CONTENTS

| <u>SECTION 1</u> GENERAL INFORMATION | Page |
|--|--------|
| Supplier Responsibility..... | 6 |
| Tooling Approval..... | 7 |
| Drawing Requirements..... | 8 |
| Math Data Media Formats..... | 10 |
| <u>SECTION 2</u> PROTOTYPE MOLDS..... | 11 |
| <u>SECTION 3</u> PRE-PRODUCTION MOLDS..... | 18 |
| <u>SECTION 4</u> PRODUCTION MOLDS | |
| Mold Base Information..... | 19 |
| Cavities and Cores..... | 21 |
| Slides and Lifters..... | 22 |
| Runner System..... | 26 |
| Ejector System..... | 29 |
| Cooling System..... | 31 |
| <u>SECTION 5</u> MACHINE SPECIFICATIONS | |

TABLE OF REVISIONS

| <u>DATE</u> | <u>REV LEV</u> | <u>DESCRIPTION</u> | <u>SECTION / PAGE</u> | <u>ITEM NUMBER</u> |
|-------------|--------------------|--|---|---|
| 01/16/98 | A | Refomatted; Added Document #END001 | “All” | “All” |
| 09/24/98 | A1 | Removed Machine #23 | Section 5 | HPM C 35 |
| 10/29/98 | A2 | Added “customer name” | Page 7 | 1.2.3 & .4 |
| 11/04/99 | A3 | Removed machine #6; Added machine #37; Added machine #38; | Section 5 Section 5 Section 5 | Van Dorn 75 Toshiba 90 Toshiba 150 |
| 12/09/99 | A4 | Added machine #39; Added 2 illustrations to Prototype section, which renumbered all remaining pages. | Section 5 Section 3 - 5 | Electric (66) |
| 03/24/00 | A5 | - Added machines #40 & #41; Removed machines #3 & #7; - Drawing numbers revised - Added Shuttle Mold note - Added figure 4-5a; which Renumbered pages 28-32. | Section 5 Page 9 Page 26 Pages 28 – 32 | ref END121 2 nd digit “1” 4.4.11 |
| 07/27/00 | A6 | Added machines #42, #43, and #44 | Section 5 | |
| 03/15/01 | A7 | Removed Machine #17; | Section 5 | |
| 08/01/02 | A8 | Removed Machines #13 and #20; Added Machines #45, #46 and #47. Also updated figs 2-2 & 2-3 | Section 5 | |
| 06/10/04 | A9 | Added Machine #48; Removed Machines #1, 4, 5, 8, 9, 10, 11, 19 21 and 22. (Note: Removed Tool Suppliers from Distribution) | | |

PREFACE

This manual has been prepared to provide standard and engineering data relative to mold design and construction.

We at ALCO Plastics welcome comments to improve the information contained in this manual. Please direct your comments to the Director of Engineering's office.

We ask that any exceptions to these standards be noted on your response to ALCO Plastics Request for Quotation. Final approval of any exceptions will be made by the ALCO Plastics Engineering Department.

As changes and additions are made to this manual, copies will be updated and sent to all suppliers.

SUPPLIER RESPONSIBILITY

- 1.1.0 All tooling must be designed and built to meet or exceed the standards contained in this manual.
- 1.1.1 The tool supplier has the responsibility for constructing a tool that is capable of producing parts that are within print tolerances. If the tooling can not produce approved parts, the necessary corrections and/or additions will be made at the tool suppliers expense.
- 1.1.2 The tool supplier is responsible to submit a preliminary tool design prior to completing the tool design or beginning tool construction.
- 1.1.3 All tool designs are the property of ALCO Plastics and/or it's customers and should not be communicated to any other company without written approval.
- 1.1.4 The tool supplier will be responsible for the submission of a tool progress report as designated by ALCO Plastics.
- 1.1.5 Any changes in delivery or cost of a tool (at the supplier's request) should be communicated immediately in writing to the ALCO Plastics Director of Engineering.
- 1.1.6 Copies of all final tool designs and math data must be delivered on tool completion.

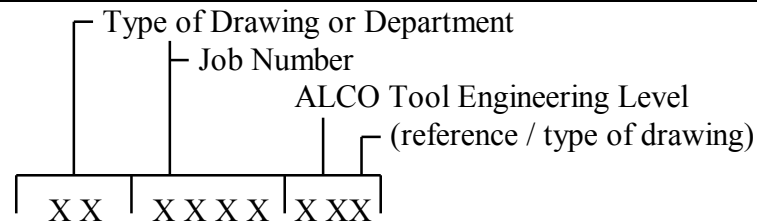
TOOLING APPROVAL

- 1.2.0 All production and prototype tooling will be sampled and evaluated in-house by ALCO Plastics personnel. The tool supplier has the option of being present during the tryout process.
- 1.2.1 All dimensions designated as critical on the part print must be process capable.
- 1.2.2 Parts requiring texturing are to be sampled and dimensionally approved prior to texturing the tool.
- 1.2.3 Production injection molds should have the ALCO Plastics Job Number stamped on the 0 , 0 corner. The customer name, name of the part and the part number should be stamped on the zero side and zero end.
- 1.2.4 Prototype tooling should have ALCO Plastics' job number and customer name stamped on the side of cavity and core inserts.
- 1.2.5 In reference to an injection mold, the word "part" refers to a complete mold shot with all cavities completed.

DRAWING REQUIREMENTS

- 1.3.0 At a minimum, all mold designs must have plan view of cavity and core, longitudinal section (Sec A-A), typical sections through all major areas of the mold, and any auxiliary sections required to clarify mold construction.
- 1.3.1 ALCO Plastics requires mold inserts to be completely detailed. (Exceptions: ejector pins, sockets, heads, caps, screws, etc.)
- 1.3.2 All mold designs must be created in CAD, and be dimensionally correct. (These designs are used in the machining process.)
- 1.3.3 Dividing lines are to be used to separate various components, when more than one mold component is drawn on a single sheet.
- 1.3.4 Tie bar size and location must be drawn on all plan views.
- 1.3.5 All designs must have a complete Bill of Materials.
- 1.3.6 All designs must be ballooned. Balloons must be split and contain both the detail number and sheet location, when appropriate.
- 1.3.7 All sheets of a tool design must have a title block in the lower right hand corner.
- 1.3.8 Preliminary tool design must be approved by ALCO Plastics Engineering Department prior to completion.
- 1.3.9 ALCO Plastics Job Number must appear in the title block. (See Figure 1-1 for description of job numbering system.)

(Figure 1 - 1)
Drawing Numbers (Job Number Breakdown / Drawing Number Reference)



Type of Drawing or Department

First Digit

1 = Engineering
 2 = Quality Assurance
 3 = Prototype Tooling
 4 = Production Tooling
 5 = Manufacturing

Second Digit

1 = Data
 2 = Product Development
 3 = S.O.P.
 4 = Gage Build
 5 = Mold Build
 6 = Fixture Build

Examples: **1 2** = Engineering Department for R & D
 4 5 = Production Mold Build
 5 6 = Manufacturing Department: fixture build for

Job Number - A job number is assigned to job, by Engineering Department to track costs and hours, when the job is released.

Engineering Level / Type of Drawing Codes

* - Engineering Level (* example: A, B, C, etc.)

* - Original Customer Data

*1 - Part 3-D

*2 - Part Drawing

*3 - Mold 3-D

*4 - Mold Drawing

*5 - Fixtures 3-D

*6 - Fixture Drawing

*7 - Gage 3-D

*8 - Gage Drawing

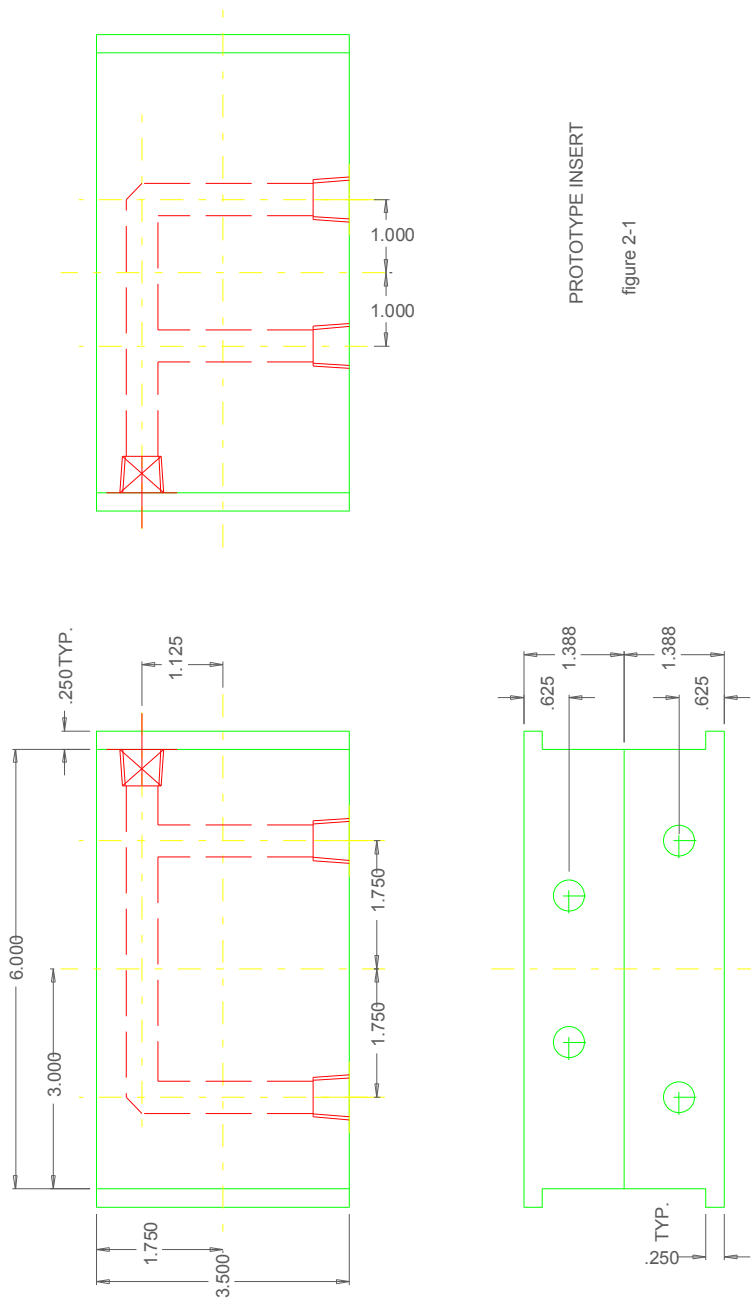
*9 - Proposals (example: B, C, etc.)

MATH DATA MEDIA FORMATS

- 1.4.0 ALCO Plastics can send and receive math data in the following formats.
- 1.4.1 3.5” Disk (DOS or Windows only) IGES format.
- 1.4.2 DC-6150 Data Cartridge (TAR format) IGES
- 1.4.3 4mm DAT cartridge (TAR format) IGES Windows.
- 1.4.4 Math data may be attached to e-mail but should be in an IGES file that has been compressed and is self-extracting. (Please contact us for address.)
- 1.4.5 All incoming tapes or floppy disks should be accompanied by a shipper listing the number and type of files contained.
- 1.4.6 ALCO Plastics currently uses the following CAD systems:
 - Cadkey (latest version)
 - CimLinc (latest version)

PROTOTYPE MOLDS

- 2.1.0 Whenever possible, prototype tooling should use one of ALCO Plastics standard insert sizes. See figures 2-1, 2-2, and 2-3.
- 2.1.1 Prototype inserts should be constructed of
 - Brass SAE CA360 (ASTM B16)
 - Aluminum 6061-T6 SAE AA6061 (ASTM B211)
 - 7075-T6 SAE AA7075 (ASTM B211)
 - DME #2 (4140)
- 2.1.2 Hand load inserts are acceptable, but not preferred, and require ALCO Plastics Engineering approval.
- 2.1.3 Prototype tooling must be capable of producing 500 pieces, which conform to print specifications and are free of flash.

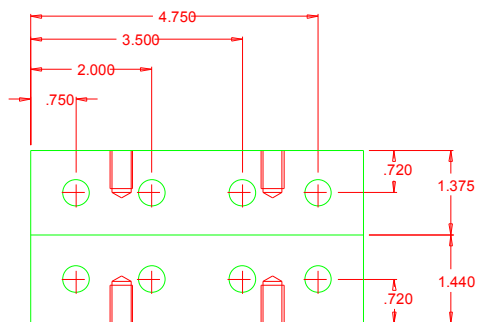
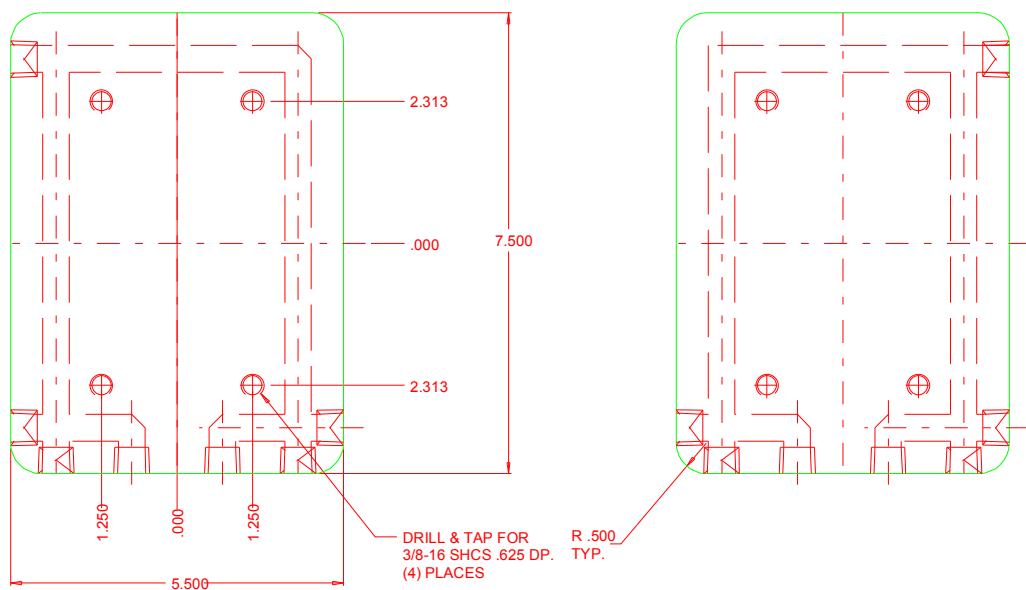


PROTOTYPE INSERT

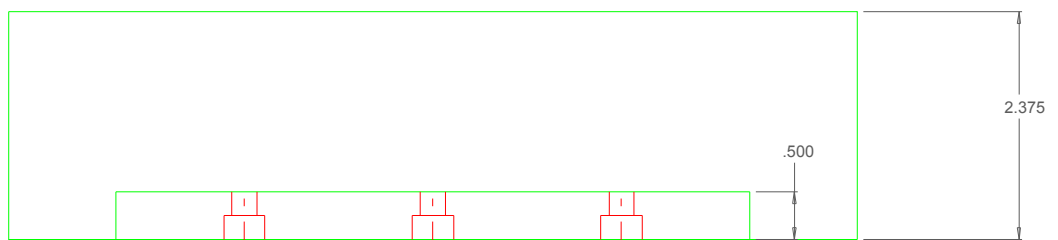
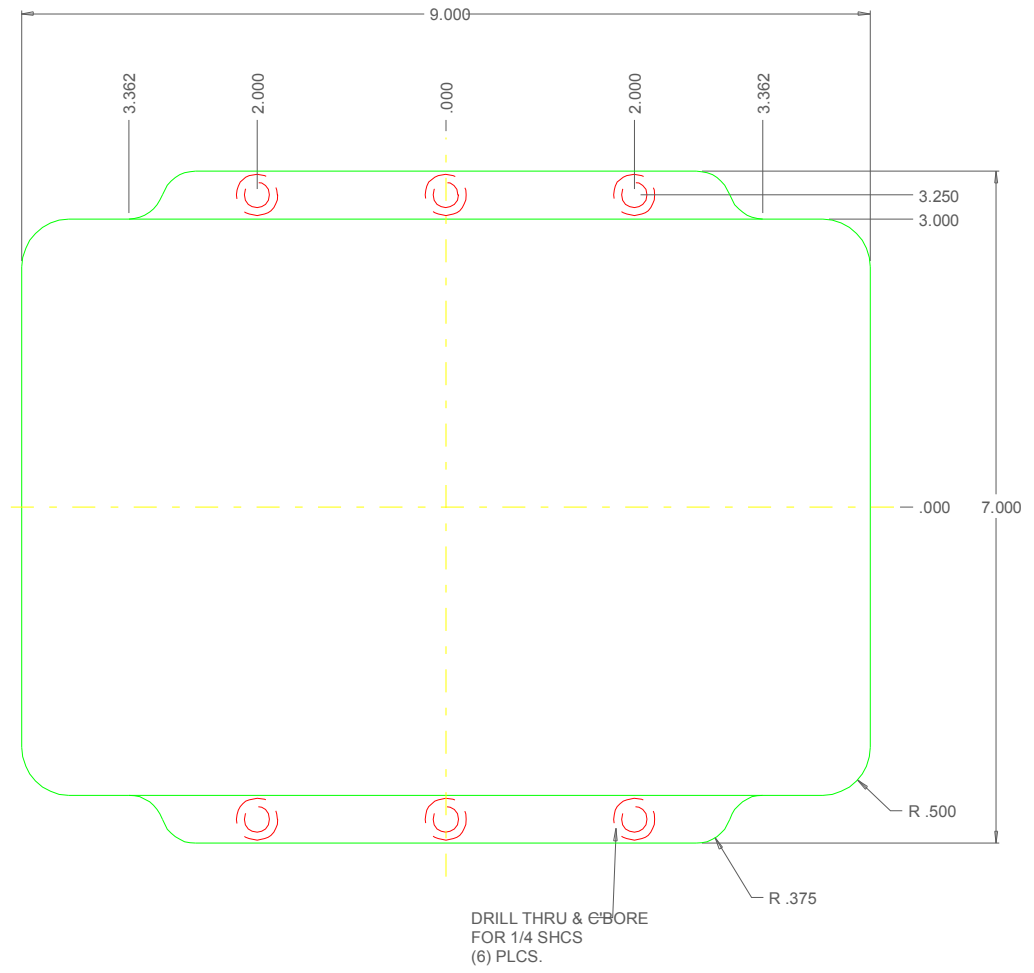
figure 2-1

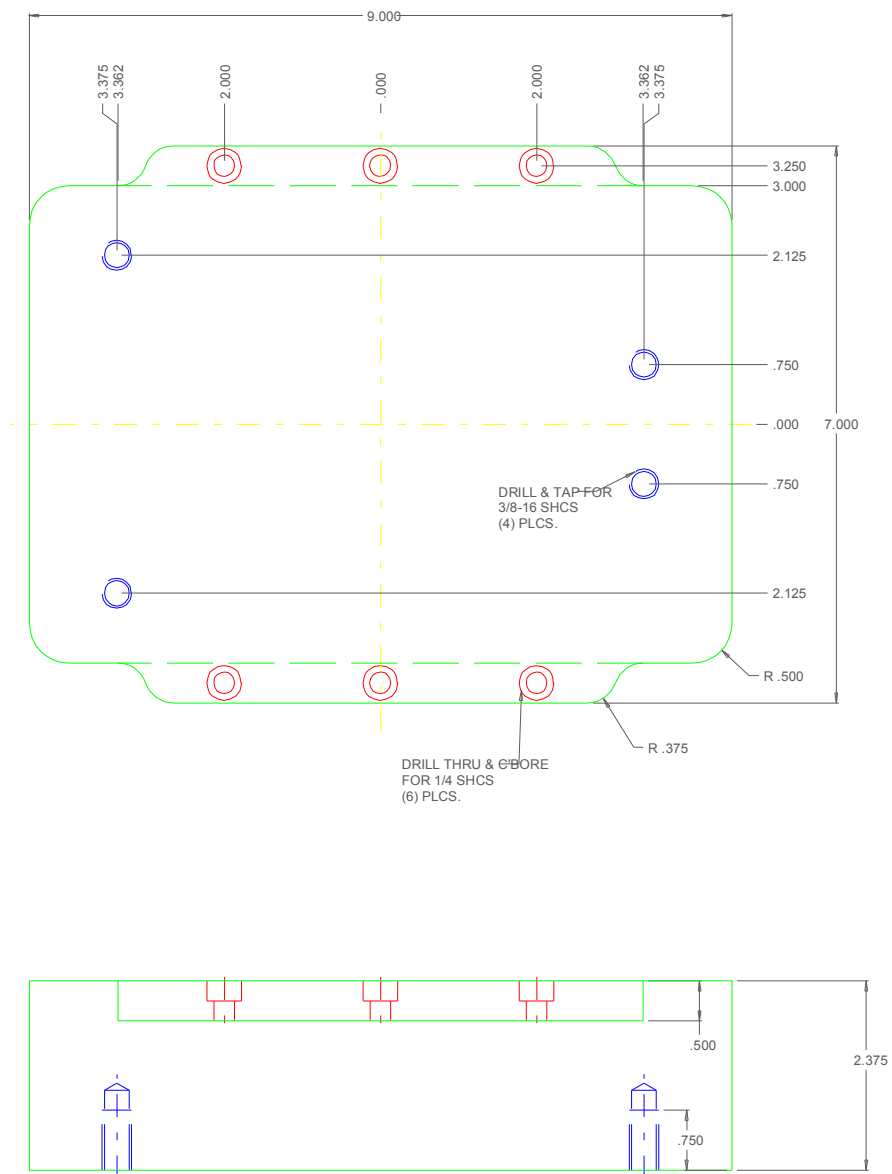
See Engineering for Cad File (Figure 2-2)

See Engineering for Cad File (Figure 2-3)



PROTOTYPE INSERT
figure 2-4





PRE-PRODUCTION MOLDS

- 3.1.0 Pre-production molds are to be built to the same design configuration as production molds. Please refer to Production Mold Standards in Section 4.
- 3.1.1 Pre-production mold bases may be made of DME No. 1 steel or equivalent.
- 3.1.2 Cavities and cores should be made of pre-tempered steel, and do not need to be heat treated.
- 3.1.3 Parts produced from a pre-production mold must represent the actual production tooling.
- 3.1.4 Pre-production molds must be capable of producing 5000 pieces, which conform to print specification and are free of flash.

MOLD BASE INFORMATION

- 4.1.0 All mold bases to be DME, National, or equivalent.
- 4.1.1 All mold bases to be DME #2 steel, National #2 steel, or equivalent.
- 4.1.2 Top clamp plate to be 1.375 thick.
- 4.1.3 Provide at a minimum two prybar slots sufficient to open the mold.
- 4.1.4 Provide eye bolt holes in a balanced position on each side of mold for handling purposes. Sizes are as follows:
 - A. Up to 500 lbs. > 5/8 - 11
 - B. 500 lbs. to 1,500 lbs. > 3/4 - 10
 - C. Over 1,500 lbs. > 1 - 8
- 4.1.5 Sufficient support must be added to ejector housing to prevent plate warpage under injection pressure.
- 4.1.6 All molds to be supplied with a standard safety strap. Molds with spring loaded slides should have slotted safety strap to relieve the spring tension. One inch of the leader pins must remain engaged with the bushings. See figure 4-1.
- 4.1.7 Identify mold base on zero side and end with the following information:
 - A. ALCO Plastics job number.
 - B. Customer.
 - C. Customer part number.Note: Use 1/4" high letters minimum.

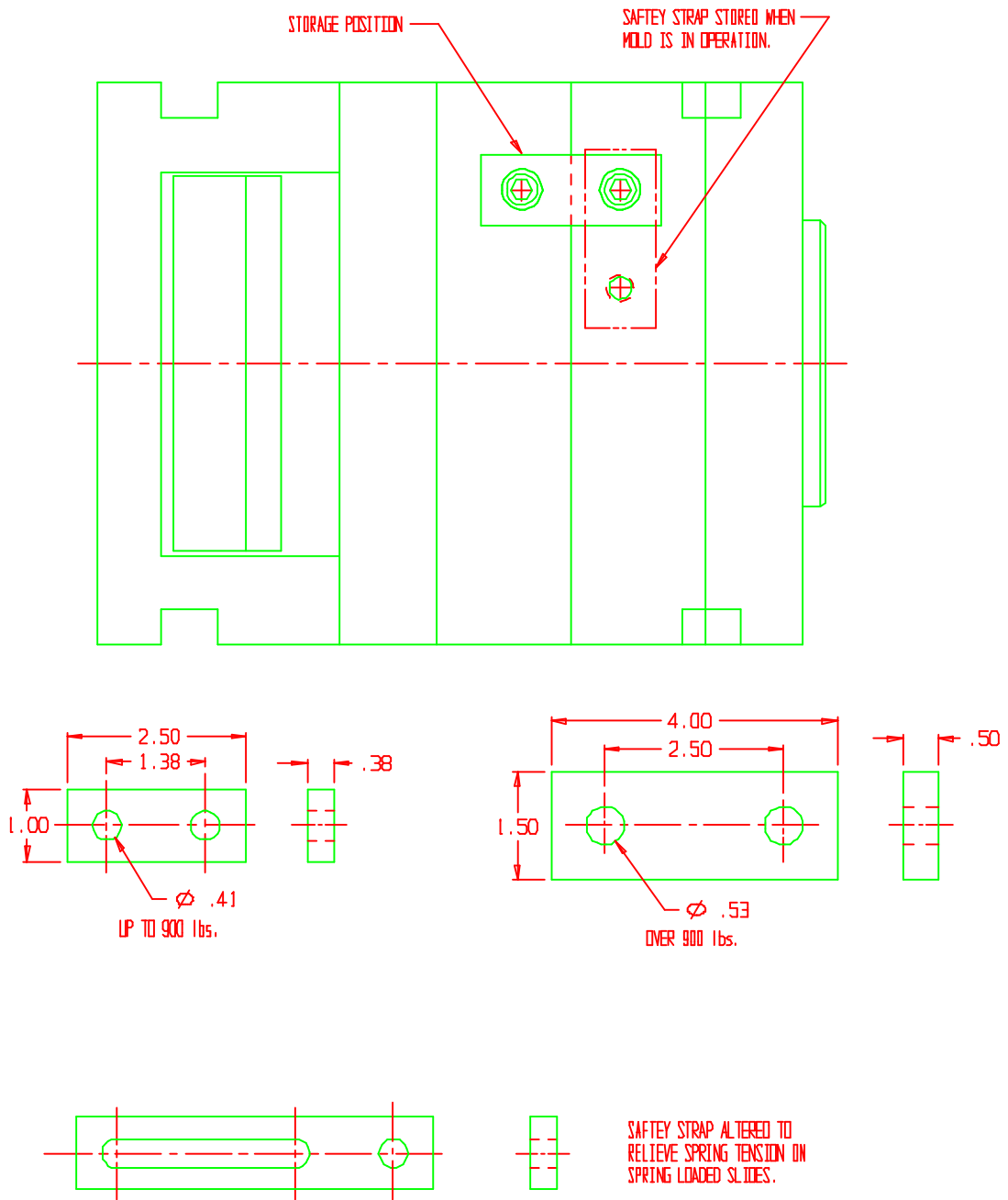


figure 4-1

CAVITIES AND CORES

- 4.2.0 All inserts to be stamped with numbers relating to pockets, etc.
- 4.2.1 All inserts to have steel type stamped on the back.
- 4.2.2 All cavities to be engraved with cavity identification number, part number, vendor identification, and material identification code.
- 4.2.3 All cavities and cores to be constructed of S-7, P-20, or 420 stainless steel as specified by ALCO Plastics Engineering Department.
- 4.2.4 Molds running abrasive materials may be required to be electroless nickel plated and hardened after part approval.
- 4.2.5 Cavities requiring texture will be grained after first shot sample approval.
- 4.2.6 All angular shut offs to be 1 degree minimum.
- 4.2.7 All cavities are to be vented to allow gas and air to escape and allow the part to fill properly.

SLIDES AND LIFTERS

- 4.3.0 All slides, gibs, heel blocks, and lifters to be stamped with numbers relating to pockets, etc.
- 4.3.1 All slides and lifters to be constructed of S-7 or P-20 tool steel as specified by ALCO Plastics Engineering Department.
- 4.3.2 All slides, gibs, and lifters to be stamped with steel type.
- 4.3.3 Gibs and heel blocks to be constructed of 4140, 6150, or 1018 steel and appropriately heat treated.
- 4.3.4 Molds running abrasive material may require components to be electroless nickel plated and hardened after part approval.
- 4.3.5 Slides to have a 5 degree lock angle (per side) to assure shut off and proper location. See figure 4-2.
- 4.3.6 Lifters and gibs to have grease grooves to aid in lubrication and help prevent galling.
- 4.3.7 Angle of horn pin to be 3 to 5 degrees less than the locking angle of the heel block. See figure 4-3.
- 4.3.8 Locking angle of heel block to be no more than 30 degrees.
- 4.3.9 All heel blocks are to be held in place by means of a pocket. Depending on the bearing height and depth of the pocket, one of three methods may be used.
 - 1) Standard heel block has a pocket depth approximately one half the bearing height. See figure 4-4A.
 - 2) Molds with a separation between the "A" and "B" plates may use an "L" shaped heel block for added strength. See figure 4-4B.
 - 3) Molds requiring a long bearing height may be double locked. See figure 4-4C.
- 4.3.10 All sliding surfaces to be heat treated to prevent wear. ALCO Plastics may require additional wear plates.
- 4.3.11 If hydraulic cylinders are used, they are to be rated at 2,000 to 3,000 PSI.
- 4.3.12 Molds with hydraulic cores are to have switches installed in such a manner as to protect them from physical damage. Each core to have a separate switch for "core in" and "core out". core sequences to be supplied by ALCO Plastics and must be stamped in the mold.

- 4.3.13 Whenever multiple cylinders are necessary using the same “core in” and “core out” sequence, all cylinders are to be connected with proper hose to a common drilled manifold.
- 4.3.14 All slides to have a positive holding device to keep slides in position while mold is open.

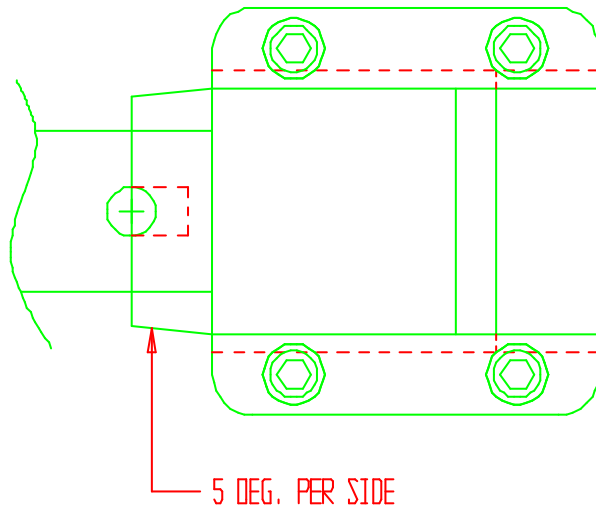


figure 4-2

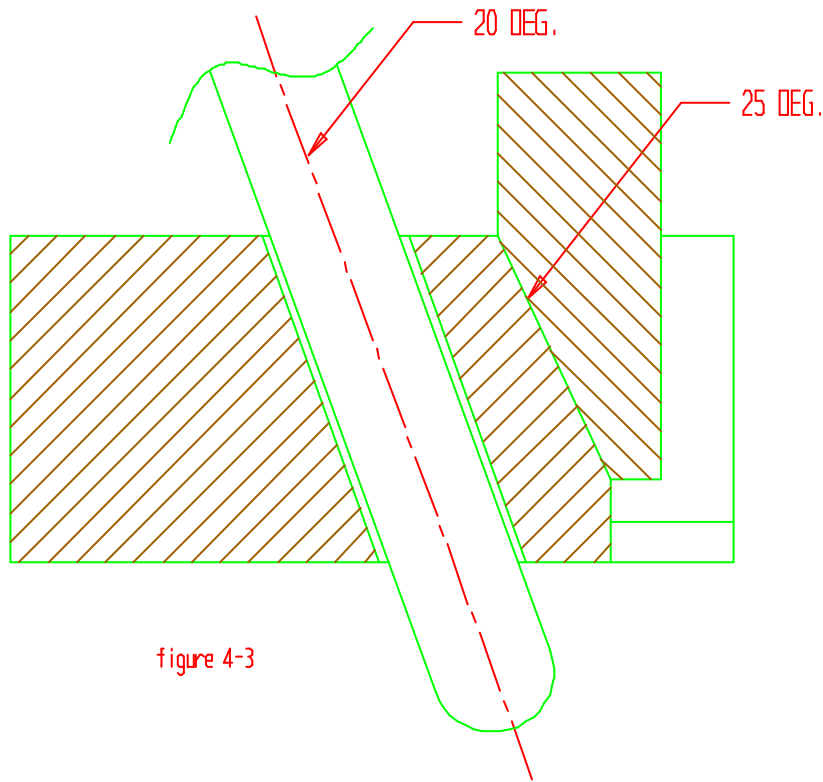


figure 4-3

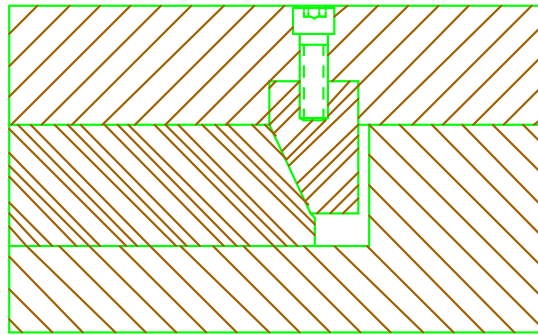


figure 4-4A

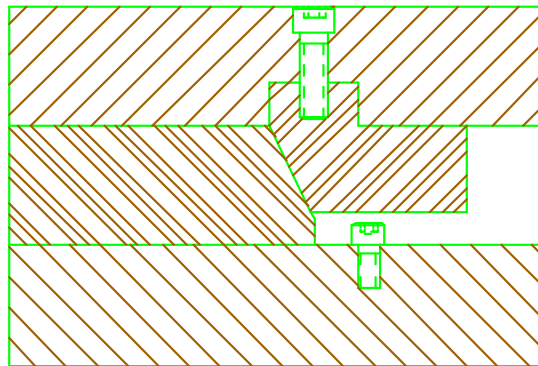


figure 4-4B

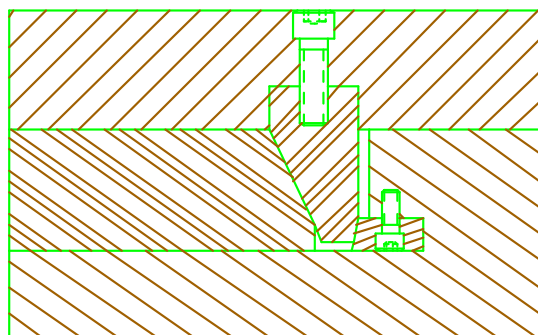


figure 4-4C

RUNNER SYSTEM

- 4.4.0 Sprue bushing should be kept as short as possible.
- 4.4.1 Molds requiring three plate construction, use National standard extension nozzle sprue bushing.
- 4.4.2 Standard sprue bushing radius to be 1/2”.
- 4.4.3 Sprue bushing orifice and runner size to be determined by ALCO Plastics Engineering Department.
- 4.4.4 Molds requiring a hot drop sprue bushing, or manifold system, must be approved by ALCO Plastics Engineering Department.
- 4.4.5 Sprue puller is standard 5 degree back draft. See figure 4-5.
- 4.4.6 The runner system must minimize material usage while still using acceptable molding practices. All runners must be polished.
- 4.4.7 All runners must be full round. Trapezoidal runners require ALCO Plastics Engineering approval. All runner intersections must be radiused.
- 4.4.8 All runners must have a cold slug at the end of each runner.
- 4.4.9 All runners must have a gas vent at the end of each runner.
- 4.4.10 When the mold is closed, the mold base should have a .005 separation minimum.
- 4.4.11 All Shuttle Molds must have ALCO Standard Shuttle Mold Sprue Bushing. See figure 4-5a

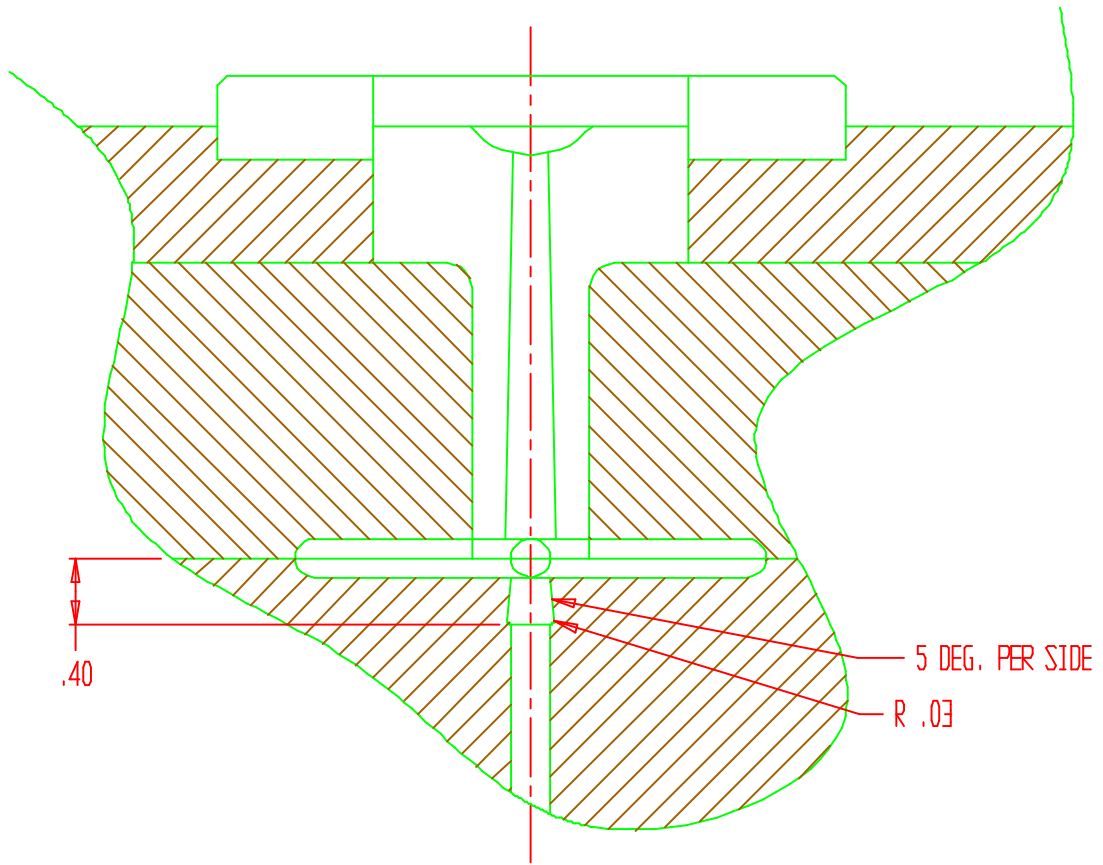


figure 4-5

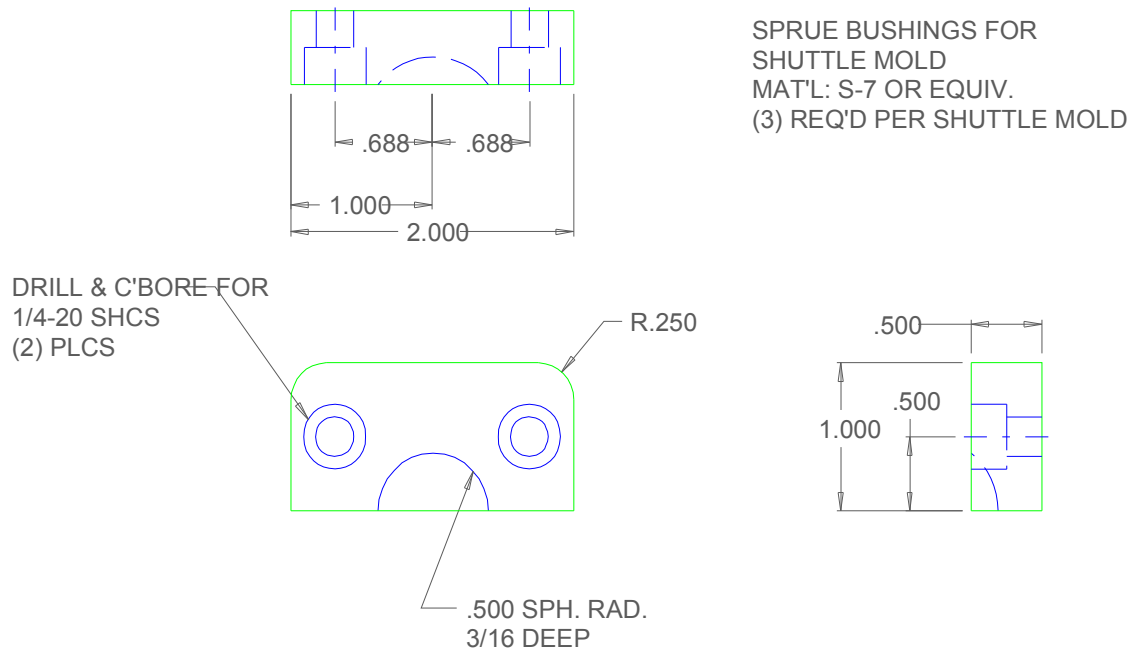


Figure 4.5a

EJECTOR SYSTEM

- 4.5.0 All ejector components should be standard DME, National, PCS, or equivalent.
- 4.5.1 All runners require ejector pins.
- 4.5.2 Mold base knockout holes to be 1.250 dia.
- 4.5.3 Knockout pattern to suit press (see machine specifications) with center knockout hole eliminated.
- 4.5.4 Guided ejection, when needed, to be installed per figure 4-6. Four guide pins and bushings required.
- 4.5.5 Positive ejector stops, when needed, to be installed directly over the knockout holes.
- 4.5.6 If ejector pins are located under a slide or moving core positive ejector returns or proximity switch must be installed to prevent tool damage.
- 4.5.7 Positive ejector returns, when needed, to be DME Toggle Lock or equivalent.
- 4.5.8 Ejector return springs to be Detroit Die Spring or equivalent. Four springs minimum required on all molds. Total spring deflection not to exceed 30 percent of free length.
- 4.5.9 Ejector return springs are never to be located around return pins.

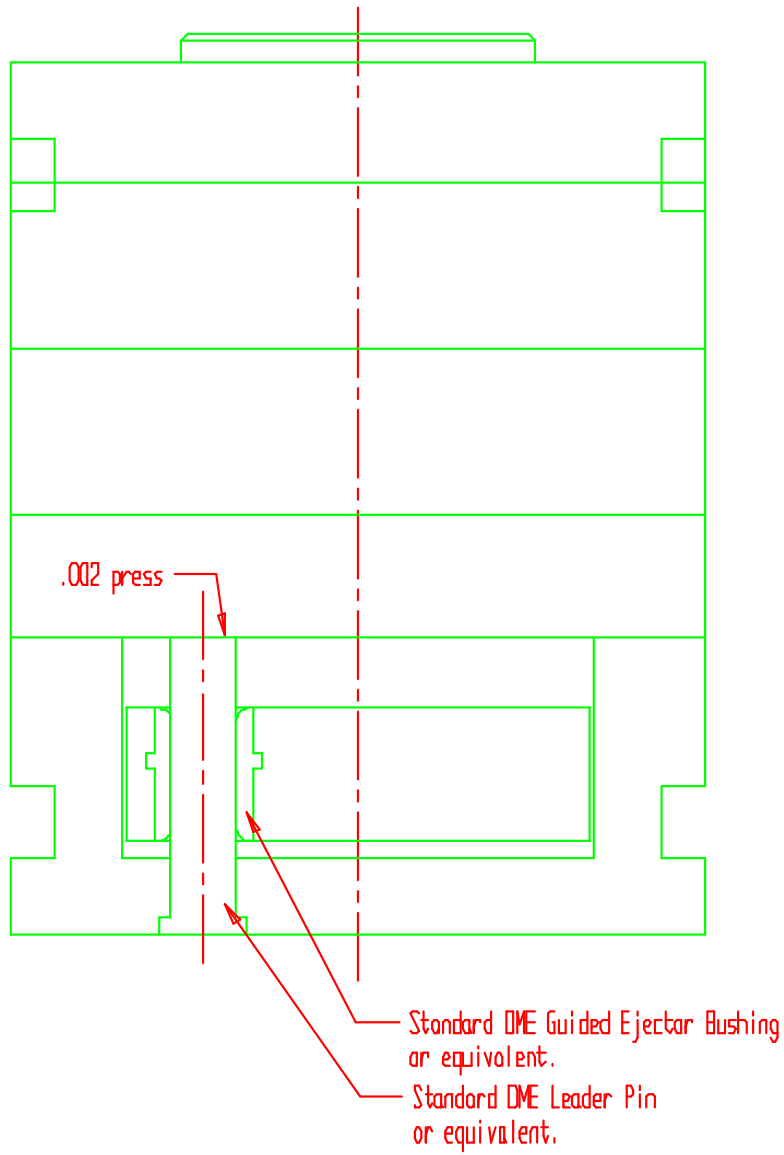


figure 4-6

COOLING SYSTEM

- 4.6.0 Water lines must be dimensionally located on the mold design drawings.
- 4.6.1 Water lines must be located in the mold to provide an even heating or cooling of the molding surfaces.
- 4.6.2 All water lines to be 1/4 - 18 NPT minimum.
- 4.6.3 Water line inlets and outlets must not interfere with the clamp slots on the cover side of the mold.
- 4.6.4 Standard DME or PCS quick disconnect water fittings must be used on inlets and outlets.
 - DME catalog number JP-352
 - PCS catalog number PC-352
- 4.6.5 Water line inlets and outlets must clear machine tie bars.
- 4.6.6 When possible, water line connectors should be recessed 1/16" below surface of mold to prevent damage. See figure 4-7.
- 4.6.7 Water lines in cavities, cores, and slides are never to be closer than 3/8" to any edge of steel.
- 4.6.8 Thermo pins to be used in hard to reach cooling areas.

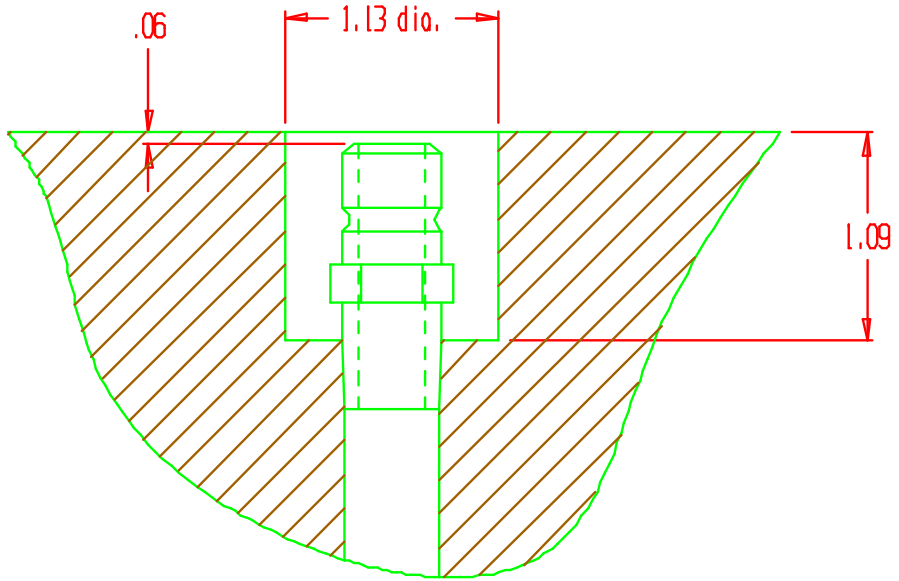


figure 4-7

(Place END121 Here)