

# Manufacturing Tooling

## 4. Work Holding Principles

Nageswara Rao  
Posinasetti

---

---

---

---

---

---

---

---

### Work Holding

- ♦ Work holder includes all devices that hold, grip, or chuck a work piece to perform a manufacturing operation.

February 5, 2008

Nageswara Rao Posinasetti

2

---

---

---

---

---

---

---

---

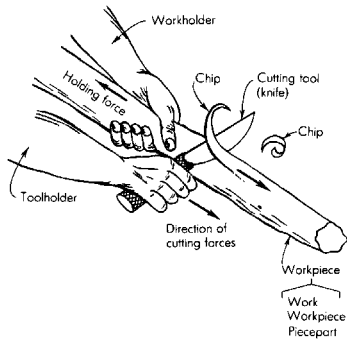


Figure 4-1. Principles of workholders.

February 5, 2008

Nageswara Rao Posinasetti

3

---

---

---

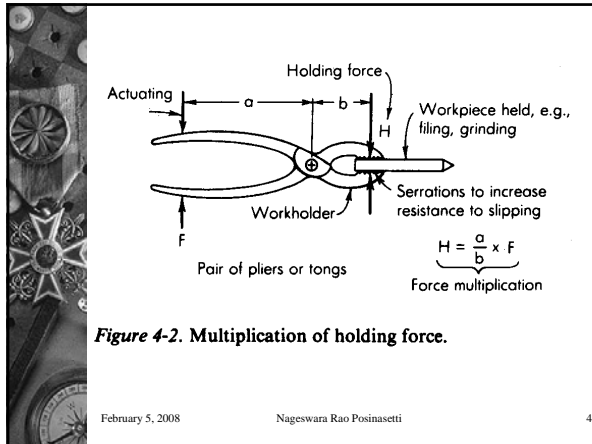
---

---

---

---

---




---

---

---

---

---

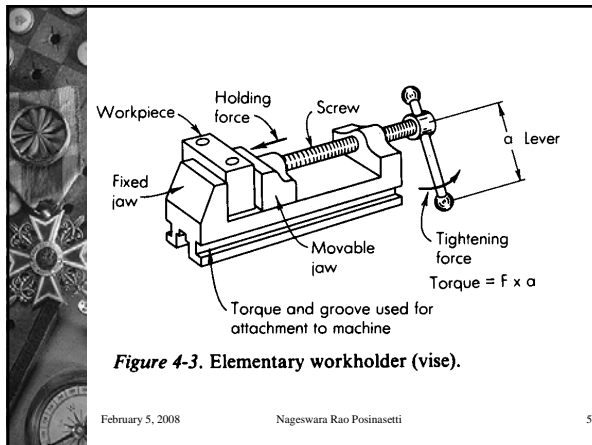
---

---

---

---

---




---

---

---

---

---

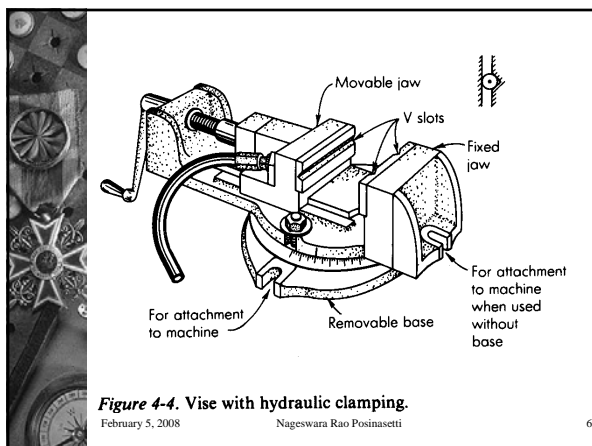
---

---

---

---

---




---

---

---

---

---

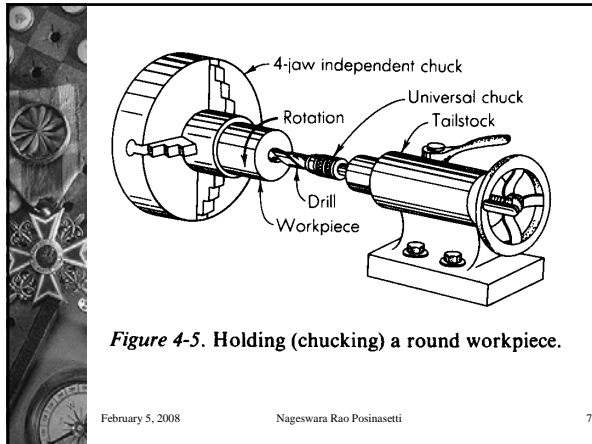
---

---

---

---

---




---

---

---

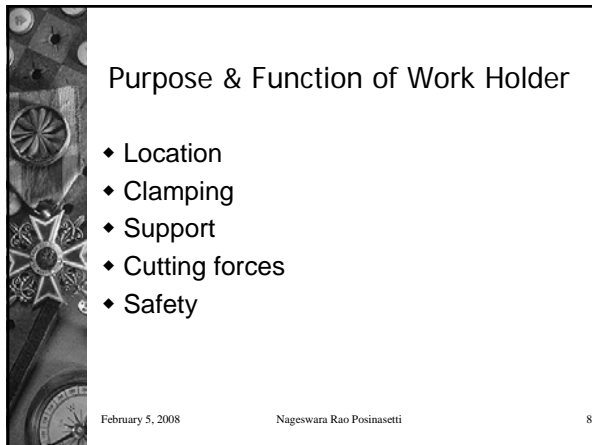
---

---

---

---

---




---

---

---

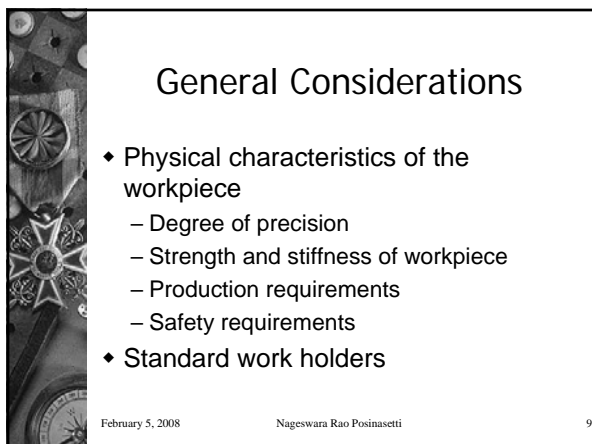
---

---

---

---

---




---

---

---

---

---

---

---

---

## Locating Principles

- ◆ Work piece surfaces
  - Flat surfaces
  - Cylindrical surfaces
  - Irregular surfaces
- ◆ Types of location

February 5, 2008      Nageswara Rao Posinasetti      10

---

---

---

---

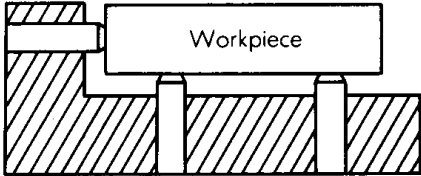
---

---

---

---

## Plane Location



Workpiece

**Figure 4-6. Plane location.**

February 5, 2008      Nageswara Rao Posinasetti      11

---

---

---

---

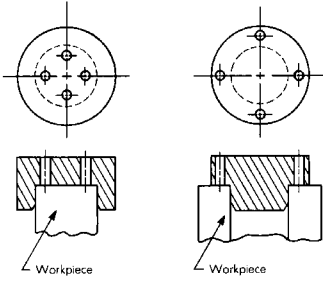
---

---

---

---

## Concentric Location



Workpiece      Workpiece

**Figure 4-7. Concentric location.**

February 5, 2008      Nageswara Rao Posinasetti      12

---

---

---

---

---

---

---

---

## Radial Location

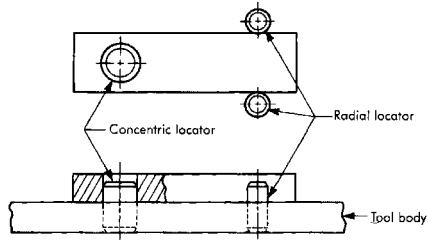


Figure 4-8. Radial location.

February 5, 2008

Nageswara Rao Posinasetti

13

---

---

---

---

---

---

---

---

---

---

## Combined Location

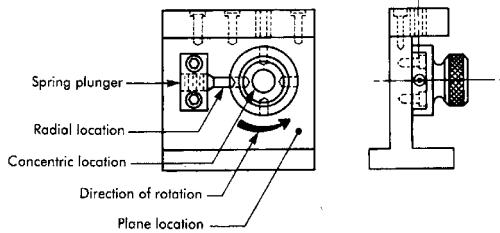


Figure 4-9. Plane, concentric, and radial location.

February 5, 2008

Nageswara Rao Posinasetti

14

---

---

---

---

---

---

---

---

---

---

## Degrees of Freedom

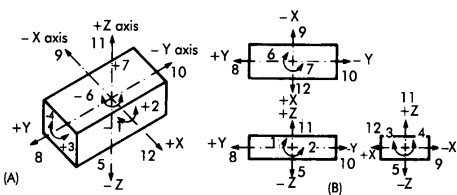


Figure 4-10. Six degrees of freedom and 12 directions.

February 5, 2008

Nageswara Rao Posinasetti

15

---

---

---

---

---

---

---

---

---

---

### 3-2-1 Method of Location

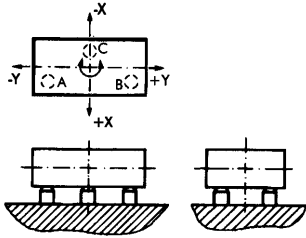


Figure 4-11. Three pins arrest three directional movements.

February 5, 2008

Nageswara Rao Posinasetti

16

---

---

---

---

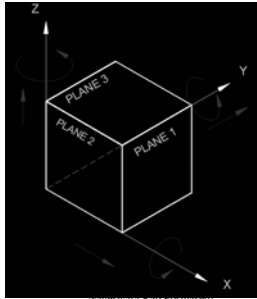
---

---

---

---

### 3-2-1 Method of Location



February 5, 2008

Nageswara Rao Posinasetti

17

---

---

---

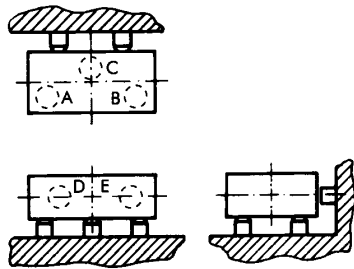
---

---

---

---

---



4-12. Five pins arrest eight directional movements.

February 5, 2008

Nageswara Rao Posinasetti

18

---

---

---

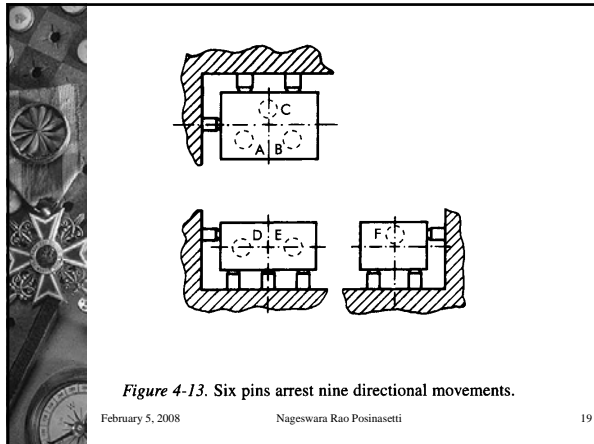
---

---

---

---

---




---

---

---

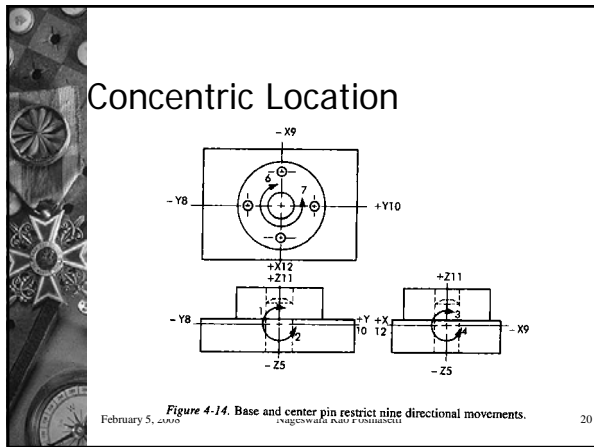
---

---

---

---

---




---

---

---

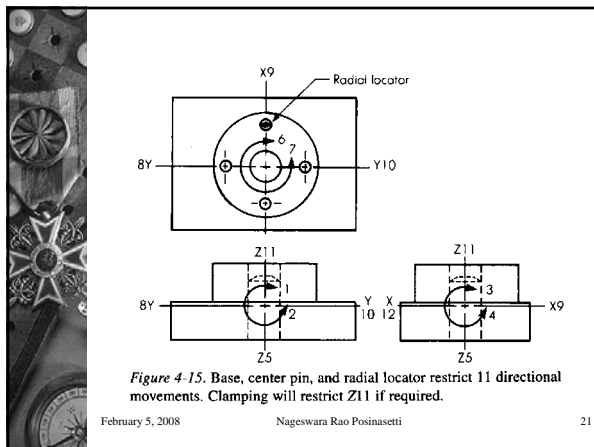
---

---

---

---

---




---

---

---


---

---

---

---

---



## Basic Locating Rules

- ◆ Position and Number of Locators
- ◆ Redundant Locators
- ◆ Locational tolerances
- ◆ Fool proofing

February 5, 2008      Nageswara Rao Posinasetti      22

---

---

---


---

---

---

---

---



**When more than one locator is placed on a surface, they should be distributed as far apart as possible on the surface**

- ◆ When more than one locator is placed on a surface (plane), they should be distributed as far apart as possible on the surface.
- ◆ This would help in placing the workpiece on locators without much skill.
- ◆ Also the clamping forces would not be able to shift the workpiece from such locators.
- ◆ A blank with irregular surface (such as sand casting) would be better located on such distributed locators.

February 5, 2008      Nageswara Rao Posinasetti      23

---

---

---


---

---

---

---

---



**When more than one locator is placed on a surface, they should be distributed as far apart as possible on the surface**

- ◆ Machining forces would not be able to disturb the equilibrium of the workpiece in the fixture with properly distributed locators.
- ◆ Wear of any locator contributes less to the inaccuracy of location if the locators are placed far apart.

February 5, 2008      Nageswara Rao Posinasetti      24

---

---

---

---


---

---

---

---





- ◆ While selecting the surface for the largest locators, consideration should be given to the largest area of the workpiece.
- ◆ The two locators should be placed on the surface with the next largest area and the single locator on the surface with the least surface area.

February 5, 2008      Nageswara Rao Posinasetti      25

---

---

---


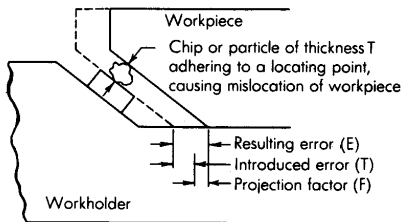
---

---

---

---

---

**Figure 4-16. Magnification and projection of error.**

February 5, 2008      Nageswara Rao Posinasetti      26

---

---

---


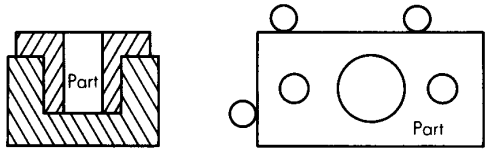
---

---

---

---

---

**Figure 4-17. Redundant locators.**

February 5, 2008      Nageswara Rao Posinasetti      27

---

---

---

---

---

---

---

---

## Redundant Locator

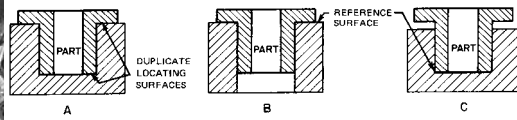


Figure 3-5 Duplicate locators.

February 5, 2008

Nageswara Rao Posinasetti

28

---

---

---

---

---

---

---

---

## To prevent incorrect loading

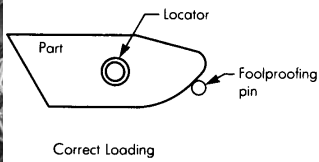


Figure 4-18. Foolproofing.

February 5, 2008

Nageswara Rao Posinasetti

29

---

---

---

---

---

---

---

---

## To prevent incorrect loading

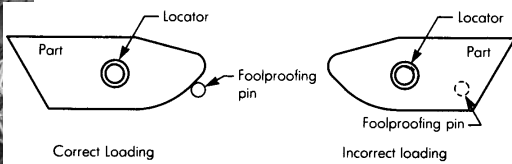


Figure 4-18. Foolproofing.

February 5, 2008

Nageswara Rao Posinasetti

30

---

---

---

---

---

---

---

---

### To prevent incorrect loading

**Figure 3-4** Foolproofing.

February 5, 2008      Nageswara Rao Posinasetti      31

---

---

---

---

---

---

---

---

### Basic types of Locators

- ◆ External locators
  - Fixed
  - Adjustable
    - Threaded locators
    - Spring pressure locators
    - Equalizing locators
- ◆ Integral locators
- ◆ Assembled locators

February 5, 2008      Nageswara Rao Posinasetti      32

---

---

---

---

---

---

---

---

### Integral locators

**Figure 4-19.** Integral locators.

February 5, 2008      Nageswara Rao Posinasetti      33

---

---

---

---

---

---

---

---

## Assembled locators

*Figure 4-20. Assembled locators.*

February 5, 2008      Nageswara Rao Posinasetti      34

---

---

---

---

---

---

---

---

## Basic types of Locators

- ◆ Locating pins
- ◆ V-locators
- ◆ Locating nests
- ◆ Adjustable locators

February 5, 2008      Nageswara Rao Posinasetti      35

---

---

---

---

---

---

---

---

## Locating pins

*Figure 4-21. Locating pins.*

February 5, 2008      Nageswara Rao Posinasetti      36

---

---

---

---

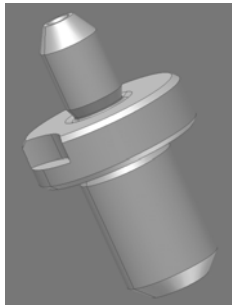
---

---

---

---

# Locator 0.5 in (Jergens)



February 5, 2008      Nageswara Rao Posinasetti      37

---

---

---

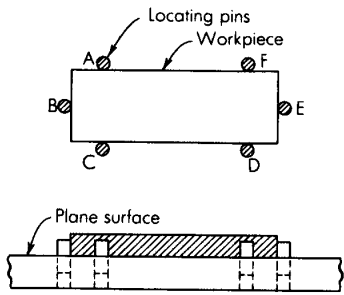
---

---

---

---

---



**Figure 4-22. Simple workholder made of plane surface and pins.**

February 5, 2008      Nageswara Rao Posinasetti      38

---

---

---

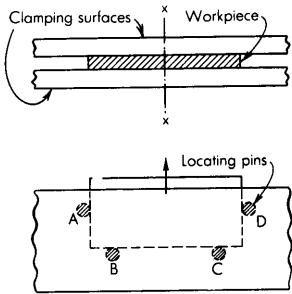
---

---

---

---

---



**Figure 4-23. Vertical locating with pins.**

February 5, 2008      Nageswara Rao Posinasetti      39

---

---

---

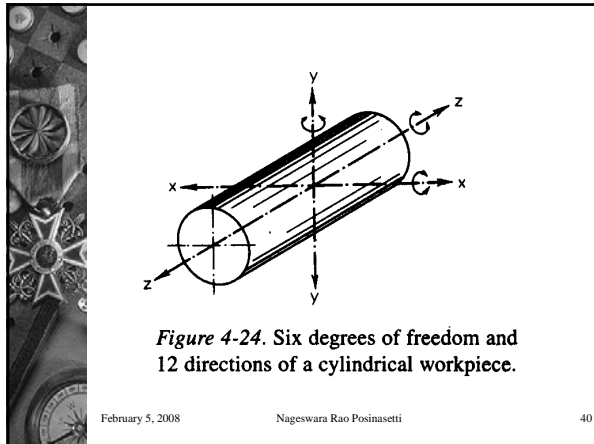
---

---

---

---

---




---

---

---

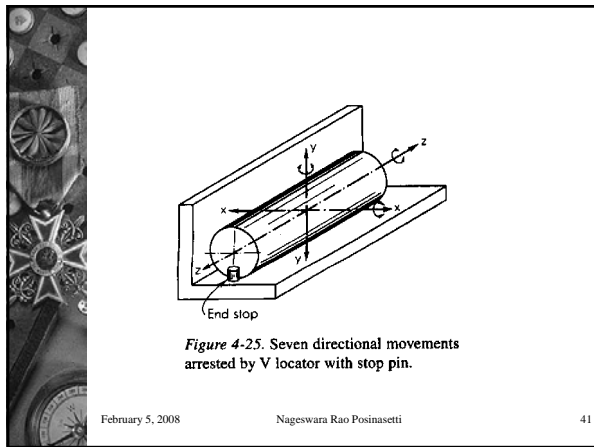
---

---

---

---

---




---

---

---

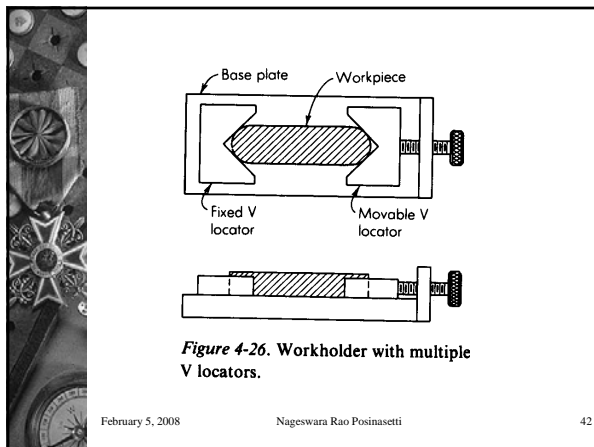
---

---

---

---

---




---

---

---

---

---

---

---

---

### V-locator error?

February 5, 2008      Nageswara Rao Posinasetti      43

---

---

---

---

---

---

---

---

### V-locator error?

February 5, 2008      Nageswara Rao Posinasetti      44

---

---

---

---

---

---

---

---

### Adjustable Locators

**Figure 4-33. Threaded adjustable locator.**

February 5, 2008      Nageswara Rao Posinasetti      45

---

---

---

---

---

---

---

---



## Support surfaces

- ◆ Select a surface where there is maximum likelihood for the part to deflect under the action of clamping and cutting forces.
- ◆ Support areas selected should not disturb the location of the workpiece in any manner nor displace the locators while providing the support.
- ◆ Support areas selected should not interfere with the loading and unloading of the component into the work holding fixture.

February 5, 2008

Nageswara Rao Posinasetti

46

---

---

---

---

---

---

---

---

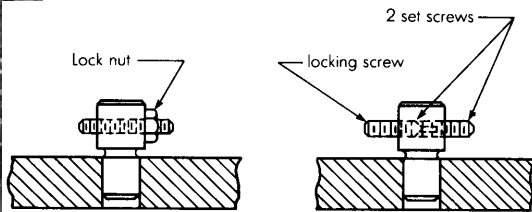


Figure 4-34. Adjustable locators with locknut or screw.

February 5, 2008

Nageswara Rao Posinasetti

47

---

---

---

---

---

---

---

---



## Adjustable Supports

- ◆ Adjustable locators positioned beneath the workpiece
  - Threaded
  - Spring
  - Equalizers

February 5, 2008

Nageswara Rao Posinasetti

48

---

---

---

---

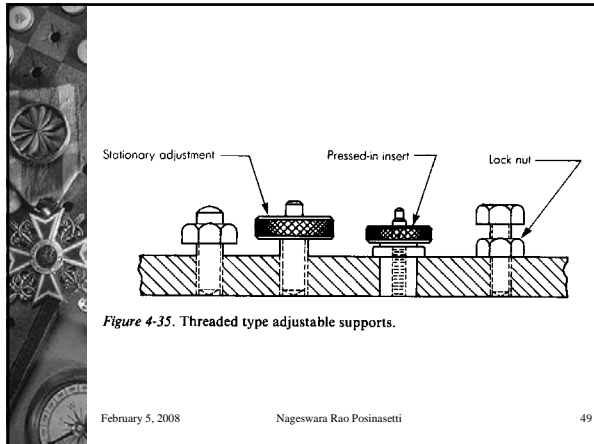
---

---

---

---






---

---

---

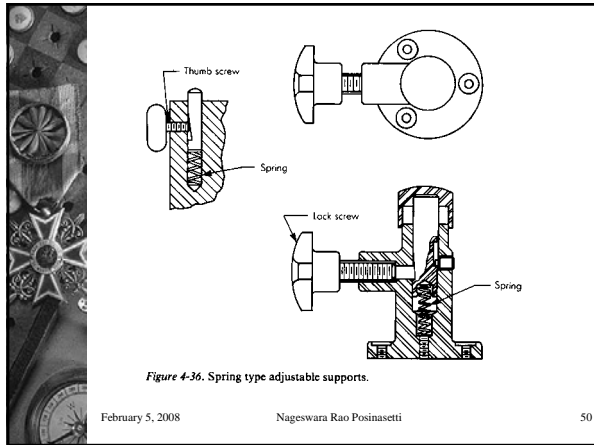
---

---

---

---

---




---

---

---

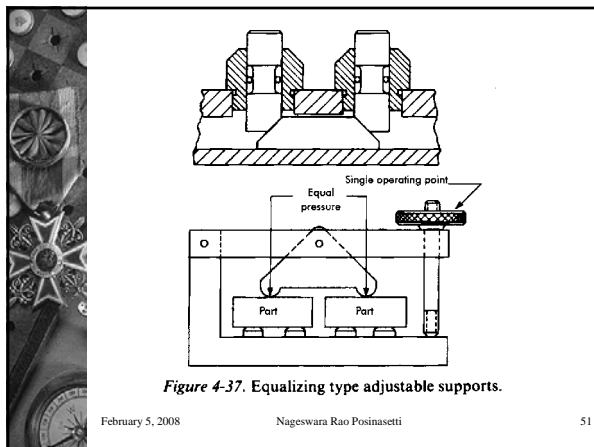
---

---

---

---

---




---

---

---

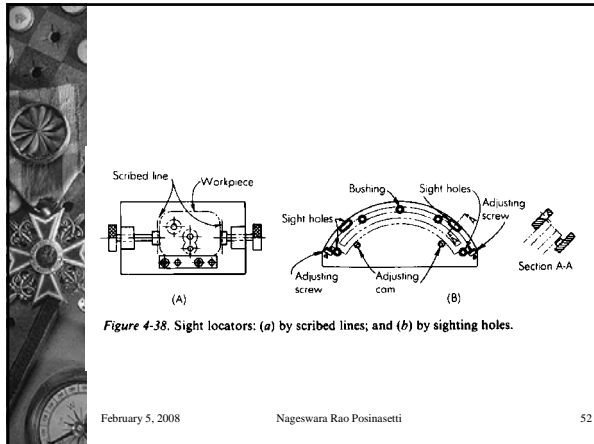
---

---

---

---

---



February 5, 2008

Nageswara Rao Posinasetti

52

---

---

---

---

---

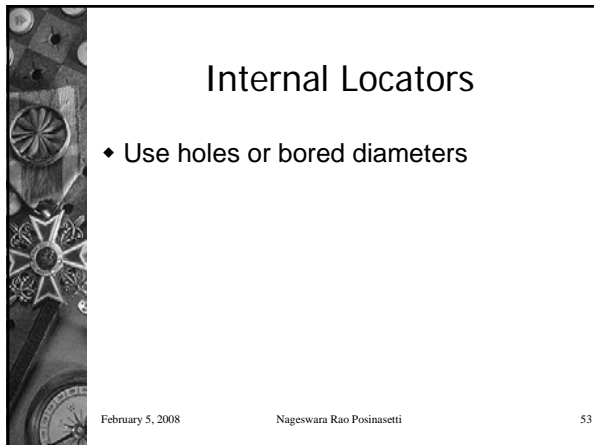
---

---

---

---

---



February 5, 2008

Nageswara Rao Posinasetti

53

---

---

---

---

---

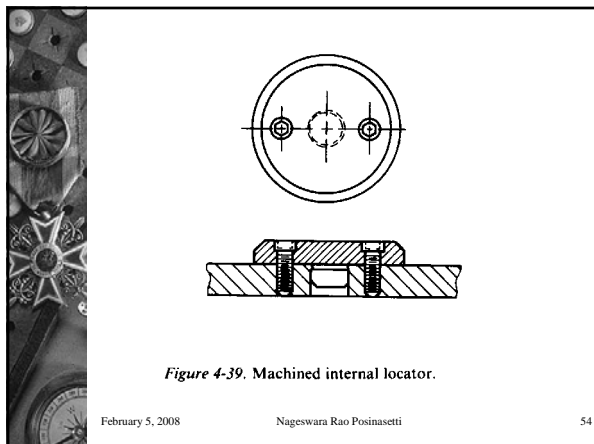
---

---

---

---

---



February 5, 2008

Nageswara Rao Posinasetti

54

---

---

---

---

---

---

---

---

---

---

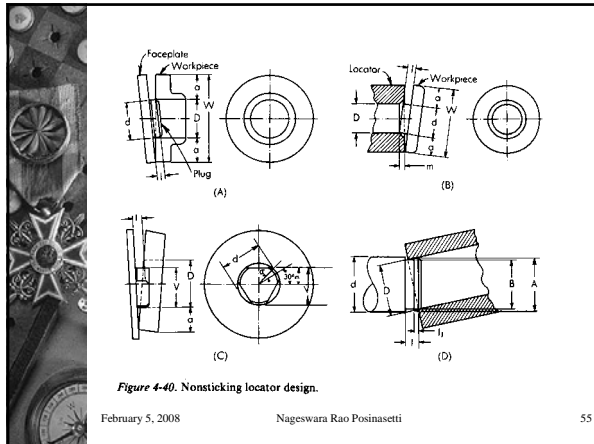


Figure 4-40. Nonsticking locator design.

February 5, 2008

Nageswara Rao Posinasetti

55

---

---

---

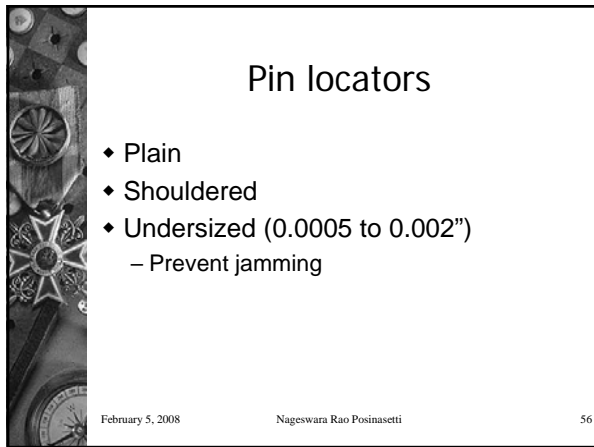
---

---

---

---

---



## Pin locators

- ◆ Plain
- ◆ Shouldered
- ◆ Undersized (0.0005 to 0.002")
  - Prevent jamming

February 5, 2008

Nageswara Rao Posinasetti

56

---

---

---

---

---

---

---

---

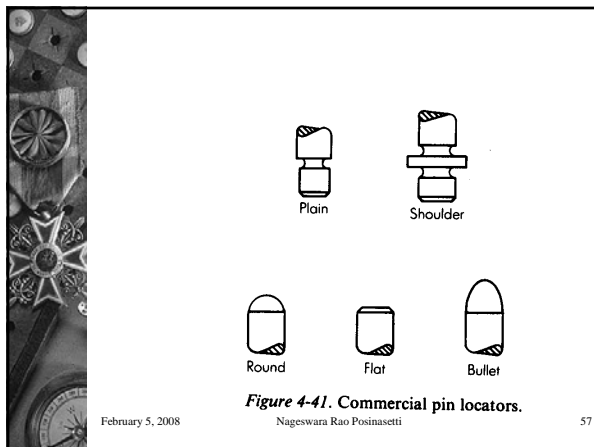


Figure 4-41. Commercial pin locators.

February 5, 2008

Nageswara Rao Posinasetti

57

---

---

---

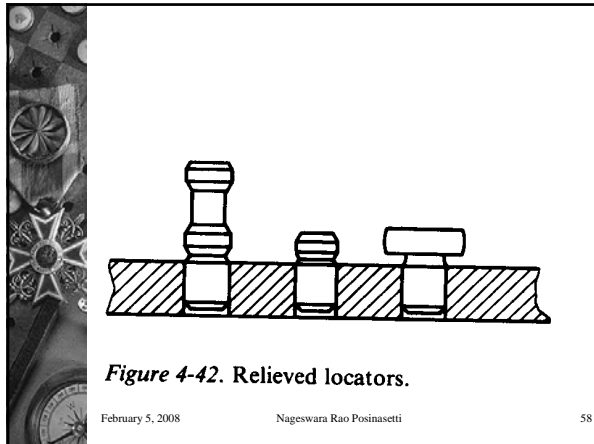
---

---

---

---

---




---

---

---

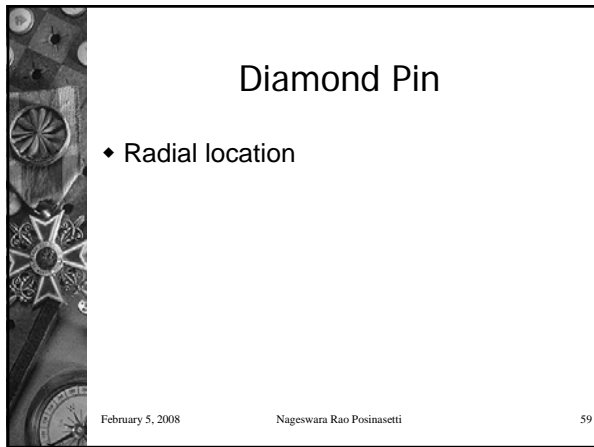
---

---

---

---

---




---

---

---

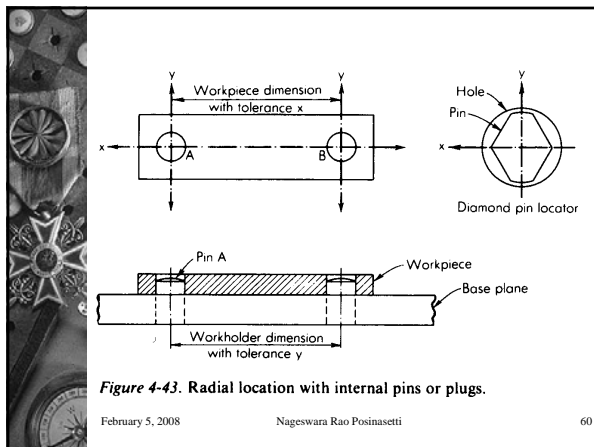
---

---

---

---

---




---

---

---

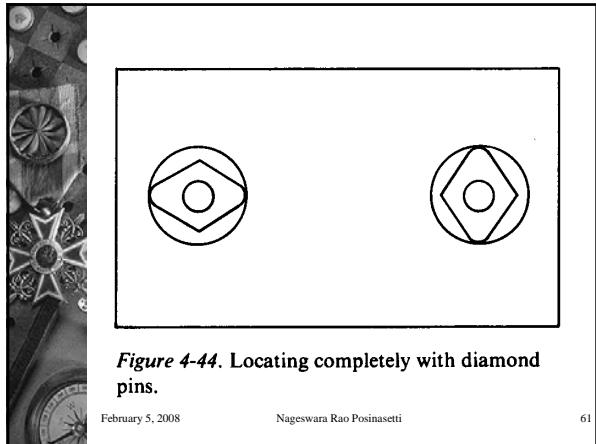
---

---

---

---

---




---

---

---

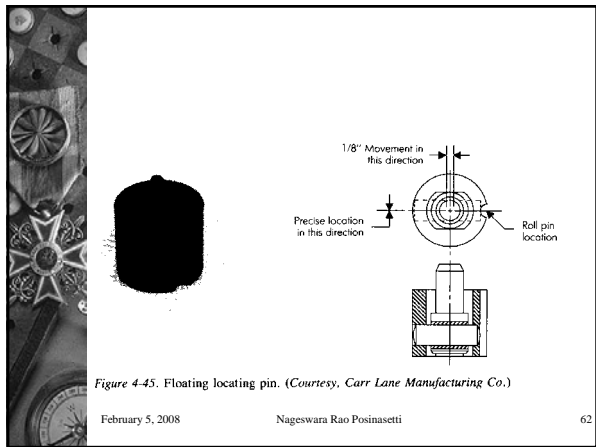
---

---

---

---

---




---

---

---

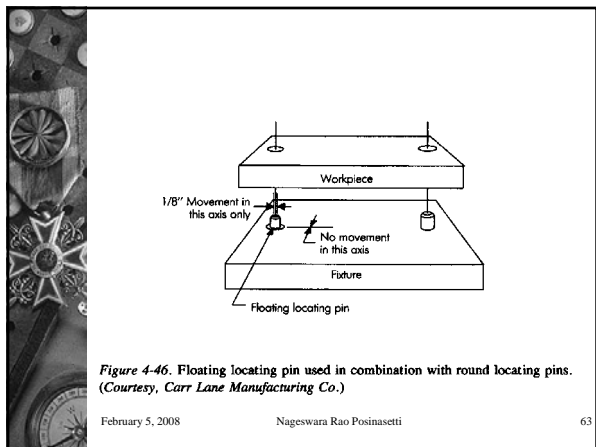
---

---

---

---

---




---

---

---

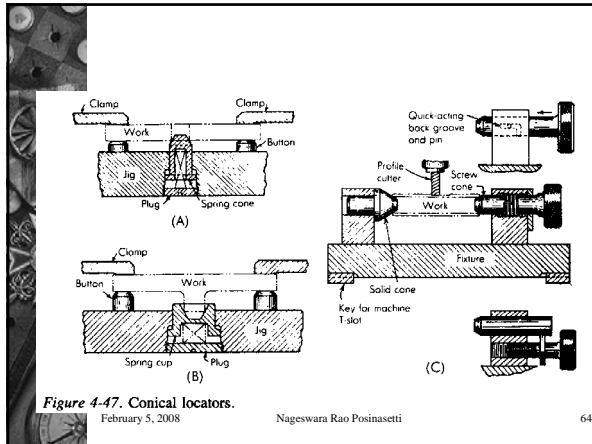
---

---

---

---

---




---

---

---

---

---

---

---

---

## Chip and Burr Problems

- ◆ Make locators easy to clean
  - Small and hard
  - Open jigs
- ◆ Make them self cleaning
  - Edge relief around locators
  - wipers
- ◆ Protect them

February 5, 2008 Nageswara Rao Posinasetti 65

---

---

---

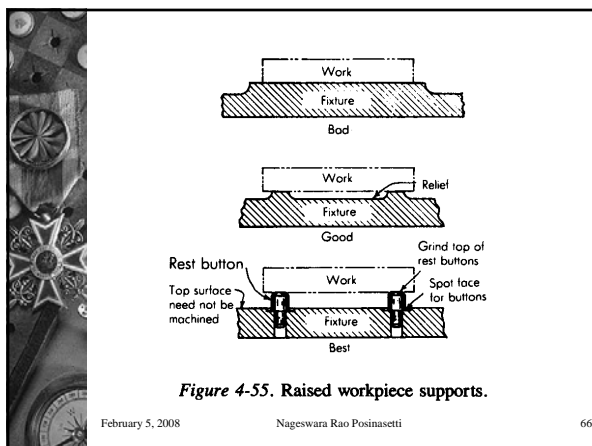
---

---

---

---

---




---

---

---

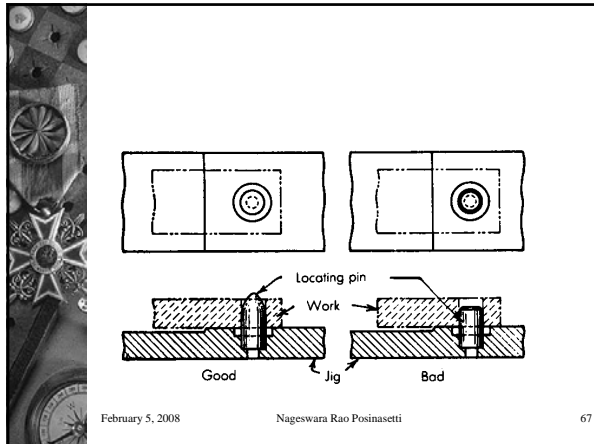
---

---

---

---

---




---

---

---

---

---

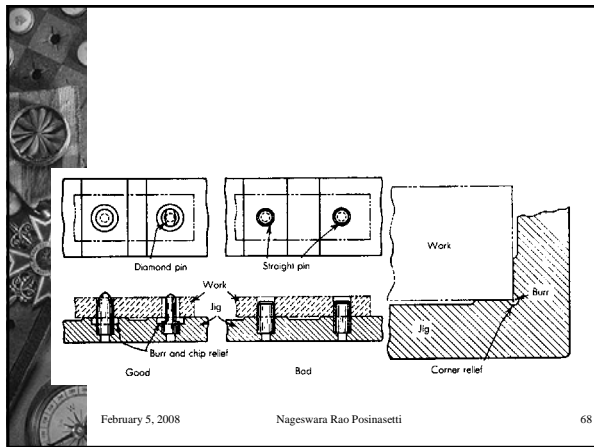
---

---

---

---

---




---

---

---

---

---

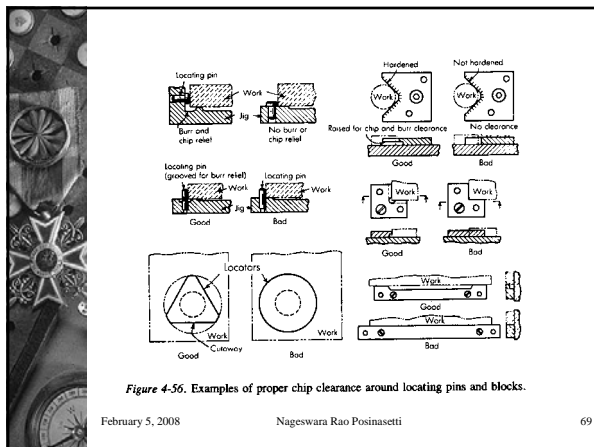
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---





<http://www.carrlane.com/>

Home | Online Catalog | Free Price Catalog | About Car Lane | CAD/CAM Drawings

CAD/CAM Drawings Available For 5RP  
(Drawings last updated on: 01/30/2004)

2-D	DWG			DXF			IGES		
	Top View 0201-2102	Left View 0201-2102	Right View 0201-2102	Top View 0201-2102	Left View 0201-2102	Right View 0201-2102	Top View 0201-2102	Left View 0201-2102	Right View 0201-2102
	Left View 0201-2102	Front View 0201-2102	Back View 0201-2102	Left View 0201-2102	Front View 0201-2102	Back View 0201-2102	Left View 0201-2102	Front View 0201-2102	Back View 0201-2102
3-D	DWG			DXF			IGES		
	SRP.DWG			SRP.DXF			SRP.IGS		
3-D				IGES					
				SRP.IGS					

Download FAQ & Help

Auto-generated on Fri Apr 29 10:40:03 2005 - Copyright © 2005 - Carr Lane Mfg. Co

February 5, 2008 Nageswara Rao Posinasetti 73



<http://www.jergensinc.com/>

**Jergens** The Standard Components With the Highest Standards

Home Page | Advanced Search | Business Catalog

Product Search:  Search by Part Number

Business Units:

News and Highlights:
 

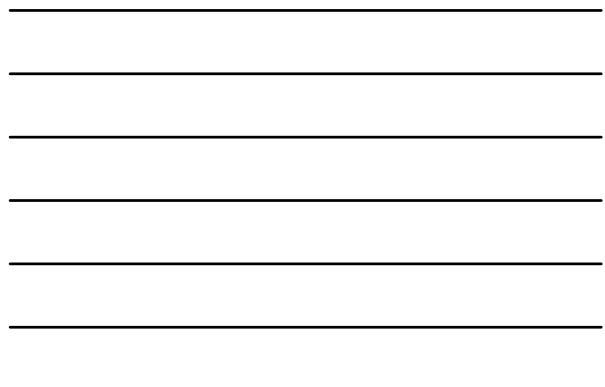
- [New! Chain Drive Headstock Tensioning Pin...](#)
- [Control Center Full Mount Ring...](#)
- [CAD Demonstration of Ball Lock™ Headstock Earth...](#)
- [Ball Lock™ Chain Link for Chain Headstock, CA...](#)
- [Flywheel Pin, Precision J & B...](#)
- [New! Precision Electronic Chain Drive...](#)
- [Durable Flywheel Chain Drive...](#)
- [Ball Lock Applications - Manufacturer #3...](#)
- [Ball Lock Applications - Manufacturer #2...](#)

Featured Products:
 

- [Control Pin Study Assembly Capable](#)
- [Ball Lock™ Headstock Earth](#)
- [Flywheel Components Catalog](#)
- [Ball Lock™ Precision Chain Drive](#)
- [Ball Lock™ Precision Chain Drive](#)

Copyright © 2005 Jergens Inc. All Rights Reserved.

February 5, 2008 Nageswara Rao Posinasetti 74



<http://www.jergensinc.com/>

**Jergens** The Standard Components With the Highest Standards

Home | My Account | Product Information | Catalog | Search | Customer Service | Site Map

Locating Components

<a href="#">Component Link, 1/8" Dia. 7'</a>	<a href="#">Ball Drive, 1/8" Dia. 7'</a>
<a href="#">Ball Drive, 1/8" Dia. 7'</a>	<a href="#">Ball Drive, 1/8" Dia. 7'</a>
<a href="#">Ball Drive, 1/8" Dia. 7'</a>	<a href="#">Ball Drive, 1/8" Dia. 7'</a>
<a href="#">Ball Drive, 1/8" Dia. 7'</a>	<a href="#">Ball Drive, 1/8" Dia. 7'</a>
<a href="#">Ball Drive, 1/8" Dia. 7'</a>	<a href="#">Ball Drive, 1/8" Dia. 7'</a>
<a href="#">Ball Drive, 1/8" Dia. 7'</a>	<a href="#">Ball Drive, 1/8" Dia. 7'</a>
<a href="#">Ball Drive, 1/8" Dia. 7'</a>	<a href="#">Ball Drive, 1/8" Dia. 7'</a>

February 5, 2008 Nageswara Rao Posinasetti 75



<http://www.jergensinc.com/>

**Jergens**  
The Highest Quality Pins with the Highest Standards

Locating Components  
Locating Pins-Slip Fit / Round & Relieved

Slots range from .015" to .1" Round Diameter. Made in stainless steel and steel alloys for marking as well as with a shoulder to act as a retainer. Used in building applications, also pins with built-in lock screws feature. Consult us for both dimensions to best achieve .002 throughout. The cone is set back. For special applications, we will provide "M" dimensions to your specifications.

- Material: Low Carbon Steel
- Lead Thread: Case hardened to H11-12/28.
- Available in hexagonal, hexagonal and hexagonal.

February 5, 2008 Nageswara Rao Posinasetti 76

---

---

---

---

---

---

---

---

---

---

---

---

<http://www.jergensinc.com/>

**Jergens**  
The Highest Quality Pins with the Highest Standards

ROUND

RELIEVED

Click on Part No. for Pin's Details

Part Number	Size	A	B	C	D	E	F	G	H
20181	Round	1.045	.914	1.314	.518	.68	.3344	.152	1.68
20182	Round	1.401	.914	1.314	.518	.68	.3344	.152	1.68
20183	Round	1.758	.914	1.314	.518	.68	.3344	.152	1.68
20184	Round	2.114	.914	1.314	.518	.68	.3344	.152	1.68
20185	Round	2.471	.914	1.314	.518	.68	.3344	.152	1.68
20186	Round	2.827	.914	1.314	.518	.68	.3344	.152	1.68
20187	Round	3.184	.914	1.314	.518	.68	.3344	.152	1.68
20188	Round	3.541	.914	1.314	.518	.68	.3344	.152	1.68
20189	Round	3.897	.914	1.314	.518	.68	.3344	.152	1.68
20190	Round	4.254	.914	1.314	.518	.68	.3344	.152	1.68
20191	Round	4.611	.914	1.314	.518	.68	.3344	.152	1.68
20192	Round	4.967	.914	1.314	.518	.68	.3344	.152	1.68
20193	Round	5.324	.914	1.314	.518	.68	.3344	.152	1.68
20194	Round	5.681	.914	1.314	.518	.68	.3344	.152	1.68
20195	Round	6.037	.914	1.314	.518	.68	.3344	.152	1.68
20196	Round	6.394	.914	1.314	.518	.68	.3344	.152	1.68
20197	Round	6.751	.914	1.314	.518	.68	.3344	.152	1.68
20198	Round	7.107	.914	1.314	.518	.68	.3344	.152	1.68
20199	Round	7.464	.914	1.314	.518	.68	.3344	.152	1.68
20200	Round	7.821	.914	1.314	.518	.68	.3344	.152	1.68

February 5, 2008 Nageswara Rao Posinasetti 77

---

---

---

---

---

---

---

---

---

---

---

---

<http://www.jergensinc.com/>

**Jergens**  
The Highest Quality Pins with the Highest Standards

Please Note: Requires Visioport Media Player to preview the solid model.  
If the security window opens you may click yes to download and the preview will open automatically.

Download  
2D Version  
3D Version

Product Support  
Comment, Complaint, Error, Part  
Send back, not doing as  
format?  
Training

Home Product Support

Click Link: This pin are manufactured in a wide range of sizes to meet any application.

3D PartStream.NET®  
by SolidWorks

February 5, 2008 Nageswara Rao Posinasetti 78

---

---

---

---

---

---

---

---

---

---

---

---