

# Aluminum Crack Repair

Without Welding

# Topics

- **Crack detection/inspection**
- **Metal stitching**
- **Threaded hole repair**

# Crack Detection

- Visual
- Pressure testing
- Dye-penetrant

# Visual

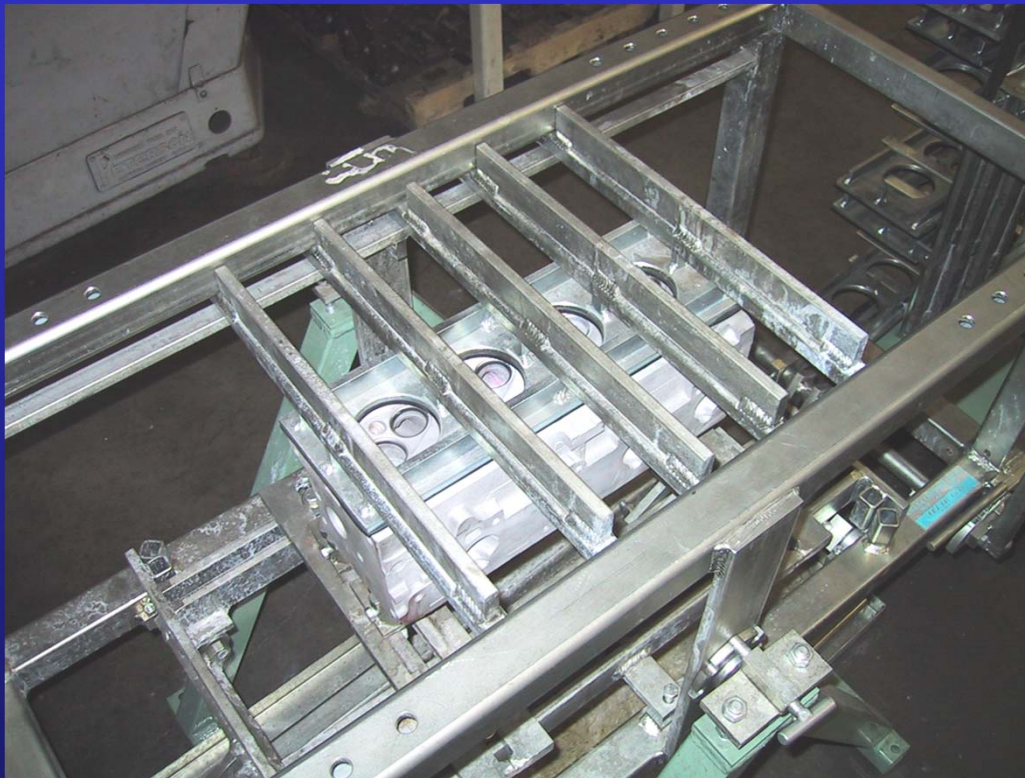
- Practiced by many as the only way of finding cracks.
- You wouldn't inspect cast iron this way.
- Inconclusive.
- You cannot find the ends of the crack.



# After Dye-Penetrant Inspection



# Pressure Testing



- Only shows cracks that leak.
- Helps determine the extent of the repair needed.
- Must be done following any repair.

# Dye-Penetrant

- Cleaner
- Penetrant
- Developer



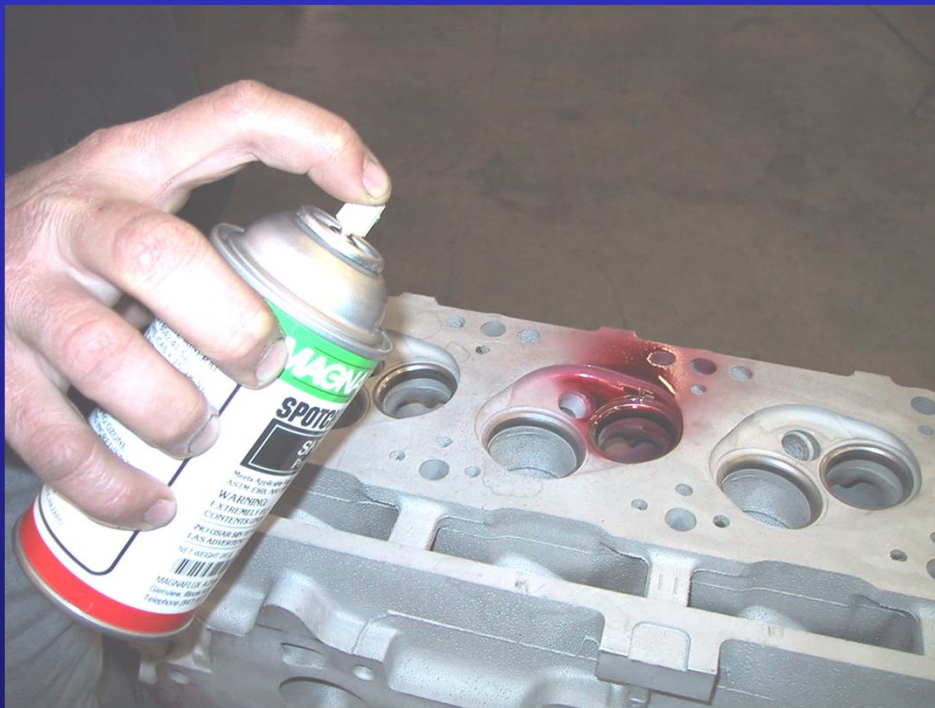
# Cleaner

- Do not use to clean the test area.
- Do not spray directly on the test area.
- Spray only on a dry shop towel or other clean cloth.



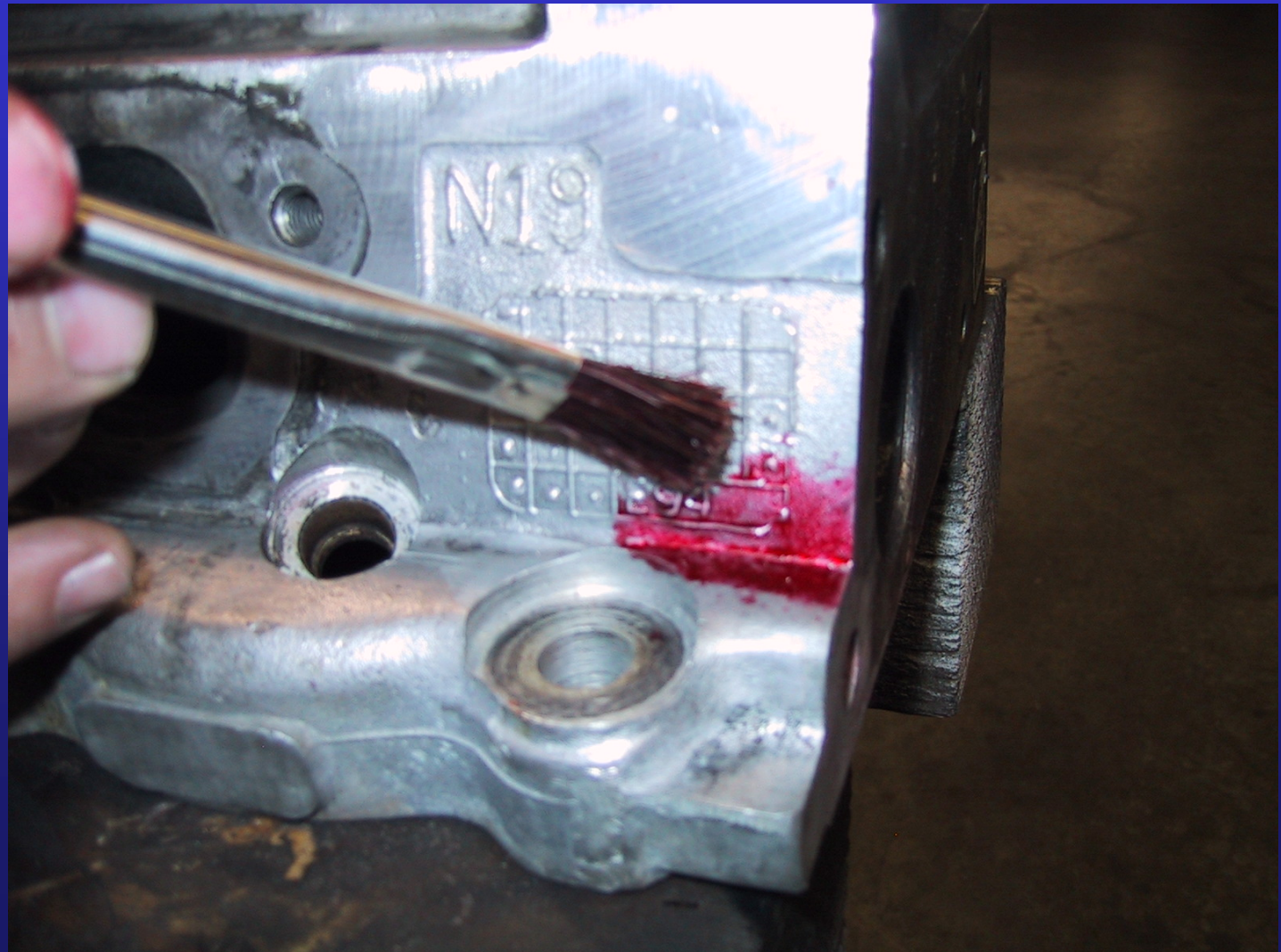


# Penetrant



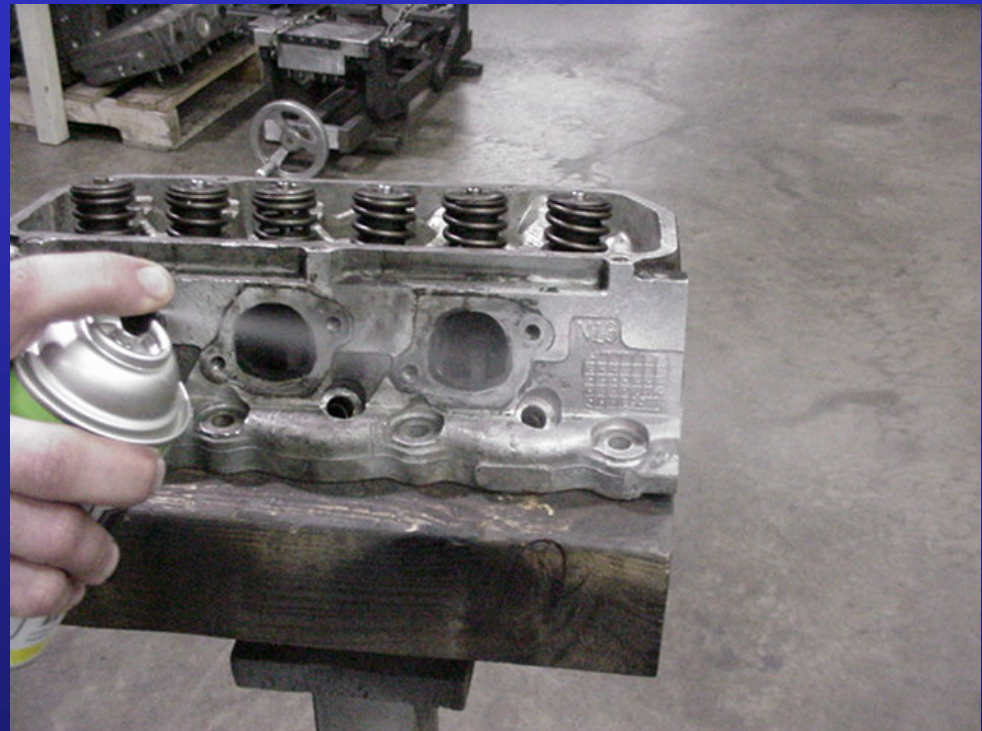
- Use small amount.
- Can be applied with a brush.
- Messy, difficult to remove.
- You must wipe as much as possible off before applying the developer.

# Applying Penetrant With a Brush



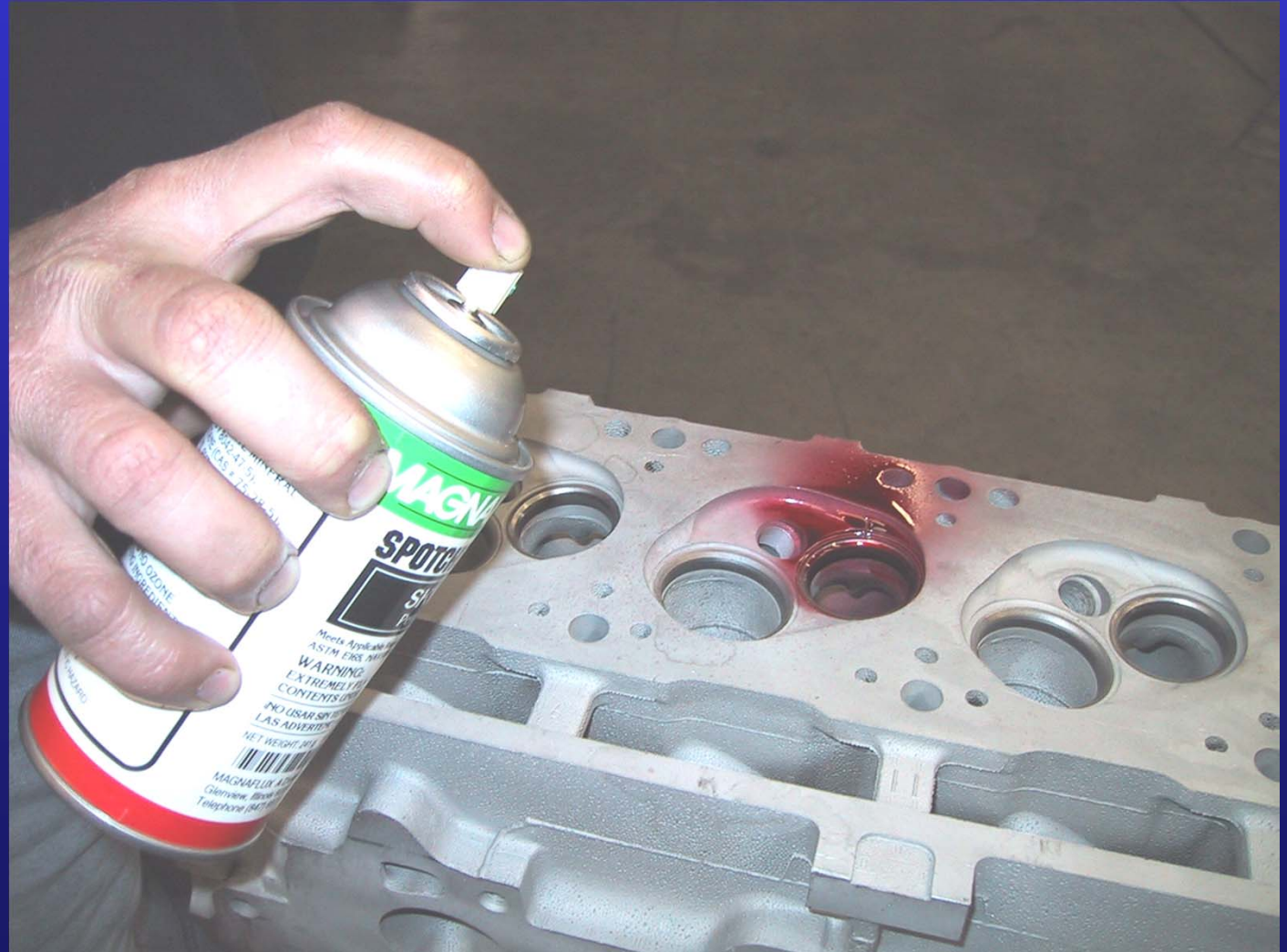
# Developer

- Test area must be wiped clean of penetrant by applying cleaner to the cloth before applying developer.
- Apply developer as dry as possible. Use compressed air to speed drying process.



# Step by step procedure

1



# Step by step procedure

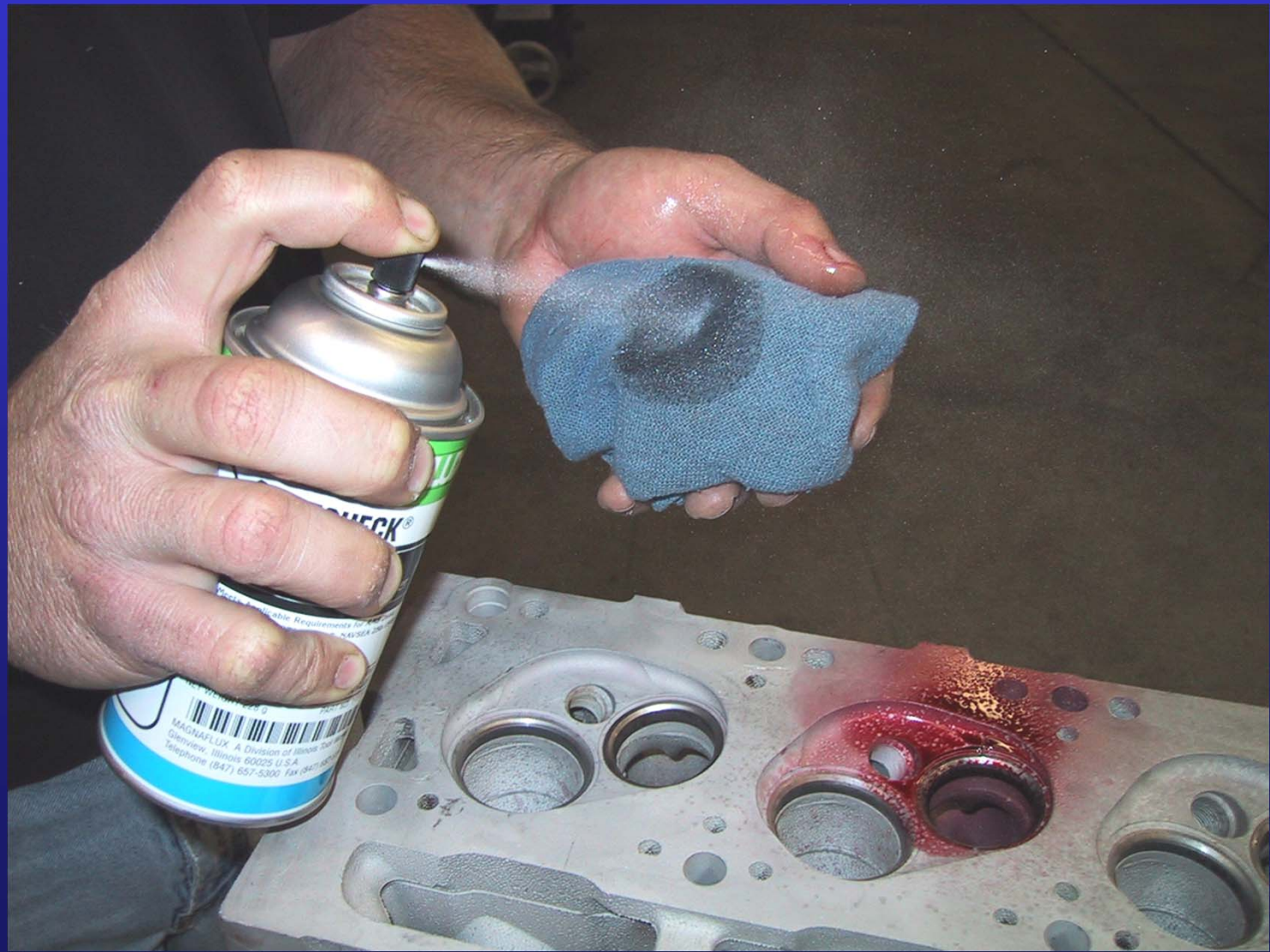
②

Wait 5 minutes



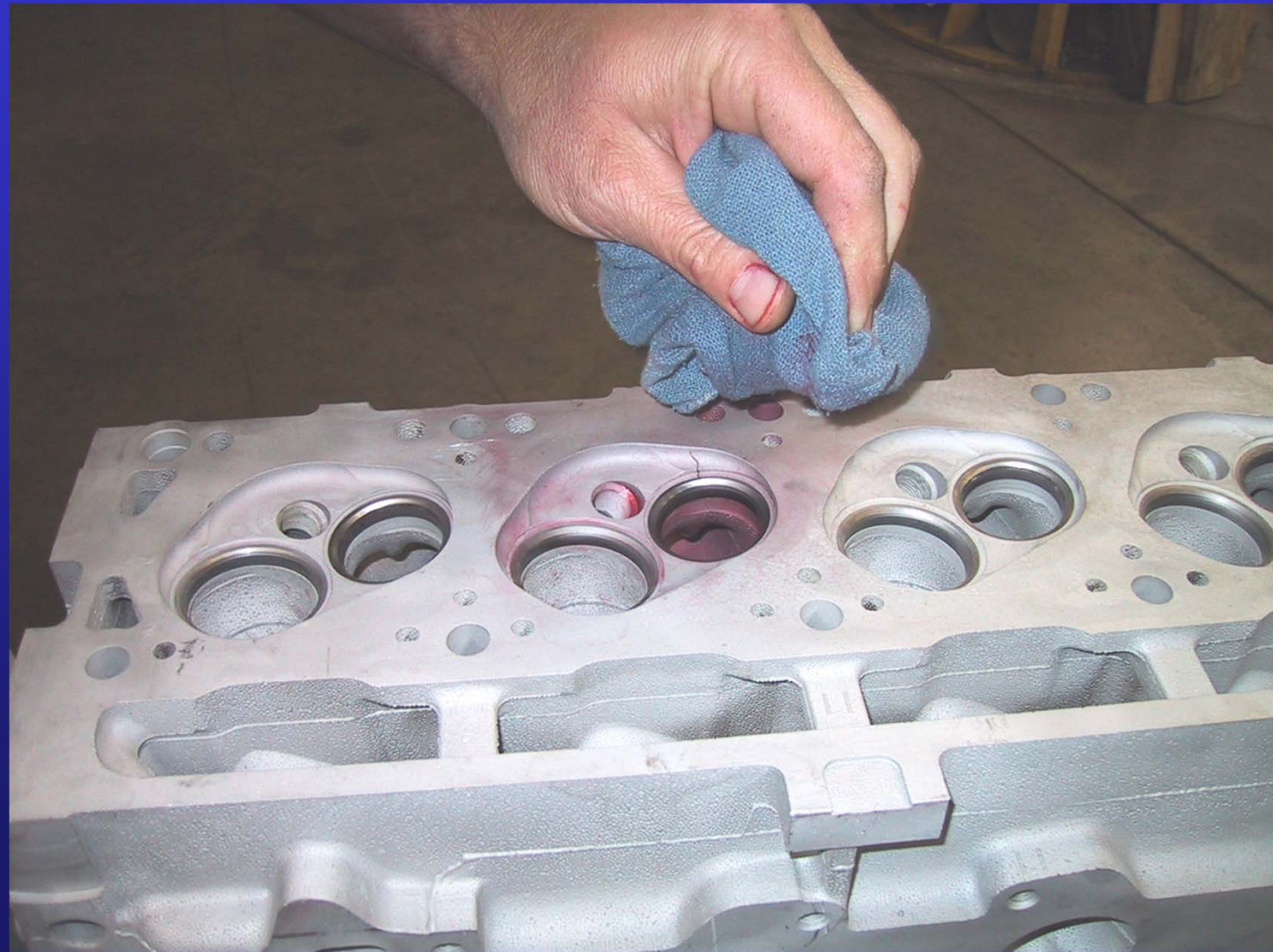
# Apply cleaner to clean cloth

3



Wipe off all visible penetrant

4



Keep cleaning until all penetrant is gone

5





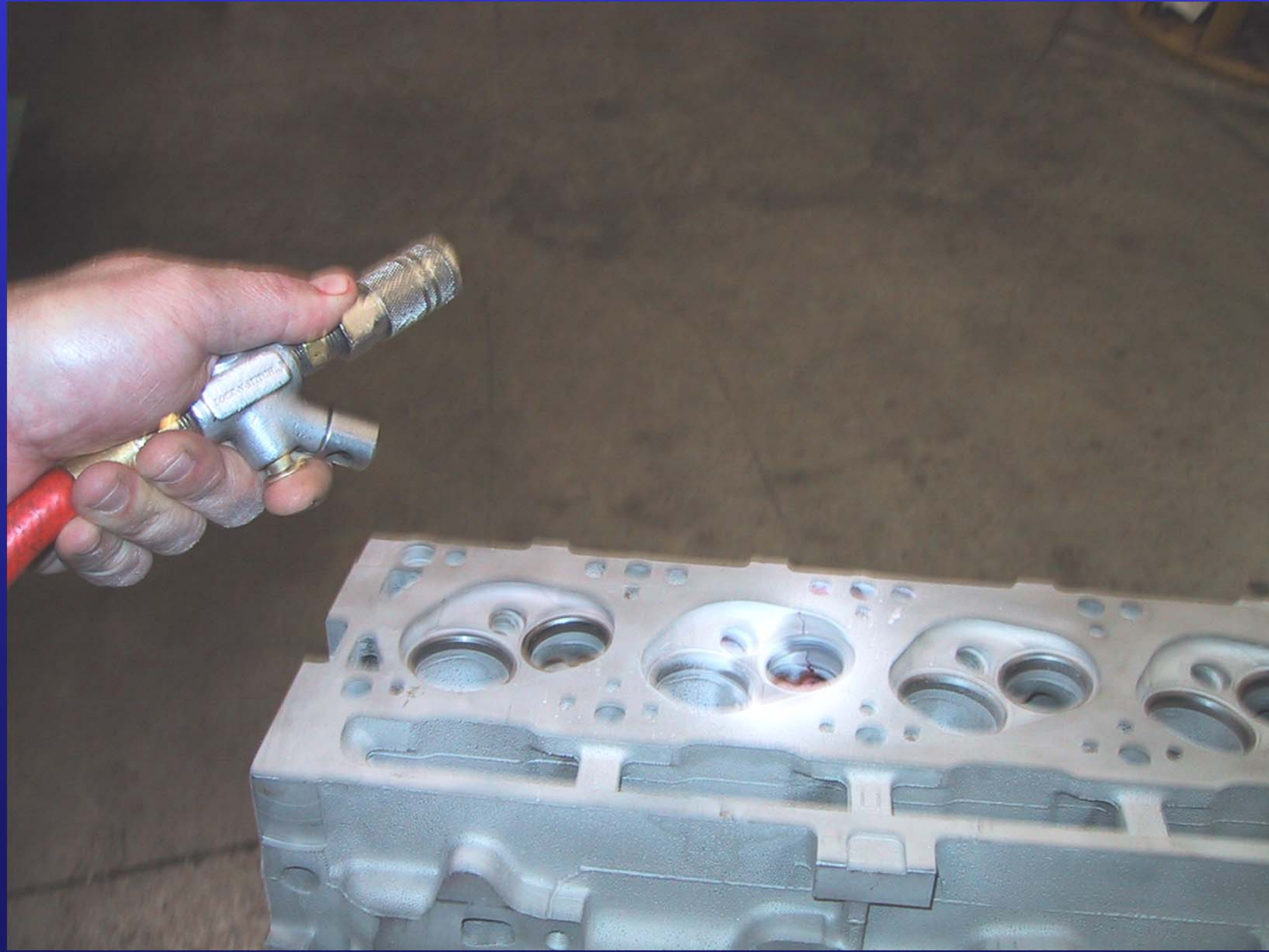
# Spray on developer very dry

6



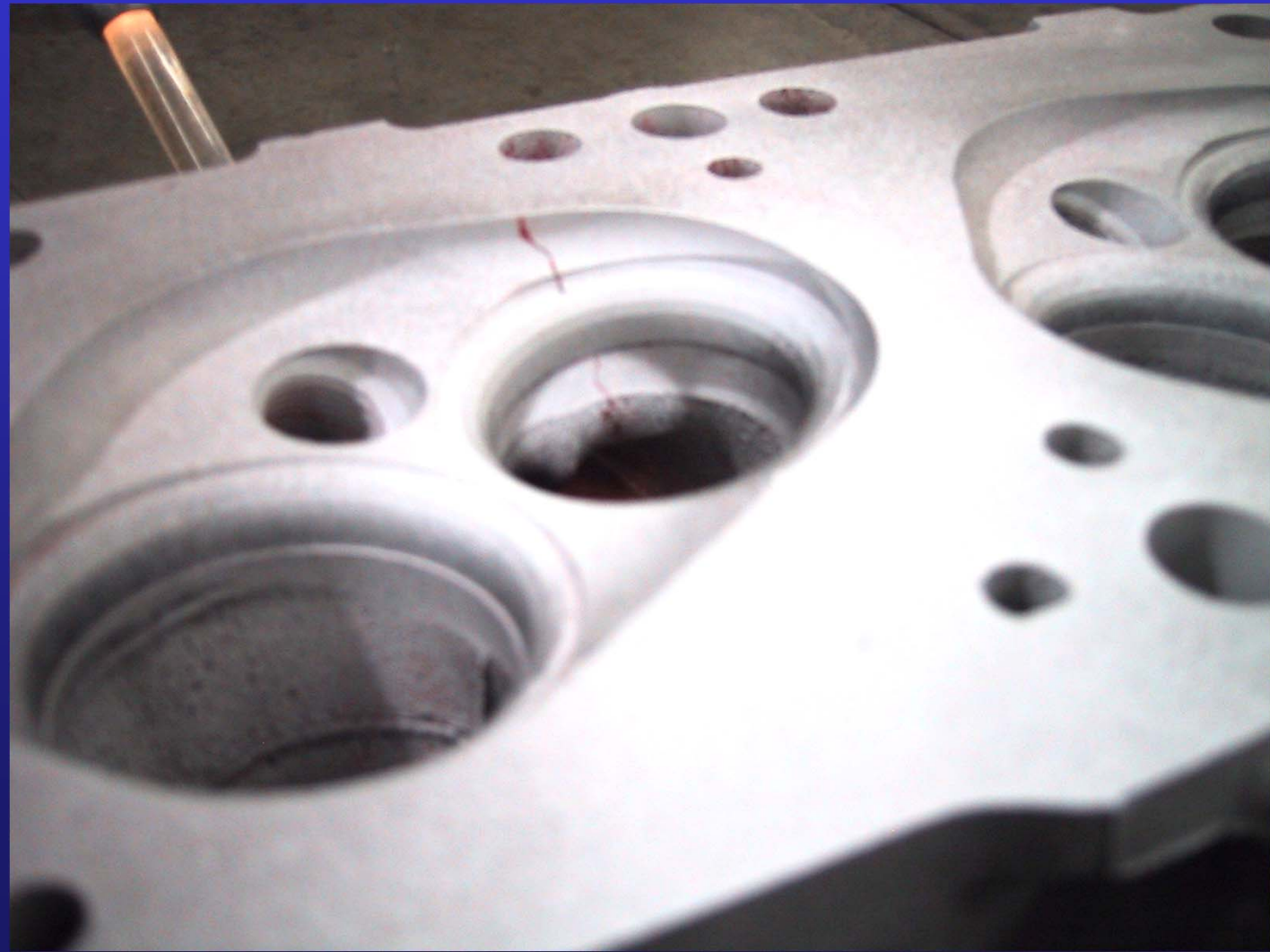
Use compressed air to accelerate drying

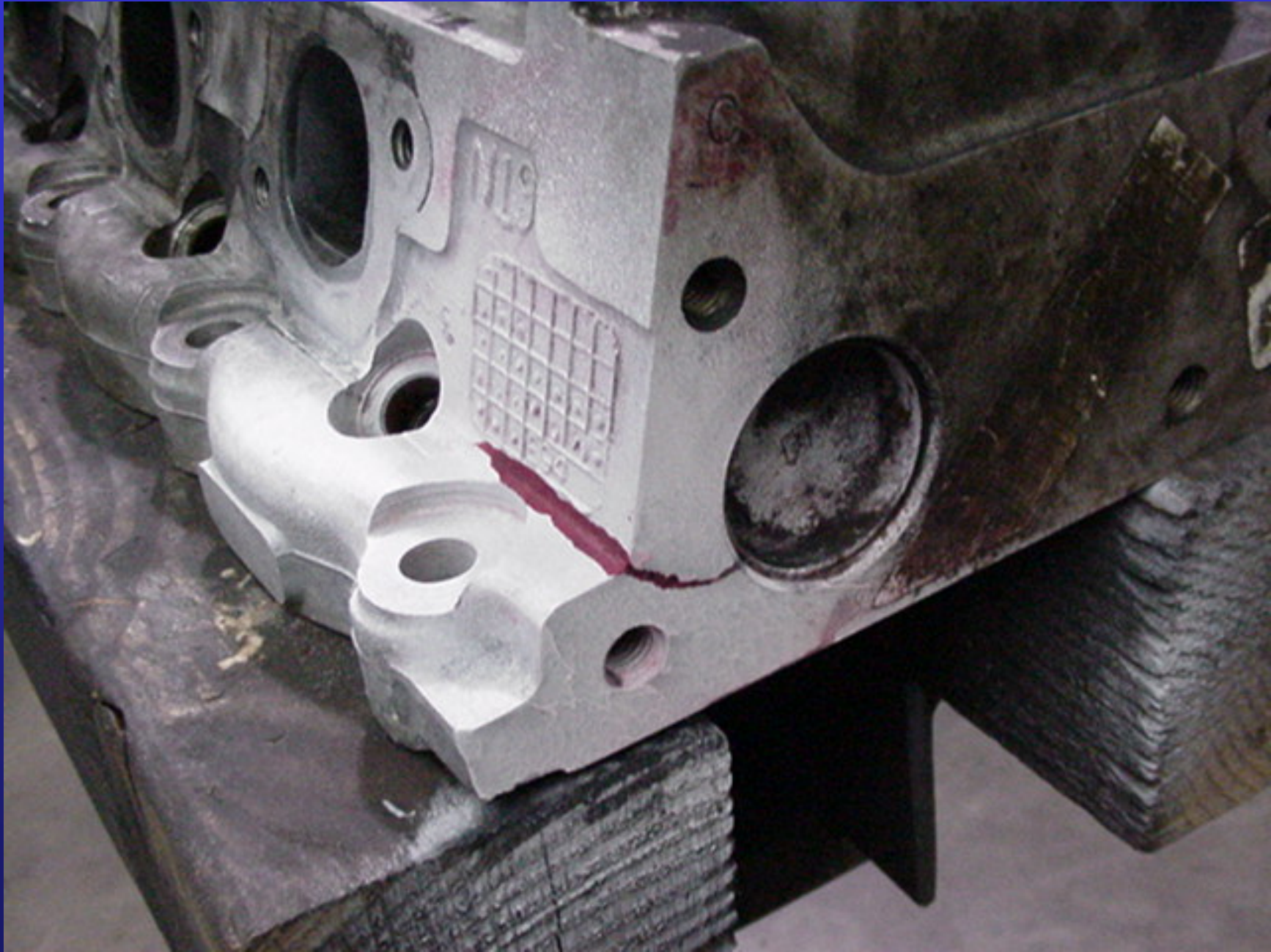
7



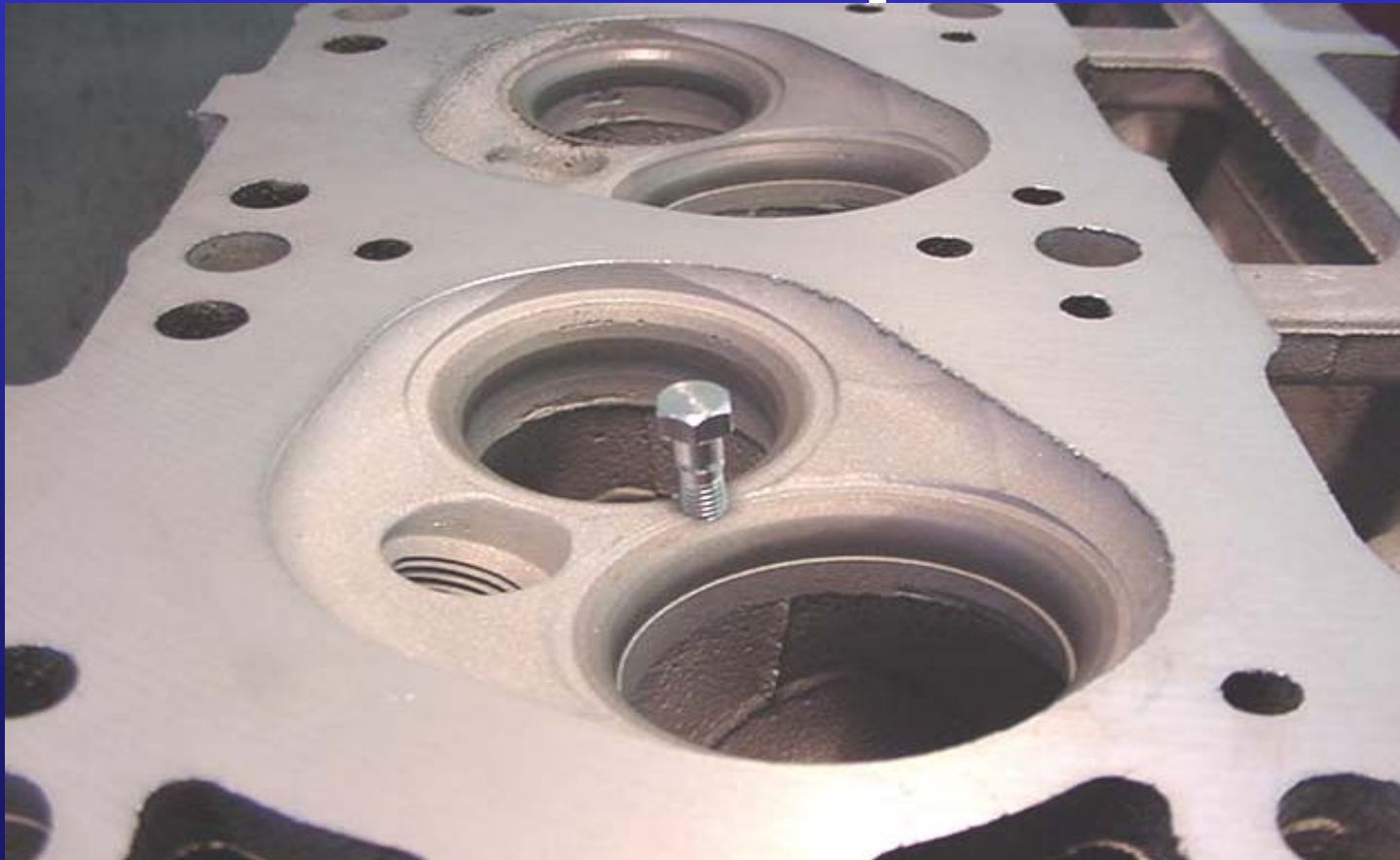
Wait 1 minute before  
inspecting

8



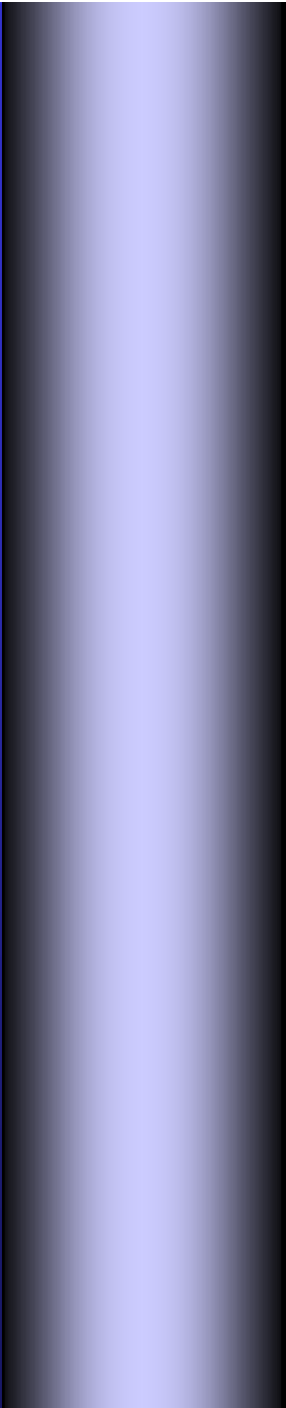


# Metal Stitching or Cold Repair



# Objective

- 1. Stop leaks**
- 2. Prevent crack propagation**
- 3. Structural integrity**
- 4. Prevent seats from coming out**
- 5. Remove the crack for cosmetic reasons**
- 6. \$\$\$**



# **Two** Types of Stitching Pins

# Standard Threaded Pins

- **Straight thread L Series pins**
- **Seal by interference fit of the threads**
- **Exert spreading pressure**
- **For sealing, seat retention and crack removal**





# **CASTMASTER** Threaded Pins



- **Spiralhook threads**
- **Radial drawing force creates structural integrity**
- **Not used for seat retention**
- **Seal leaks**
- **Prevent crack propagation**

# Working With Aluminum

- **Requires cutting fluid for drilling and tapping.**
- **Galls easily.**
- **Cuts easier than cast iron.**
- **Very easy to oversize and egg-shape drilled holes.**
- **Aluminum stitching pins are required in combustion chambers of cylinder heads.**
- **Steel pins can be used for structural repairs.**

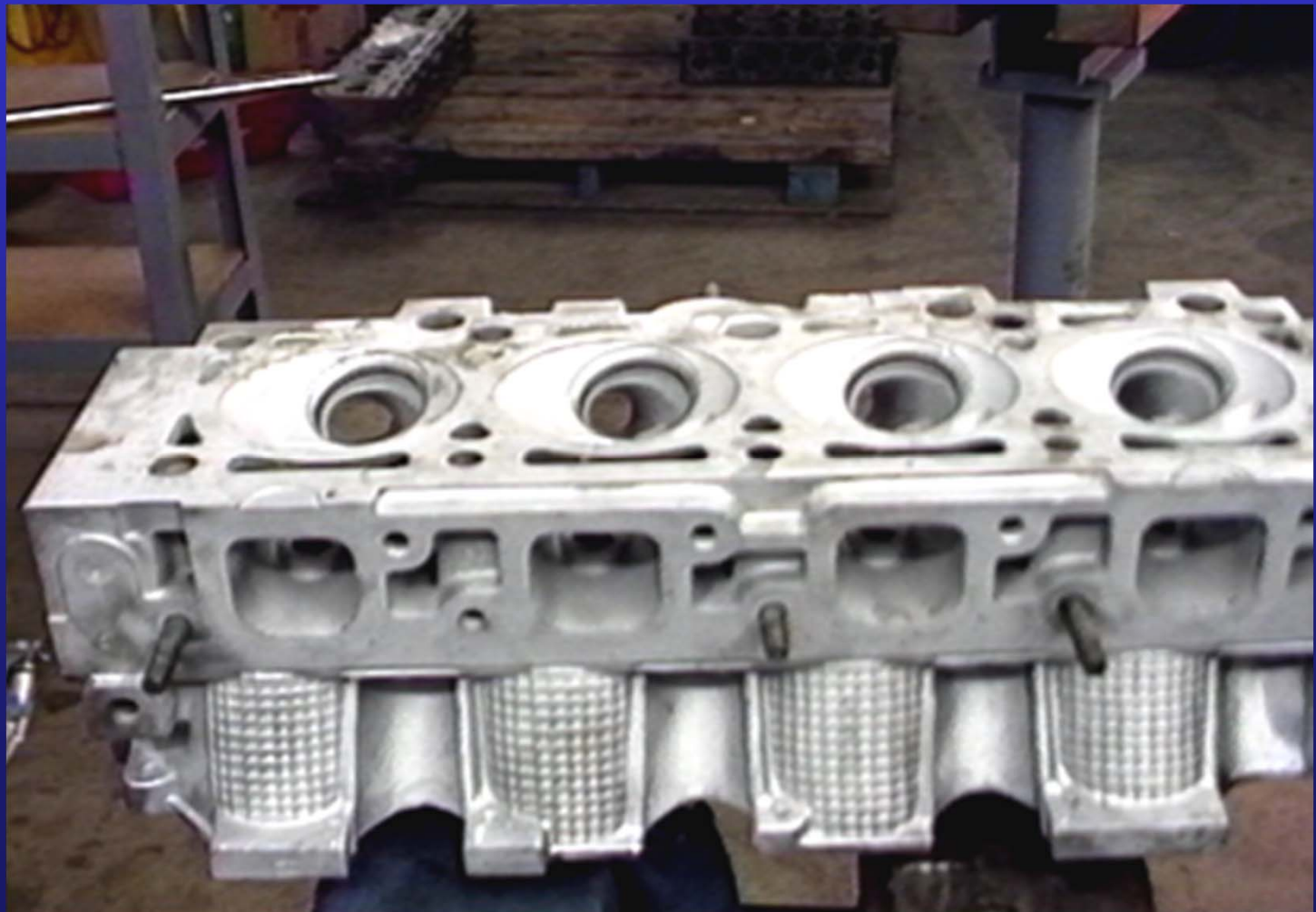
# Cylinder Heads

- **Many cracks can be repaired without removing the seat inserts by using L Series pins.**
- **Do not drill into water if the crack does not leak.**
- **When the crack does leak you must install pins under and behind the seat to stop the leak.**

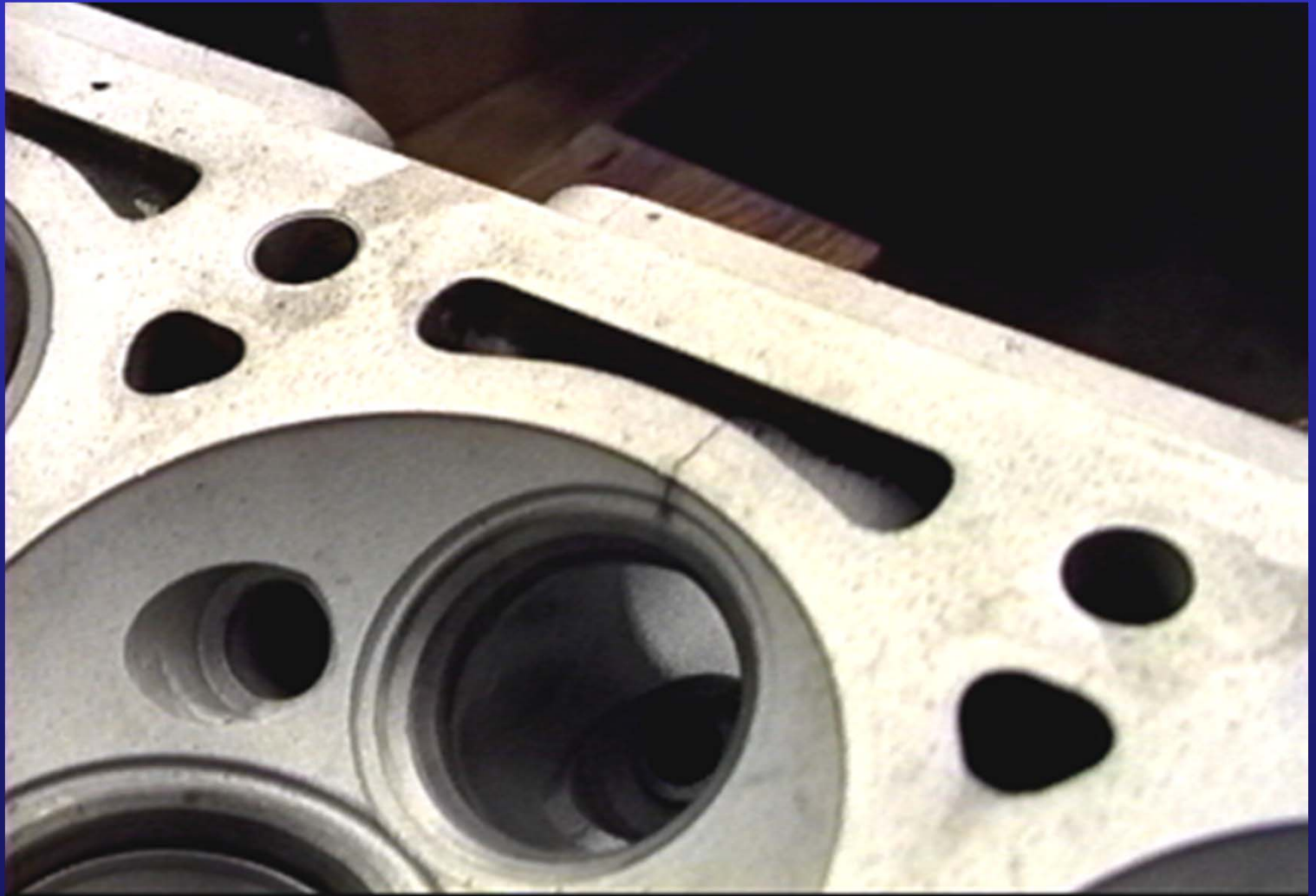
# Cylinder Heads

- Only when the crack goes between two seats can you use a steel pin.
- Cracks on the top side and between cylinders on the deck surface require **CASTMASTER** pins for structural integrity.

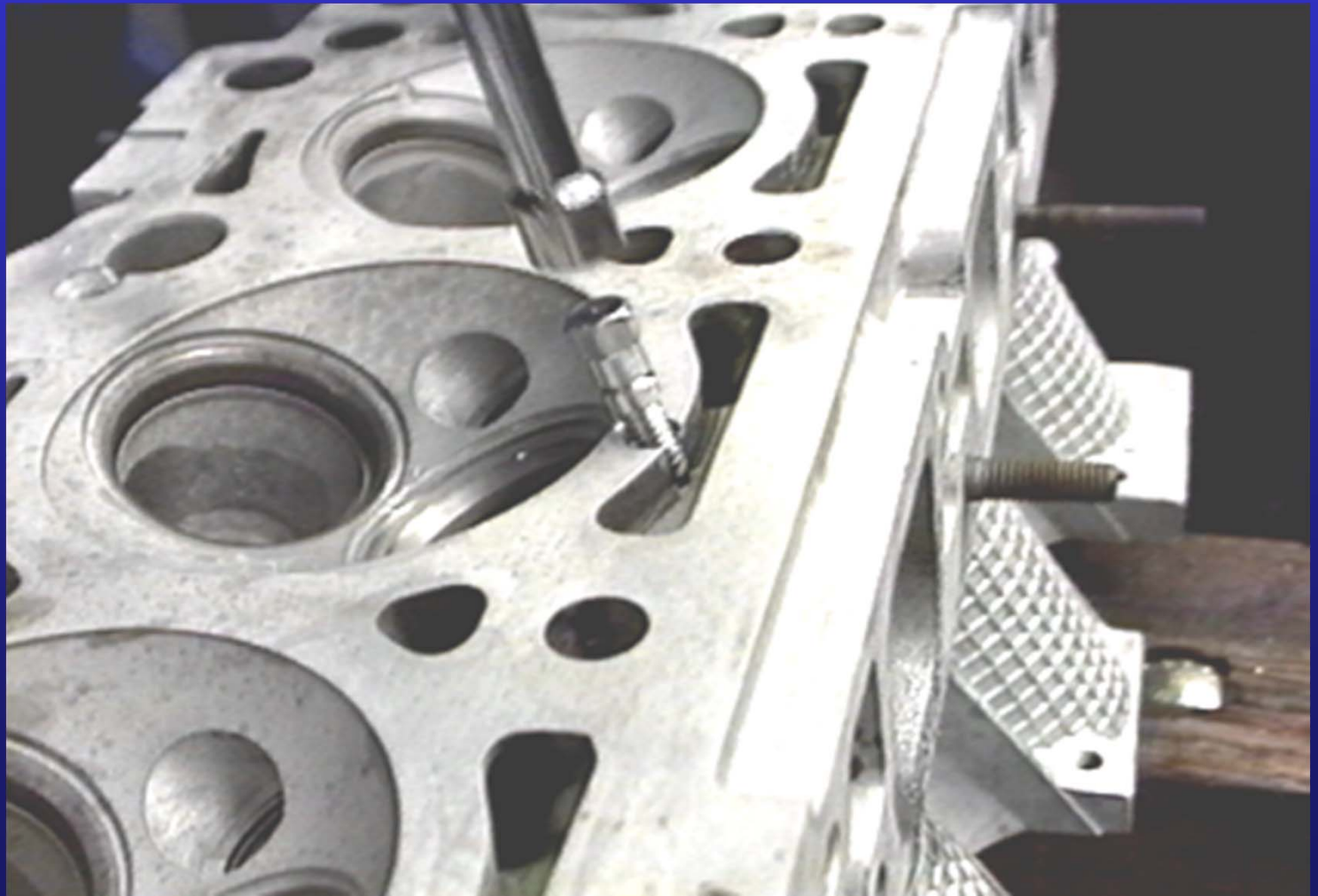
# Ford Escort cylinder head



# Crack over exhaust port



# Install C1 CASTMASTER stitching pin

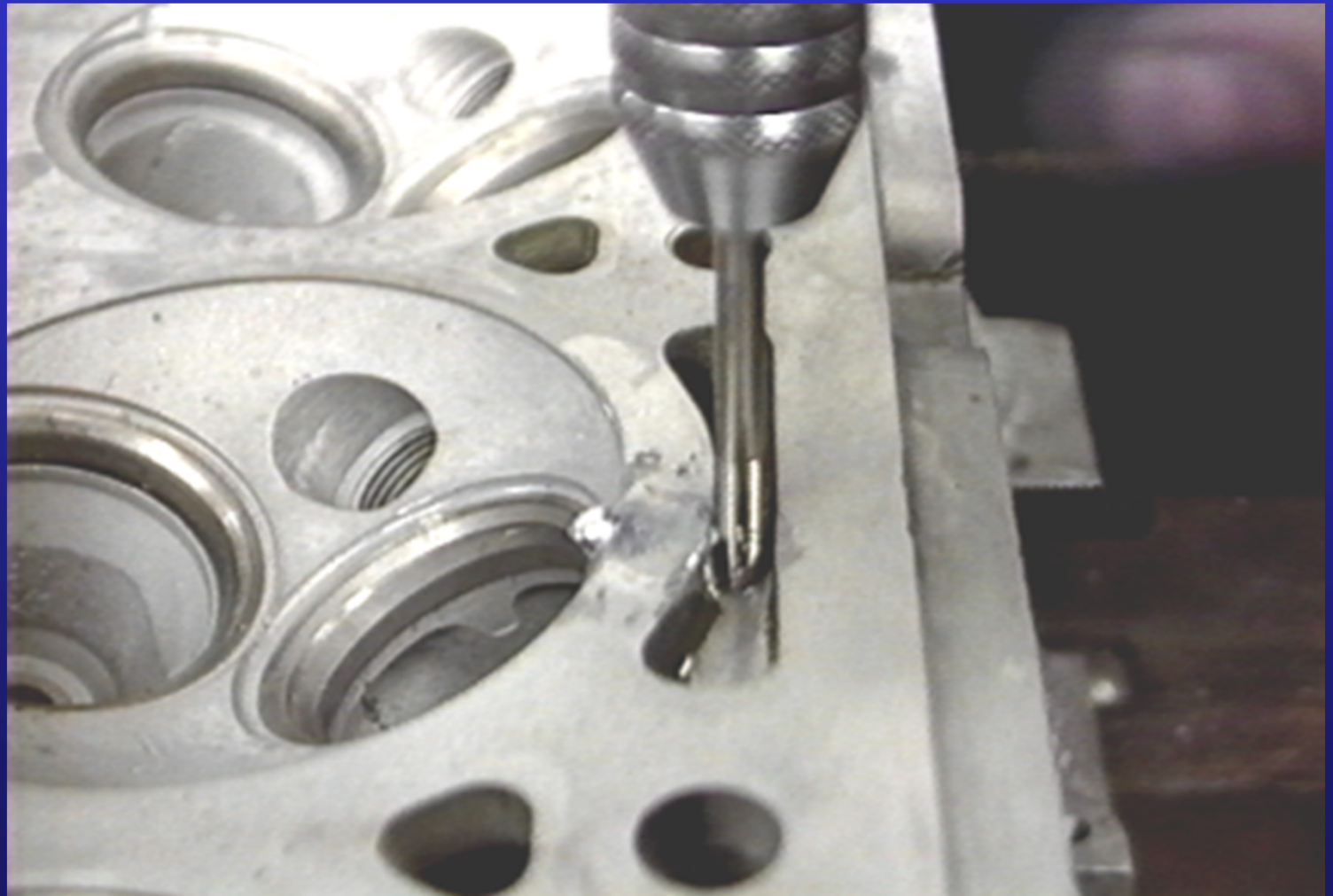


**Install L Series pin  
intersecting the seat insert**

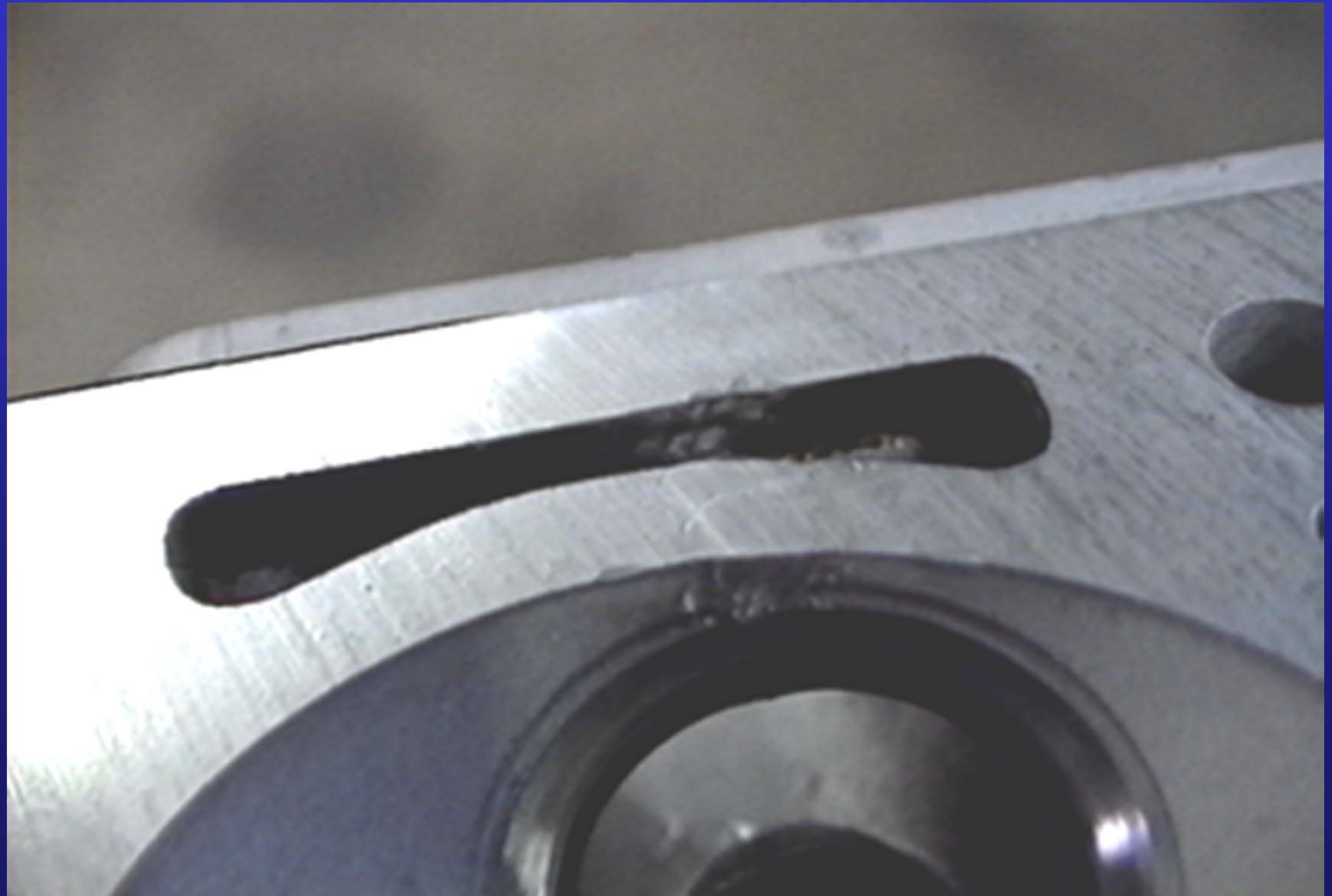




**Install L Series pin into the  
floor of the water hole**



# Finished repair



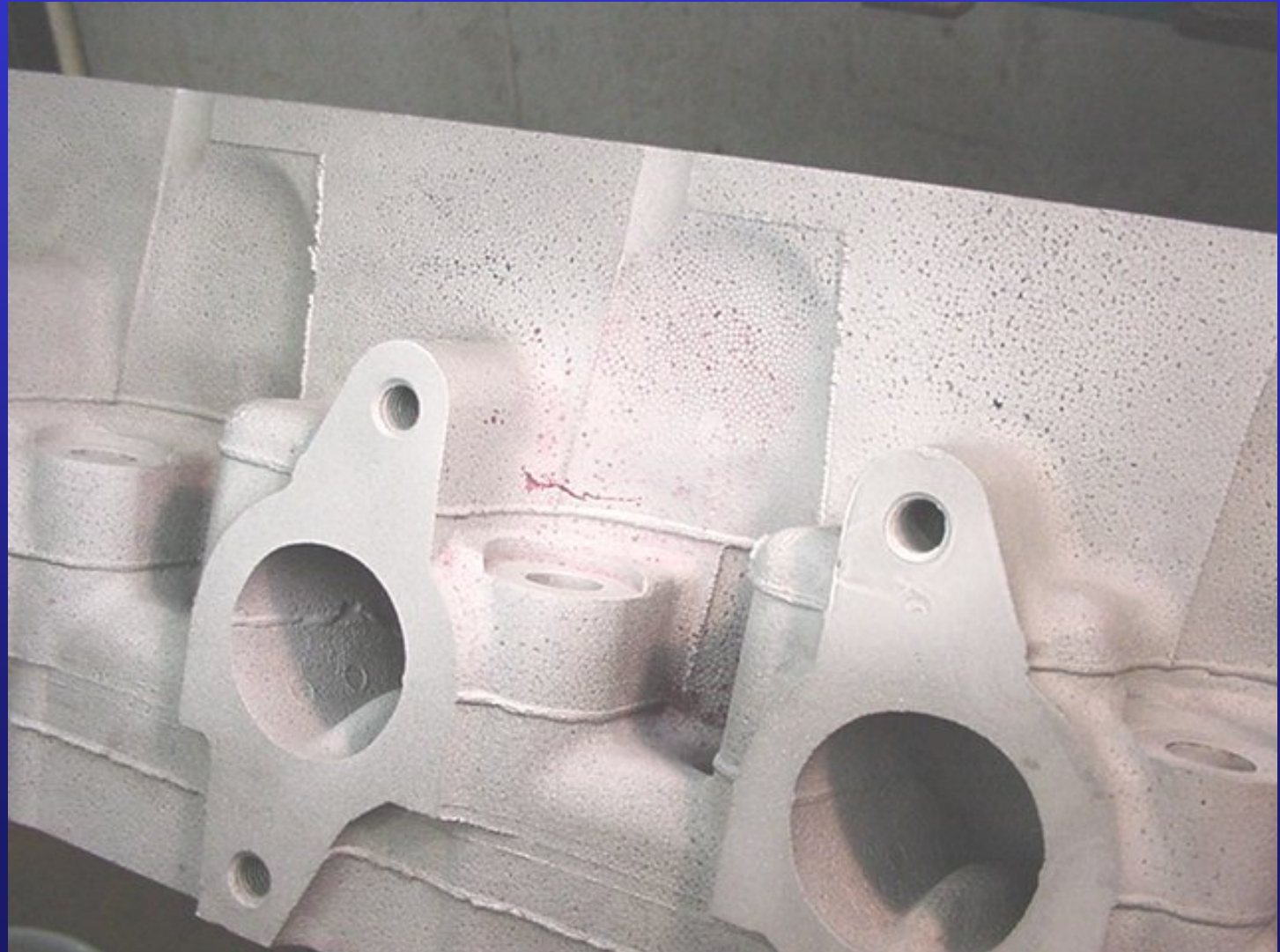
# Stitching Pin Selection

- Most aluminum cyl heads have fairly thin walls so you should use L4 pins that have very fine threads.
- The fine threads also work well when tapping into the hard seat insert.
- L4 pins will fit in between the seats in most cases.
- Larger diameter pins are used when the casting is thicker.

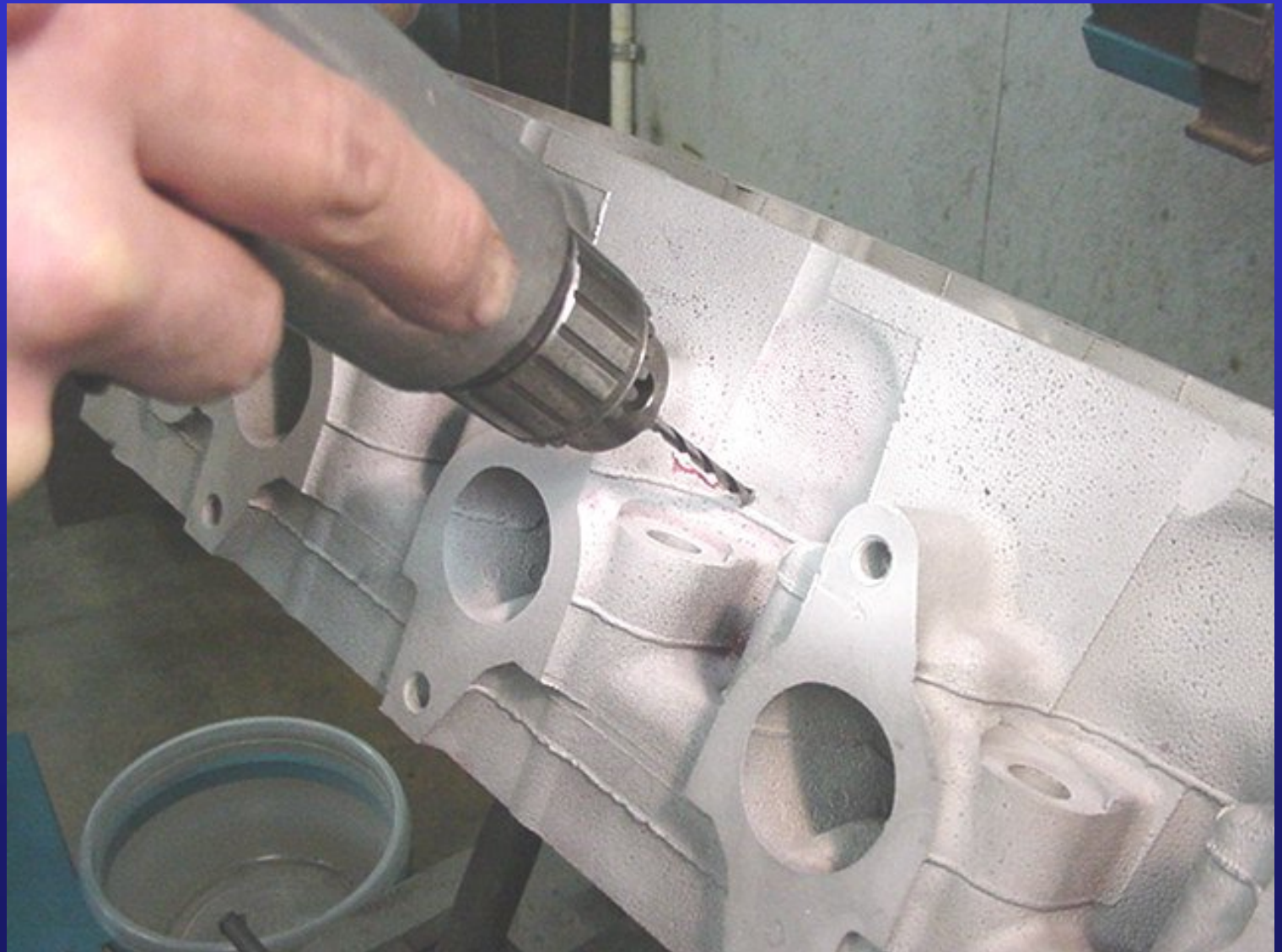


**Structural Repair  
Using  
CASTMASTER  
Stitching Pins**

# Inspection



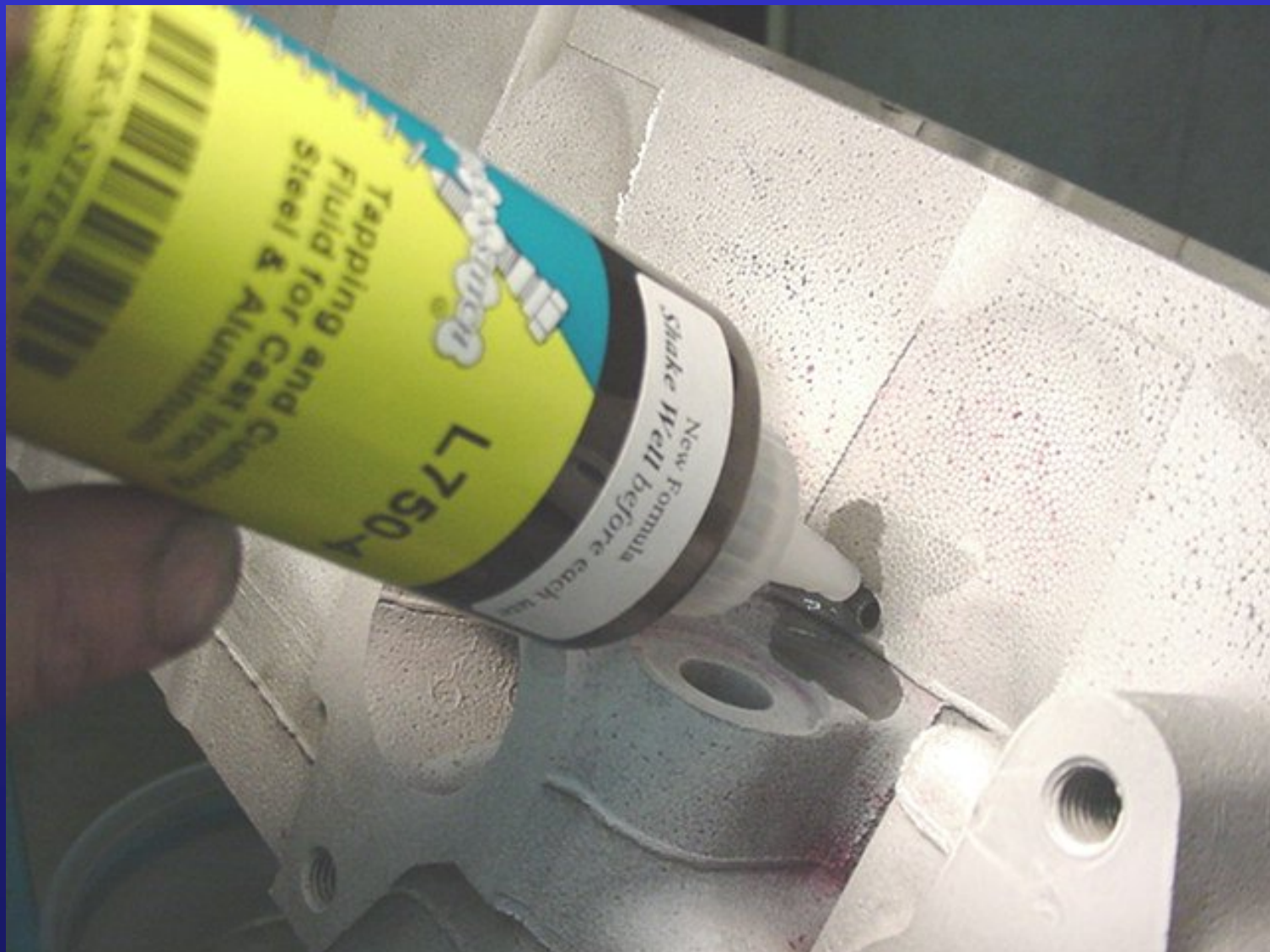
# Drill the first hole



# Spotface the hole



# Apply tapping fluid





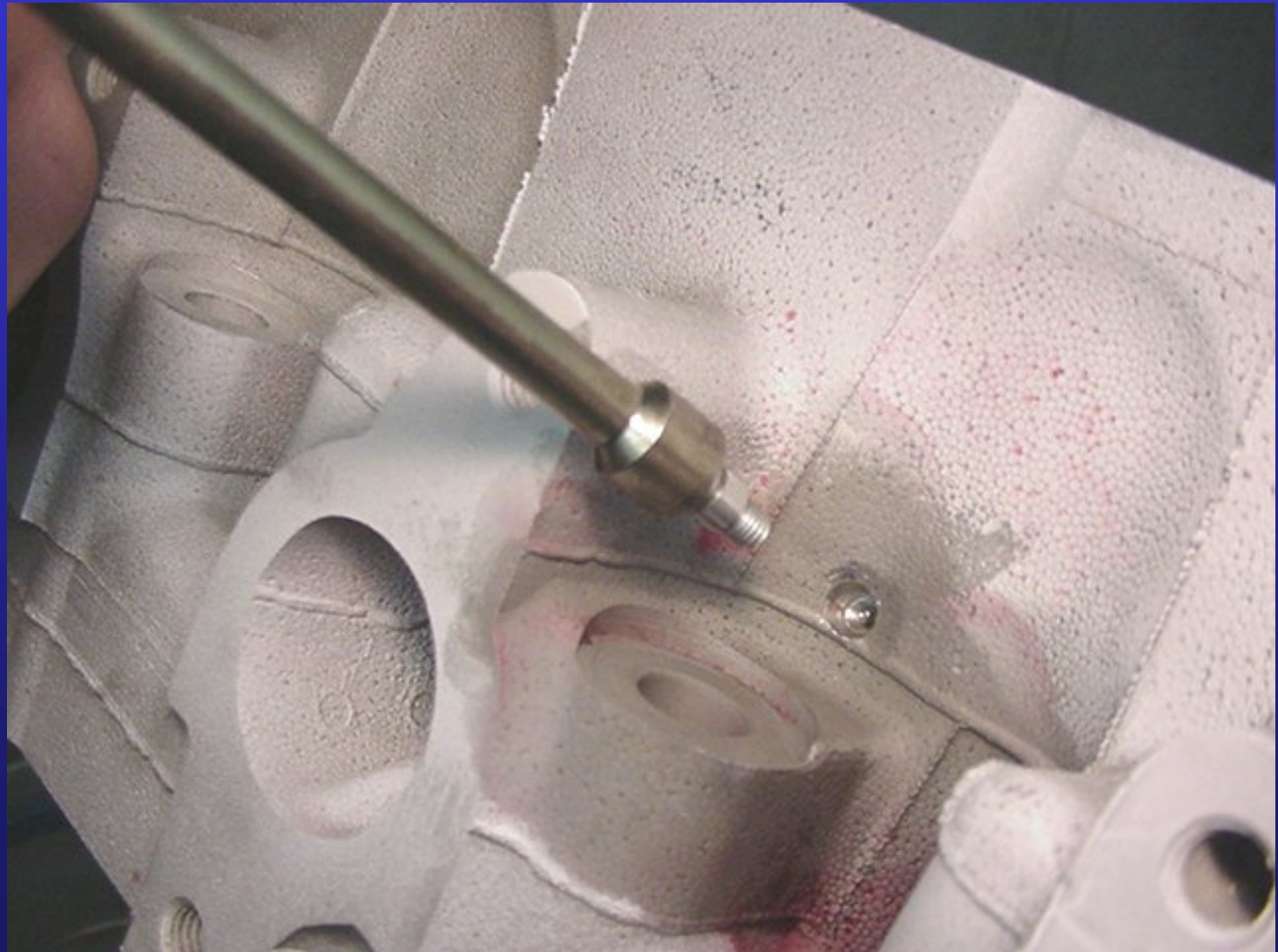
# Tap the hole



# Apply thread sealant



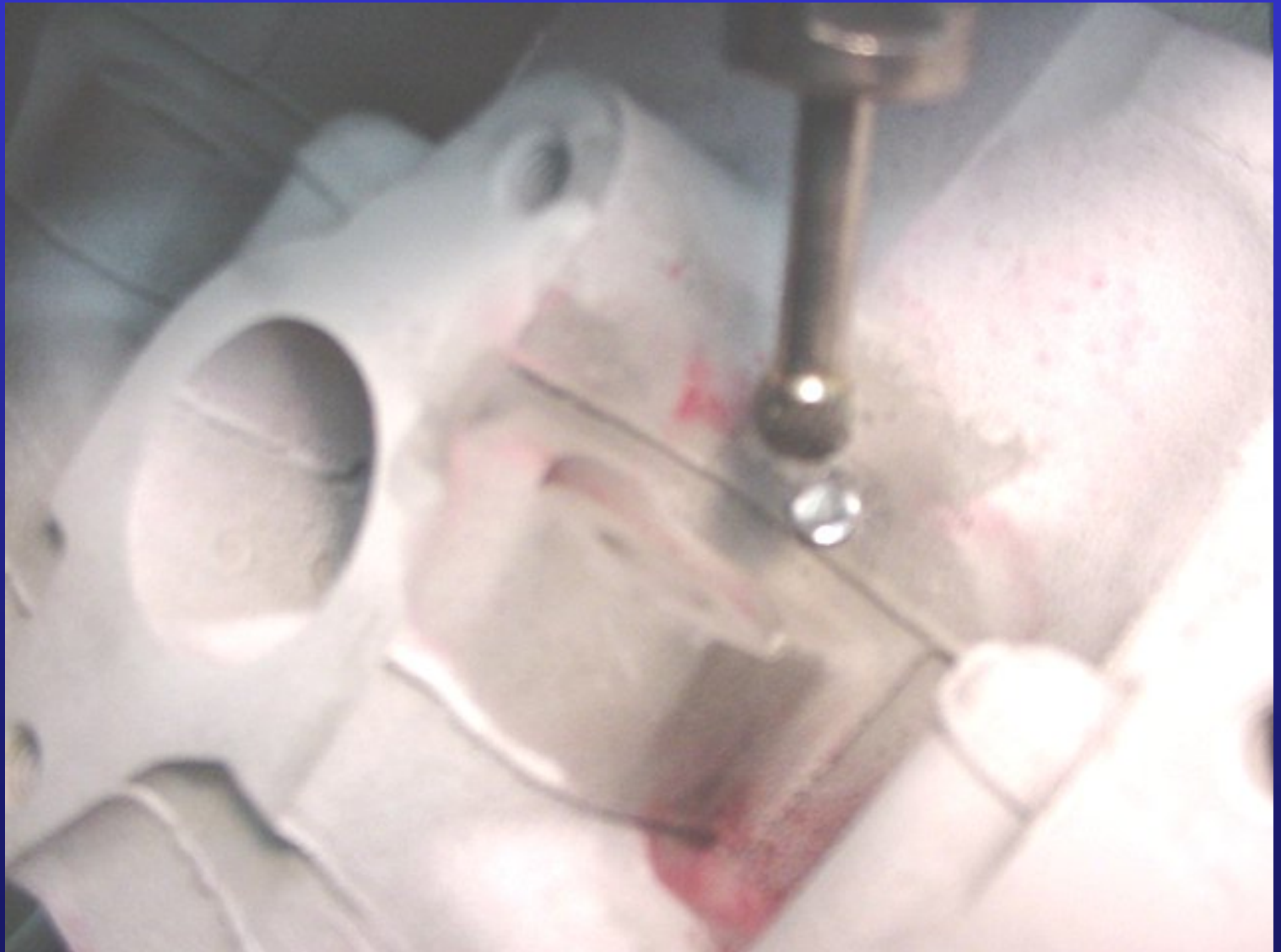
# Install a C1A aluminum CASTMASTER stitching pin



**The head of the pin twists off  
when tight**



**Grind off excess shoulder  
close to flush**



**Drill so that pins slightly overlap**



**Continue installing pins until  
the crack is removed**



**Grind pins flush andpeen  
lightly with a needle scaler**

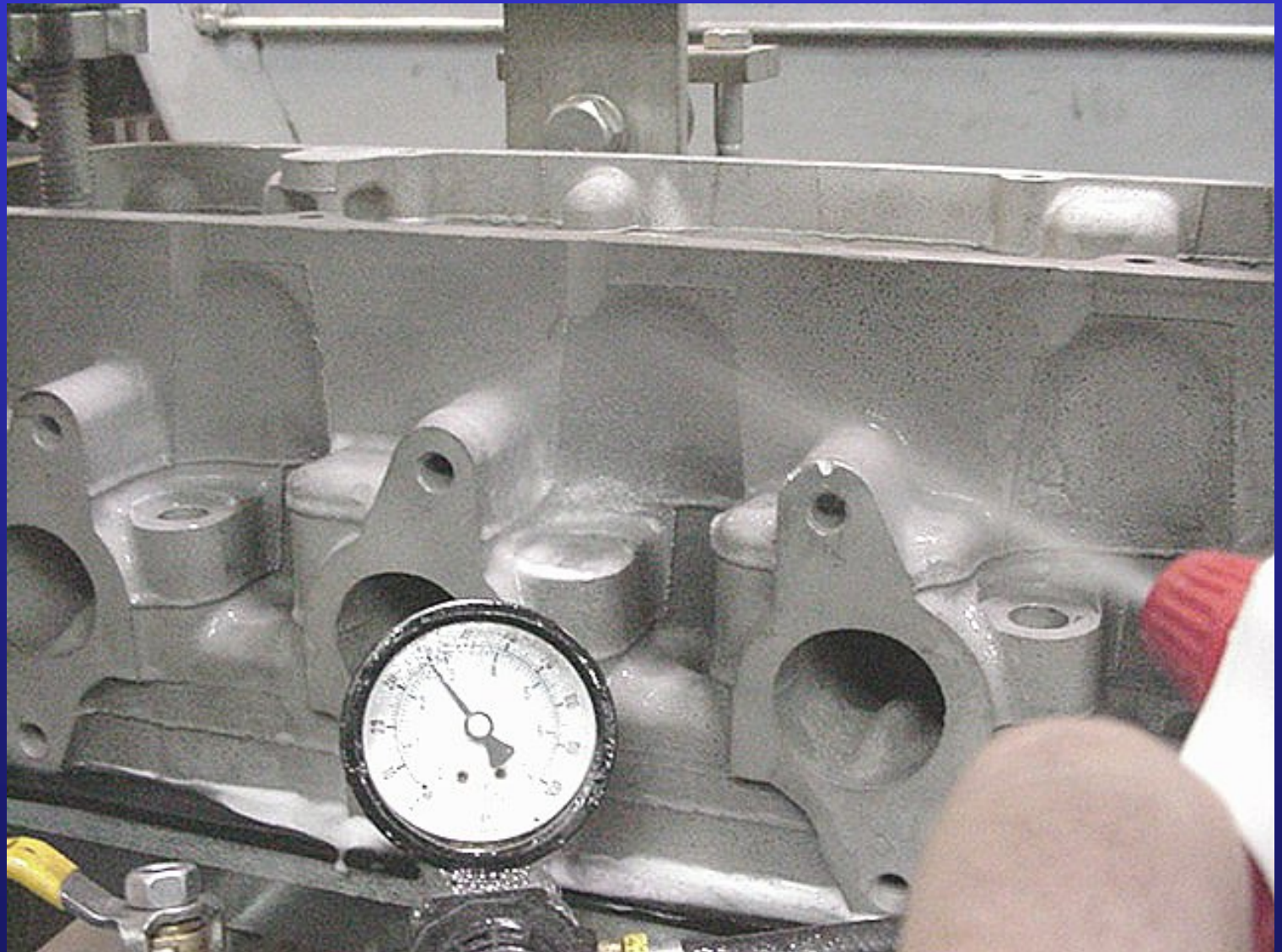




# Completed Repair



# Pressure test to 40 PSI



# Advantages Over Welding

- **Faster**
- **Very cost effective**
- **No distortion**
- **Will not anneal the surrounding aluminum**

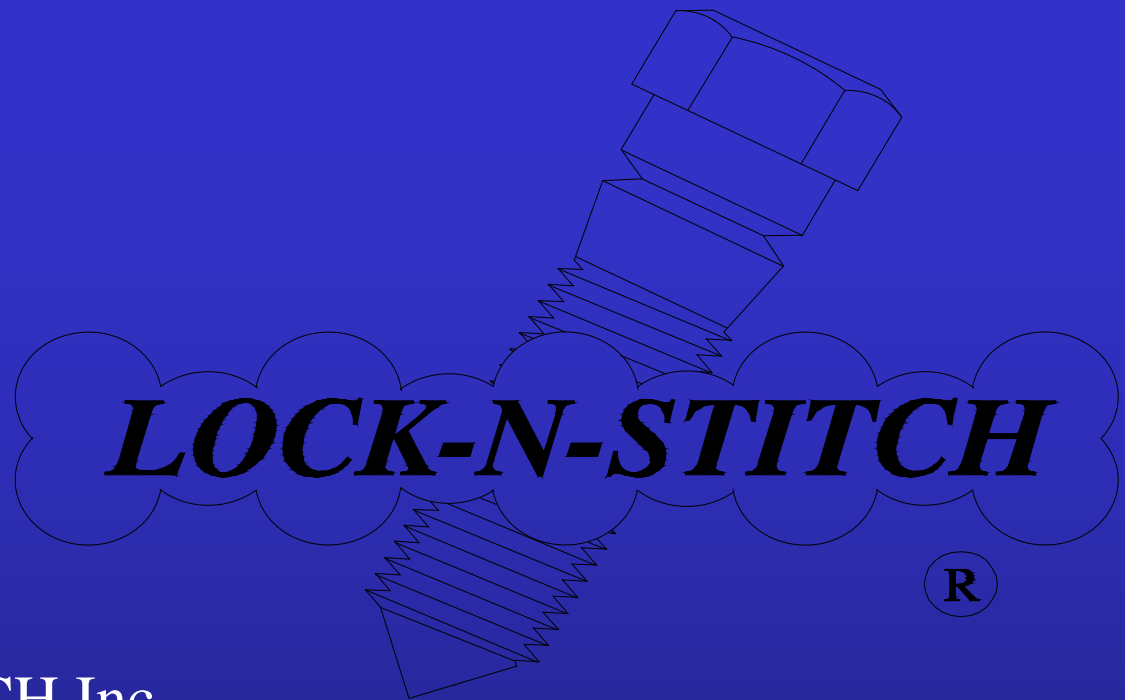
# Advantages of Welding Over Stitching

- **Welding can repair erosion and electrolysis damage.**
- **Welding can add reinforcement by adding material to weak areas such as around head bolt holes.**
- **Welding can replace missing pieces.**
- **Welding can build up bearing bores.**

# **Other Aluminum Castings That Can Be Repaired by Stitching**

- ✓ **Aluminum oil pans for Cummins, Cat and other diesel engines**
- ✓ **Water cooled marine manifolds**
- ✓ **Bell housings and transmission cases**
- ✓ **Engine blocks and intake manifold**





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