

# SHERWIN PSM-5 PENETRANT SYSTEM MONITORING PANEL

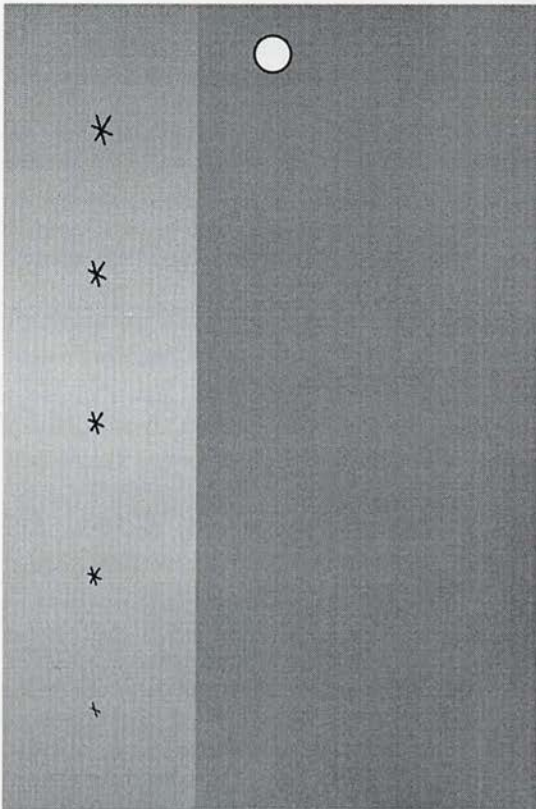


## WHAT THE PSM-5 PANEL DOES

The "Penetrant System Monitoring Panel" provides a quick means of determining the continued serviceability of liquid penetrant inspection systems: fluorescent or visible; water-washable; post-emulsifiable, or pre-wash.

The panel verifies that all system elements —penetrant, emulsifier, wash, dryer, and developer— are functioning properly. It brings attention to major shifts in the system's operating parameters.

A sudden, undetected deterioration of one of the chemicals or a malfunction of one of the stages could result in failure to disclose a dangerous flaw, and lead to accepting a defective part. Processing with a Sherwin PSM-5 panel at scheduled intervals alerts operators to system failures. It establishes the time slot for identifying parts that may have to be reinspected.



The Sherwin PSM-5 panel, a "known defect standard," is the most practical means to meet the MIL-STD-6866 and ASTM E-1417 requirement for a daily system performance check. It also conforms to the P&WA TAM 146040 specification, and meets other company specifications as well.

## WHAT THE PSM-5 PANEL DOES NOT DO

The Sherwin PSM-5 panel does not replace periodically examining chemicals for brightness, water contamination, etc., nor does it replace periodically inspecting pressure and temperature gauges, nozzle apertures, etc. The panel is not a sensitivity comparison tool; it does not replace the NiCr panel or the KDS panel. Moreover, a gradual performance change, probably, will not be noted when using the PSM-5 panel.

The PSM-5 panel detects SUDDEN changes!

## DESCRIPTION

Sherwin Incorporated manufactures each PSM-5 panel to P&WA specifications from stainless steel. The panels are 0.090 inches thick and measure 4x6 inches.

A chrome plated strip runs the length of one side of the panel. Five crack centers are evenly spaced in the chrome strip. The crack centers are raised circular patterns forming a star, or sunburst. The smallest crack may appear as a single or dual line instead of a star.

## SHERWIN PSM-5 PANEL

The cracks appear in order of magnitude; the largest being visible with low sensitivity materials and the smallest being difficult to detect with even the highest sensitivity materials. The largest crack center is about 1/4 inch, the second largest 5/32 inch, the third 3/32 inch, the fourth 1/16 inch, and the smallest about 1/32 inch in diameter.

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Adjacent to the chrome plating is an oxide grit blasted area, considered “medium rough,” and used to monitor washability and background fluorescence.

There are two versions of the panel. In one, the chrome plated section is polished and mirror-like. In the other, the chrome section has been lightly grit blasted to dull the mirror finish. If necessary, Sherwin Incorporated will advise in making the proper choice.

While no two panels are identical—crack patterns vary because chrome plating properties and thickness cannot be controlled precisely—each panel conforms to P&WA specifications as confirmed and certified by the Sherwin Incorporated laboratory.

### **WHAT THE PSM-5 PANEL SIGNALS**

The Sherwin PSM-5 panel helps alert technicians to major shifts, such as those listed below, which affect penetrant system performance.

1. Penetrant composition—mainly contamination.
2. Emulsifier composition—mainly contamination.
3. Hydrophilic emulsifier—too little or too much water.
4. Developer concentration.
5. Penetrant dwell time and mode; emulsifier and developer dwell times.
6. Wash water pressure, temperature, and dwell.
9. Oven temperature and dwell.

Monitoring the panel's performance alerts NDT operators to procedural or chemical changes that affect the inspection process. Changes in crack and/or background appearance indicate system changes. The one step in the inspection process difficult to monitor with the PSM-5 panel is the pre-cleaning step.

### **HOW TO USE THE PSM-5 PANEL**

The Sherwin PSM-5 panel should be used to verify penetrant system performance at the beginning of each shift; more frequently if the system is suspected of behaving unreliably.

The panel's effectiveness depends directly on the technician's skill. The technician must be able to discern a “difference” in the panel's appearance from one test to another, such as increased background fluorescence or decreased flaw indication brightness.

**Reading Crack Centers**—Examine crack centers for “how well,” as well as “if,” they are shown. For example, if the developer component is malfunctioning, crack centers may still be revealed, but they may not be as bright as normal. An *experienced* technician must read the panel and recognize that something is wrong.

**Reading Fluorescent Background**—Washability and background fluorescence must also be interpreted by a skilled technician. Some penetrant systems, especially high and ultra sensitivity systems, leave a fluorescent background on the panel's grit blasted area. Other systems may leave no background. Neither condition, in itself, is alarming, unless it represent a change from normal system performance. Thus, the panel monitors background level; it does not establish a standard. Acceptable background is determined on actual production parts and will not be the same for every penetrant system.

Experience will teach technicians how to interpret PSM-5 panel indications. For example, with a hydrophilic emulsifier system, higher than normal background fluorescence might indicate over dilution of the emulsifier, shortened emulsifier times, absence of a pre-wash, etc. Conversely, lower background fluorescence might indicate failure to dilute the emulsifier, over-extended emulsifier dwell, inadequate developer application, etc.

Even the chrome plating, itself, is revealing. Failure of aqueous developer to wet the chrome may mean that the solution strength is low, or that the wetting agent has biodegraded. Heavy spots on the chrome may be significant in some penetrant systems.





## **SYSTEM SENSITIVITY AND THE PSM-5 PANEL**

The PSM-5 panel is manufactured to P&WA specifications; all the prescribed cracks are on the panel in predictable locations. An ultra sensitivity penetrant, e.g., Sherwin RC-77 Fluorescent Penetrant, should show all five cracks if all system components are functioning properly. A high sensitivity penetrant, e.g., Sherwin HM-604 Fluorescent Penetrant, should reveal four cracks, and, often, the fifth. Similarly, a medium sensitivity penetrant, e.g., Sherwin HM-3A Fluorescent Penetrant, should show the three largest crack centers, and, on occasion, the fourth.

It is possible that certain medium sensitivity penetrants will consistently show all five cracks on a given PSM-5 panel. This does not undermine the panel or the penetrant system's credibility. It means ultimate performance is being obtained. Concern should arise if three cracks are shown when five were expected.

## **OTHER CONSIDERATIONS**

**Clogged Panel Cracks and Panel Maintenance**—Occasionally, a PSM-5 panel will fail to reveal the smallest cracks when normally they had been revealed. This may be due to clogged panel cracks rather than penetrant system failure.

Residues interfere with both penetration and rebleed. If the small crack appears bright and clear one day, but fails to show the next, the materials and system are suspect. However, if the smallest cracks gradually become less pronounced, panel clogging due to improper cleaning must be suspected.

Occasionally excessive background appears on the grit blasted section. Grease or other contamination on the panel rather than inadequate penetrant system washing may lead to this problem.

Proper panel cleaning and maintenance are extremely important. Sherwin Bulletin "PSM-5 Panel Maintenance" explains how to clean and care for the panel. Another bulletin, "Penetrant System Monitoring Panel—Usage Procedures," describes how to use the panel.

If a panel indicates possible system deterioration, verify the panel's indications by using a "master panel."

**Panel Verification; the Master Panel**—Since failure to detect the smallest cracks may arise from improper panel maintenance, two panels—one for daily use and a second "master" to verify the first—are usually required. Periodically verifying the working panel is a prudent procedure.

**Separate Panels for Separate Systems**—Using the same panel to monitor both a high sensitivity and an ultra high sensitivity system may produce false, misleading indications of the systems' integrity. Therefore, it is important to maintain a separate panel for each penetrant system being monitored.

**Recalibration**—One major company, which mandates the use of PSM-5 panels, based on their experience, requires the recalibration of their own, in-house panels approximately every six months. Experience has shown that recalibration requirements will vary with how much a panel is used and with how well it is maintained. Sherwin Incorporated recommends that PSM-5 panels be recalibrated, at least, annually. It is possible for users to do this, and Sherwin's lab will advise on the appropriate procedures to follow.

Panels may also be returned to the factory for thorough cleaning, re-grit blasting, and crack verification. If a PSM-5 panel can be restored to the original Pratt-Whitney drawing, it will be recertified and returned. If the panel cannot be restored, the user will be notified. The fee for recalibrating and recertifying a PSM-5 panel will be quoted on request. Allow approximately ten working days for shipping and processing.

### OPERATIONAL PROCEDURES TO OBSERVE

- Hold panel at an angle to prevent chrome surface from reflecting ultra-violet light directly into eyes, and to insure that lower powered luminescent indications will be seen.
- Use minimum developing time —usually 10 minutes. Do not expect indications to appear instantly as with cracked aluminum blocks.
- Dry panel after post cleaning; solvent residues can prevent penetrants from entering flaws.
- Use separate working panels for each penetrant system.
- Use a master panel for validating working panels.
- Rigorously maintain testing parameters. Do not short-cut panel processing, such as by substituting a hand wipe for an oven dry. Observe procedures described in Sherwin Bulletin "Sherwin PSM-5 Penetrant System Monitoring Panel—Usage Procedures."
- Clean panel immediately after test. Observe instructions in Sherwin's "PSM-5 Panel Maintenance."