

EXTERIOR PLASTIC PAINTED PARTS PERFORMANCE

GM4497M

1 SCOPE. This specification covers the laboratory test requirements for GM Approved Paint on Parts (APOPS), PPAP Approval, Processing conditions and routine quality control for exterior plastic painted automobile components.

1.1 This specification applies only to substrate and paint related materials that have been qualified and approved to the appropriate GMP.XX.XXX, GMXXXXM, and/or 998XXXX specifications.

1.2 RESTRICTED AND REPORTABLE CHEMICALS (GM1000M). All materials supplied to this specification must comply with the requirements listed in GM1000M, **Restricted and Reportable Chemicals**.

2 REFERENCED STANDARDS.

GM1000M	GM9503P	GM9525P
GM4465P	GM9505P	GM9531P
GM9071P	GM9507P	GM9904P
GM9233P	GM9508P	ASTM D870
GM9501P	GM9509P	ISO 2808

3 REQUIREMENTS.

3.1 Tests shall be conducted using the latest issue of the test methods indicated. Suitable precautions should be taken to ensure that applicable safe limits are not exceeded when conducting test procedures, processes and/or handling the materials required by this specification.

3.2 For APOPS testing, all testing shall be performed in an accredited laboratory. Laboratory accreditations to ISO/IEC Guide 25 or to General Motors (GM) General Procedure GP-10 are acceptable.

3.3 For PPAP testing, use a lab from an organization that is either third party registered to QS9000 or has laboratory accreditations to ISO/IEC Guide 25 or to GM General Procedure GP-10.

3.4 Unless otherwise specified, painted samples shall be subjected to the testing after a minimum aging period of 72 h following the baking or drying cycle. A shorter aging period may be used, provided it is recognized that this represents a more severe condition of test and that results obtained at different aging times under 72 h are not a good basis for comparing the relative performance characteristics of paint finishes.

3.5 DOCUMENTATION. Test reports shall be written per the **Requirements for Test Report** in ISO/IEC Guide 25. Additionally, a test report that contains the following shall be submitted:

3.5.1 A copy of the Registration or Scope of Accreditation for each test facility that provided data.

3.5.2 Description of paint materials and paint processing conditions. Use data reporting Table 5 - Paint Processing Data Form.

3.5.3 Datapaq or equivalent indicating part surface temperature versus time for all paint bakes including postcure.

3.5.4 Paint film thickness per ISO 2808. Measure a minimum of 4 areas on each part tested and 1 area on each panel tested. Additional areas may be required due to part design. Please see the responsible materials engineer for a definition of the number and placement of the areas required. Report the thickness of each paint layer for each location.

3.5.5 Paint performance data. See Table 6 - GM APOPS Test Data Form. Enlarge as required. A subset of the tests on this form may be used to report PPAP data.

3.5.6 Schematic indicating the location on the part from which the test panels and film builds were obtained.

3.5.7 All tested samples shall be retained by the supplier for review by the appropriate GM materials engineer at least until APOPS approval is obtained.

4 APOPS QUALIFICATION. Figures 1, 2 and 3 depict the APOPS approval process. Parts furnished for APOPS approval shall meet the test requirements as shown in Table 3.

4.1 All testing is the responsibility of the GM supplier who applies paint to the parts in question.

4.1.1 All parts including each individual style must be tested unless a specific written deviation is granted by the responsible materials engineer.

4.2 PANEL TESTING. This is the first phase of APOPS approval. This testing need only be performed if a combination of the materials intended for use does not currently have an APOPS number in the database. Perform testing as indicated in Table 3 for panel testing.

4.2.1 All testing is to be performed on panels or surrogate parts of the production intended materials (substrate, power-wash, adhesion promoter (if applicable), primer (if applicable), and topcoat system).

4.2.2 Each test must be completed on a minimum of 3 samples (panels or surrogate parts).

4.2.3 Testing shall be performed in 4 colors: White, Black, Light Metallic, and Red Mica. If the color palette contains a Tricoat, that color must be tested in addition to the 4 standard colors. If the 4 standard colors are not contained in the color palette, the materials engineer may approve substitutions or deletions.

4.2.4 All bakes are to be those of the production system and must fall within the bake charts for each layer.

4.2.5 All film builds are to be as specified on the drawing.

4.2.6 Parts which are source primed and subsequently top-coated at assembly plants shall be capable of accepting the topcoat paint system and meeting the requirements specified

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with both prime only and with both topcoat and prime. Panel testing must be performed on the entire system, including topcoat.

4.2.7 When this testing is completed, the panels cut from the parts and test report will be reviewed by the responsible materials engineer and entered into the APOPS database.

NOTE: Full APOPS approval is not given at this time, component testing must also be conducted for full approval.

4.3 COMPONENT TESTING. This is the second phase of APOPS approval. This testing must be performed for all components. Perform testing as indicated in Table 3 for component testing.

4.3.1 All specimens for testing must be obtained from parts that have been molded, painted and processed using the same equipment, tools, materials, processing conditions and manufacturing locations that will be used to manufacture production parts for vehicle assembly.

4.3.2 Each test must be completed on a minimum of 3 samples, each obtained from separate parts (except fascias - see 4.3.3).

4.3.3 For *fascia* systems, testing is not required in triplicate due to the size and cost of the parts. In this case, 3 samples may be taken from different locations on the same part. See Figure 4 for example testing locations. Since fascias vary in design, please see responsible materials engineer prior to choosing the locations.

4.3.4 Testing shall be performed in 4 colors: White, Black, Light Metallic, and Red Mica for original non repaired parts. If the color palette contains a Tricoat, that color must be tested in addition to the 4 standard colors. If the 4 standard colors are not contained in the color palette, the materials engineer may approve substitutions or deletions.

4.3.5 Testing to Table 3 must also be performed in White only on a part that has seen 2 primer repairs and 2 topcoat repairs (Example: primer-bake, primer-bake, primer-bake, topcoat-bake, topcoat-bake, topcoat-bake - 6 paint layers).

4.3.6 All bakes are to be those of the production system and must fall within the bake charts for each layer.

4.3.7 All film builds are to be as specified on the drawing.

4.3.8 Parts which are source primed and subsequently topcoated at assembly plants shall be capable of accepting the topcoat paint system and meeting the requirements specified with both prime only and with both topcoat and prime. See responsible materials engineer to determine the number of parts to be topcoated and to coordinate the topcoating of the parts in the assembly plant.

4.3.9 When this testing is completed, the panels cut from the parts and test report will be reviewed by the responsible materials engineer and entered into the APOPS database.

NOTE: Full APOPS approval may be given at this time depending on test results.

5 PROCESS REQUIREMENTS. The following processing requirements must be followed at a minimum.

5.1 BAKE. All bakes must comply with NAO Paint approved bake charts for each specific product. NAO Paint approved bake charts are those that have an approval signature of the responsible engineer at the bottom. These bake charts may be obtained from the paint suppliers.

5.1.1 All parts having a TPO substrate with adhesion promoter must see a minimum of 5 minutes @ 121°C (250°F) bake somewhere in the painting process, adhesion promoter bake or topcoat bake.

5.2 FILM BUILD. All film builds must comply with those specified on the engineering drawing.

5.3 WET ON WET PROCESSING. Defined here as the application of basecoat over uncured primer. This type of processing is not approved at GM.

5.4 REPROCESSING. Defined as running a previously finished part through the original (OEM) process. The following must be followed at a minimum for all part reprocesses:

5.4.1 All reprocessed parts must meet all the requirements stated in this specification and all other specifications and requirements listed on the engineering drawing.

5.4.1.1 Sanding is allowed on the topcoat system to remove surface imperfections or defects. APOPS approval and documentation of process tested must be established and recorded.

5.4.1.2 At a minimum, APOPS approval must be obtained on a white panel or part that has been through 2 primer or adhesion promoter reprocesses and 2 topcoat reprocesses and bakes.

5.4.1.3 Clearcoat over Clearcoat and Adhesion Promoter over Adhesion Promoter is not permitted.

5.4.1.4 For TPO only, a white panel must be progressively sanded to substrate, feathered out, re-adpro'd over entire part and re-topcoated over entire part and baked per previous bake schedules. This process must be run in the actual production facility and include powerwashing, etc. Documentation of the process must be submitted to the responsible material engineer.

5.4.1.5 Sanding is not allowed on RAW TPO unless this has been APOPS tested and process documented with the responsible material engineer. Testing per 5.4.1.1.

5.4.1.6 In addition, for all other reprocesses, APOPS data must be available for review to confirm their acceptance to the quality control requirements.

5.4.2 Topcoats and color keyed or color specific primers are to be repaired with the OEM or two-tone color only specified by the GM WAXXXX color number (i.e. white over white, red over red, etc.)

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5.4.3 The maximum number of reprocess applications is 2 for primer and 2 for topcoat as given in Table 1 below.

TABLE 1 - REPROCESSING REQUIREMENTS

Paint Layer	Number of OEM Applications	Maximum Reprocess Applications	Maximum Number of Bakes	Max Total Film Build (of Given Paint Layer)
Primer	1	2	3	4 mils - 100 μ m
Topcoat	1	2	3	9 mils - 225 μ m
Total		4	6	13 mils - 325 μ m

5.4.3.1 A part may see a total of 6 heat cycles in paint and a total of 7 heat cycles including postcure.

5.4.3.2 All film builds must meet the minimum requirements specified on the engineering drawing and the maximum requirements given below in Table 2.

TABLE 2 - MAXIMUM FILM BUILDS

Layer	Maximum Film Build
Primer	100 μ (4 mils)
Topcoat	225 μ (9 mils)

5.4.4 Spot repair is not a GM approved process except for SMC which must be repaired to meet the requirements in GM9233P

6 QUALITY CONTROL REQUIREMENTS. The following requirements must be met at the specified frequencies. Any painted part supplier to GM must keep records of the following activities and be able to provide them for review at any time. No aging period is required for quality control samples. A quality control plan will be developed with every supplier for every part to determine the areas of the part in which the tests need to be performed. Table 7 has requirements for each quality control test.

6.1 DAILY TESTING. The following tests must be run *every shift on 1 color* that is run for that particular shift: Colors must be randomized. Report the daily test date on the form included as Table 8.

6.1.1 Film Build. Record all layers independently.

6.1.2 Tape Adhesion (GM9071P). Cross-Hatch and Cross-Cut methods.

6.1.3 Water Immersion (ASTM D870). 2 h minimum immersion.

6.1.4 Thumbnail Hardness (GM9507P).

6.1.5 Cure (GM9509P).

6.2 A Datapaq or equivalent part temperature chart recorder must be run a minimum of *one time per day per oven*. To ensure that each oven is consistent from shift to shift, the Datapaq or equivalent charts must be taken on alternating shifts. For example: Monday - Shift 1, Tuesday - Shift 2, Wednesday - Shift 1, etc.

6.3 WEEKLY TESTING. The following tests must be run **once per week on every color** run that particular week. Report the weekly test data on the form included as Table 9.

6.3.1 Film Build. Record all layers independently.

6.3.2 Tape Adhesion (GM9071P). Cross-Hatch and Cross-Cut methods.

6.3.3 Water Immersion (ASTM D870). 2 h minimum immersion.

6.3.4 Thumbnail Hardness (GM9507P).

6.3.5 Cure (GM9509P).

6.3.6 96 h Humidity (GM4465P) plus Tape Adhesion (GM9071P) - Cross-hatch and Cross-Cut methods.

6.3.7 Mandrel Bend (GM9503P). As specified per the part drawing.

6.3.8 Gasoline Resistance - Dip (GM9501P-A) as specified per the part drawing.

7 PPAP TESTING. Perform testing on all program colors as indicated in Table 4 for components. Both an APOPS printout and a GM4497M approval printout from MATSPC will be required with the PPAP package.

8 GENERAL INFORMATION. This standard was originated by the Exterior Painted Parts Task Group and approved by the Paint Committee in January 1997. The following revisions include:

Rev	Date	Description
A	9/97	Defined Accred. Reqs.
B	12/97	GM4466P to ASTM D870

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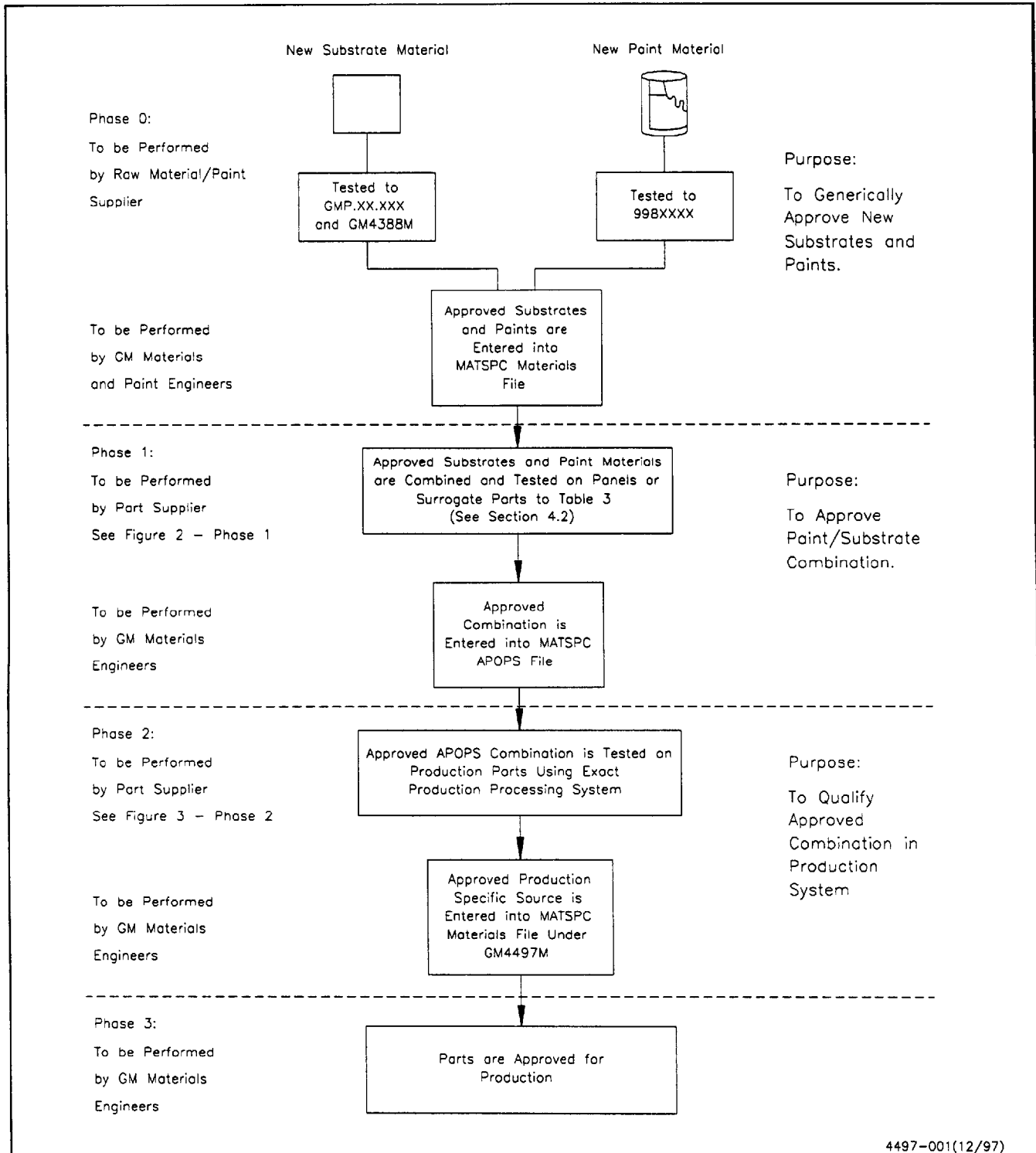
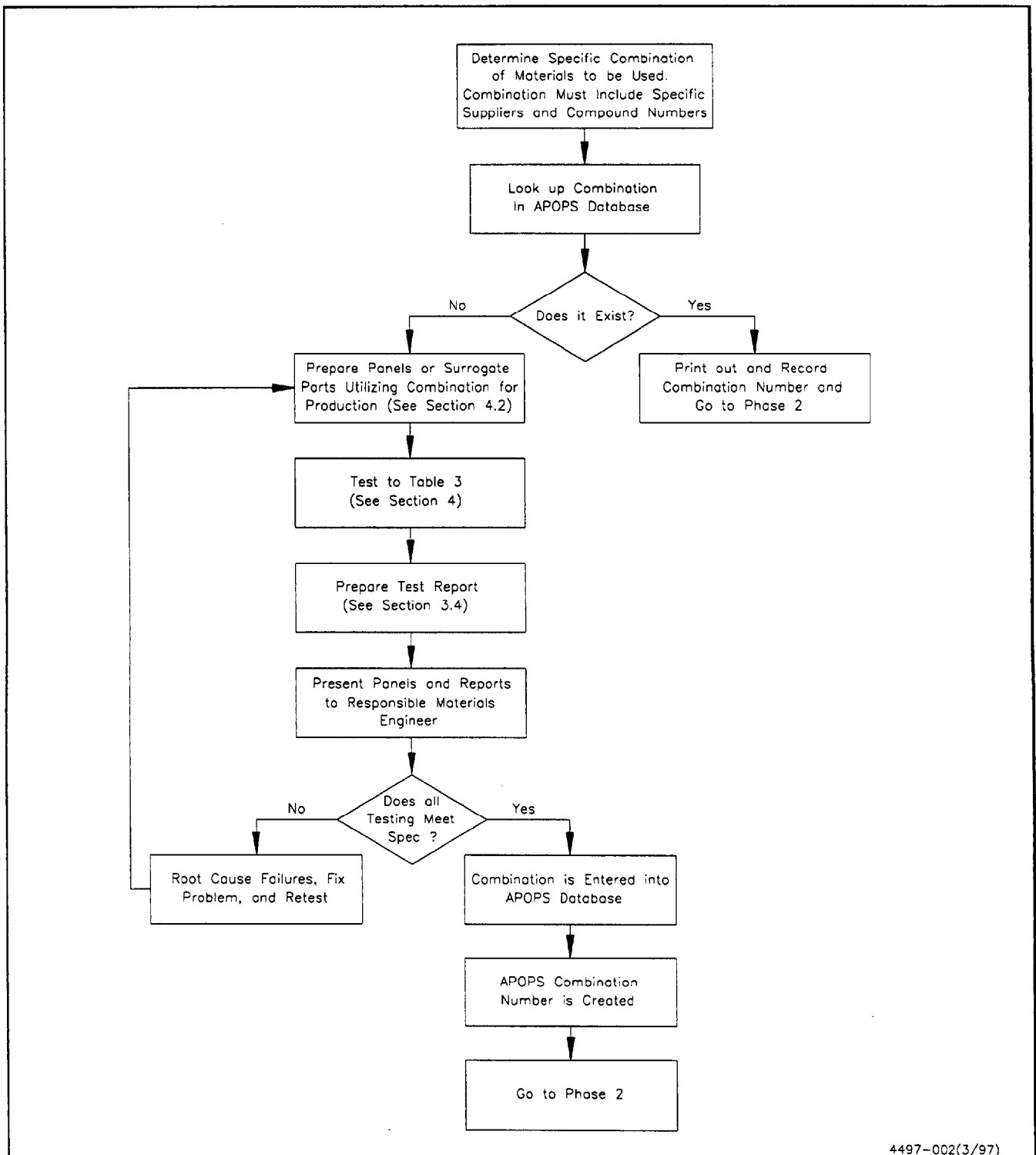


FIGURE 1 - OVERALL APOPS PROCESS

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FIGURE 2 - PHASE 1 - TO APPROVE A PAINT/SUBSTRATE COMBINATION

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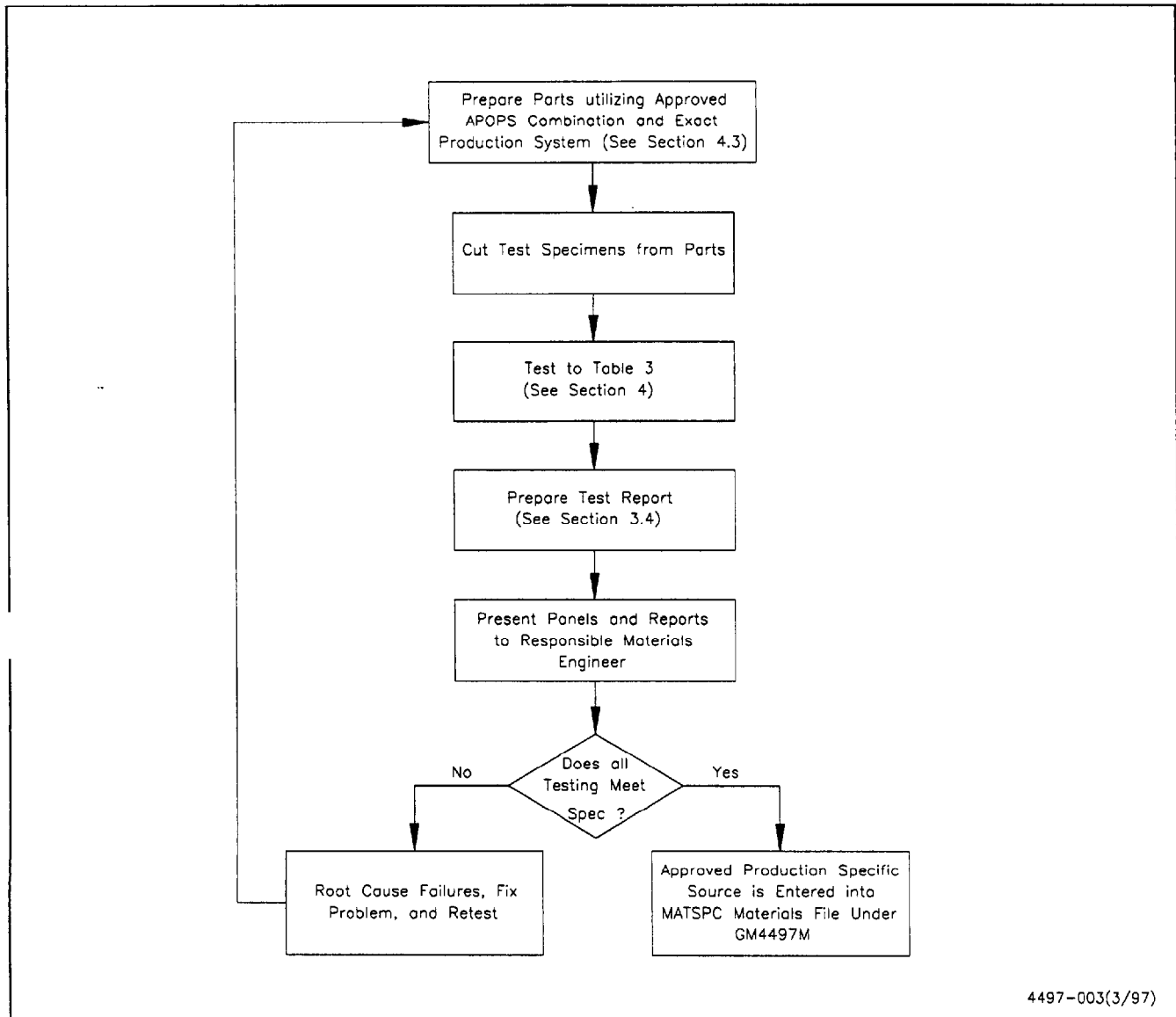


FIGURE 3 - PHASE 2 - TO QUALIFY AN APPROVED COMBINATION IN A PRODUCTION SYSTEM.