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Qualification Strength Testing of Bonded Telescope Parts P0362 Rev -

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QUALIFICATION STRENGTH TESTING OF BONDED TELESCOPE PARTS

- for all bonded flight telescope parts
- also use *GP-B Telescope Image Divider Assembly (IDA) General Alignment and Bonding Procedures* (SUGP-B P0282) for procedures concerning safety; personnel; work area requirements; fixture cleaning and acceptance; flight part inspection, handling, storage, and cleaning; redline authority; and sign-off and recording requirements.

CAUTION:

- The flight parts used in this operation may be heavy, delicate, and somewhat irreplaceable with multiple critical surfaces that can be easily damaged or contaminated by normal handling. Compliance with the above defined safe handling practices is critical.
- Use the chart below to determine which test(s) to use for each bond

		methods				
bond	**proc.#**	**1**	**2A**	**2B**	**3**	**4**
Tertiary Mirror/Baseplate	P0361	do	if	if	if	do
Primary Mirror/Baseplate	P0361	do	if	if	if	do
Secondary Mirror/Corrector Plate	P0361	do	if	if	if	do
Metering Tube/Baseplate	P0374	do	no	no	no*	if
Corrector Plate/Metering Tube	P0375	do	no	no	no*	if
ChB Roof Splitter/ChB Plate	P0285	do**	no*	if	if	n/a
ChB Reflector/ChB Plate	P0286	do	if	if	if	n/a
Housing/ChB Plate	P0287	do	do	if	if	n/a
Beam Splitter/B.S. Holder	P0288	do	no*	if	if	n/a
B.S. assy./ChA Plate	P0290	do	if	if	if	n/a
ChA Roof Splitter/ChA Plate	P0291	do	no*	if	if	n/a
ChA Reflector/ChA Plate	P0292	do	if	if	if	n/a
Housing/ChA Plate	P0293	do	do	if	if	n/a
ChB Relay Lenses/Housing	P0294	do	if	do	if	n/a
ChA Relay Lenses/Housing	P0295	do	if	do	if	n/a
IDA Pad/ChA Plate	P0303	do	if	if	if	n/a
IDA Pad/Corrector Plate	P0336	do**	if	do	no*	n/a
DPA Shim/Corrector Plate	P0337	do	if	do	no*	n/a
DPA Reflector/DPA Shim	P0338	do	do	if	no*	n/a
DPA Post/DPA Shim	P0339	do	do	if	no*	n/a
Reticle Plate/ChB Plate	P0373	do**	if	do	no*	n/a
Sensor Block/Corrector Plate	P0340	do	do	if	no*	n/a
Clamp Supports/Corrector Plate	P0341	do	do	if	no*	n/a

if = at the discretion of the flight part bonder
* high risk to critical surfaces

** must be viewed from alternate angles

1) Method 1 (visual evaluation):

1.1) After completion of the appropriate assembly procedure, a certified flight part bonder (per P0282) shall visually evaluate the bond area and note any irregularities.
1.2) If the entire bond area cannot be viewed, or if any 'risk' irregularities (includes: large unbonded regions, visible particulate inclusions, unusual residue around bond, and apparent wedging of bond) are identified, additional methods *must* be employed.
1.3) At the discretion of the evaluator (considering risk to flight parts and applicability of method), additional methods *may* be employed.
1.4) If the entire bond area is clear of 'risk' irregularities, and additional methods are not required, the evaluator may certify the bond as flight strength qualified.

2) Method 2 (small force shear/peel):

2.1) After completion of the appropriate assembly procedure and Method 1 (if applicable), a certified flight part handler (per P0282) shall evaluate the assembly to be tested and select the mechanical process to be used.

2.2) Method 2A (string pull):

2.2.1) Ensure that the assembly is adequately anchored prior to testing (held by assembly fixturing or by hand are acceptable, provided P0282 is followed).
2.2.2) Tie a fixed loop (Bowline knot recommended) in a piece of clean woven nylon string (~0.020 diameter) such that the loop will fit easily over the part to be tested as close as possible to the bonding area leaving about one foot of standing end.
2.2.3) Attach a small weight with a mass of between ten and twenty times that of the part to be tested to the standing end of the string.
2.2.4) While keeping the strain of the weight off of the string, carefully place the loop over the part to be tested close to the bond interface ('shear' test), using great care to protect all critical parts and surfaces, and carefully apply light tension to the standing end in a direction perpendicular to the bond until the slack in the loop and standing end is taken in.
2.2.5) Use a finger to act as a pulley (if required to maintain the correct direction of force) and gently restore the strain of the mass to the string.
2.2.6) Repeat steps 2.2.4 and 2.2.5 as desired using different directions of pull.
2.2.7) At the discretion of the evaluator, repeat steps 2.2.4 through 2.2.6 with the loop placed farther from the bond interface ('peel' test).

2.3) Method 2B (manual push)

2.3.1) Ensure that the assembly is adequately anchored prior to testing (held by assembly fixturing or by hand are acceptable, provided P0282 is followed).
2.3.2) Stack a small set of weights with a mass of ten to twenty times that of the part to be tested on a table top in such a manner that the footprint of the stack on a small surface is approximately the same as that of the part to be tested.
2.3.3) Using an Alpha clean room swab (or similar object that will not harm or contaminate critical surfaces) held in hand, apply sufficient force to the stack near the table top in a direction perpendicular to the table top such that the stack moves freely (overcomes static friction).

2.3.4) Using another swab held in hand, apply an approximately equal force to the bonded part close to the bond interface in a direction perpendicular to the bond interface.
2.3.5) Repeat step 2.3.4 as desired using different directions of push.

2.4) While applying any forces, visually evaluate the bond area (if possible) and closely observe the bonded parts for any change in appearance or position for several seconds.
2.5) At the discretion of the evaluator (considering risk to flight parts and applicability of method), additional methods *may* be employed.
2.6) If no changes were observed in the bond area or parts positions, and additional methods are not required, the evaluator may certify the bond as flight strength qualified.

3) Method 3 (cryocycle)

3.1) After completion of the appropriate assembly procedure and Method 1 (if applicable), a certified flight part handler (per P0282) shall evaluate and handle the assembly to be tested.
3.2) Visually evaluate the bonding area (if possible) and relative position of the bonded parts.
3.3) Enclose the bonded parts in a non-thermally isolated container using care to protect critical surfaces from damage or contamination (usually a clean room plastic bag).
3.4) Enclose the container in step 3.3 in a second container (usually another bag or a canister).
3.5) Using appropriate safety practices regarding cryogenic material handling, carefully and slowly lower the container into a pool of liquid Nitrogen until it is completely submerged. Wait until the boil-off rate of the Nitrogen is the same as it was before introducing the container (usually 5-15 minutes). Add more Nitrogen as required.
3.6) Carefully remove the container from the Nitrogen and allow it to return to room temperature (at least 10 minutes plus 10 minutes/pound of the gross container weight).
3.7) Repeat steps 3.5 and 3.6 twice more.
3.8) Clean the outside of the secondary container to remove any dust or fluid contamination using cleanroom wipes and Ethanol. Remove the inner container and

clean it also. Visually inspect inner container to ensure that all contaminants have been removed prior to opening.

3.9) Remove the bonded parts from the inner container and inspect for contamination. Clean as required using P0282.

3.10) Compare bonding area and relative position of the bonded parts to evaluation taken in step 3.1.

3.11) At the discretion of the evaluator (considering risk to flight parts and applicability of method), additional methods *may* be employed.

3.12) If no changes were observed in the bond area or parts positions, and additional methods are not required, the evaluator may certify the bond as flight strength qualified.

4) Method 4 (large force shear)

4.1) After completion of the appropriate assembly procedure and Method 1 (if applicable), a certified flight part handler (per P0282) shall evaluate and handle the assembly to be tested.

4.2) Clean the Large Force Shear Test Fixturing according to P0282.

4.3) Carefully transport the bonded parts and install the 7.25" diameter part into the fixture (use a second person to assist as required). Lock the fixture closed.

4.4) Tie a fixed loop (figure eight on a bight recommended) into a cleaned piece of PVC coated, wire reinforced, electrical cable (~0.080" diameter) large enough to fit over the part to be tested and allow the two sides of the loop to meet at an angle of less that sixty degrees when under tension. Tie a second small loop into the other end at such a distance that the weight hanger will be suspended a few inches off the ground when installed.

4.5) Carefully place the loop over the part to be tested close to the bond interface, using great care to protect all critical parts and surfaces, and carefully apply light tension to the standing end in a direction perpendicular to the bond until the slack in the loop and standing end is taken in.

4.6) Carefully hang the weight hanger on the small loop and adjust the loop as required such that both sides of the large loop will bear equal stresses.

4.7) Place cushioning under the weight hanger to lessen any damage to flight hardware, fixturing, or personnel that might occur if the bond or any fixturing should fail.

4.8) In small increments, add weights to the hanger. Use great care to avoid sudden shock loads by dropping weights on to the hanger. Use care to keep the weights balanced on the hanger. Remove any weights and reapply as necessary.

4.9) Increase the weight load until it is ten to eleven times the weight of the bonded part. Carefully remove the weights using the same precautions in step 4.8.

4.10) At the discretion of the evaluator (considering risk to flight parts and applicability of method), additional methods *may* be employed.

4.11) If no changes were observed in the bond area or parts positions, and additional methods are not required, the evaluator may certify the bond as flight strength qualified.