

Technical specification for the SM Mirror Manipulator Assemblies

Technical Specification 6.8.76.8, Rev. 0

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1.0 INTRODUCTION

1.1 PURPOSE

This document contains the Technical Specifications for the M1, M3 PEEM, M3 STXM and M4 Mirror Vacuum Vessels and Mirror Manipulators of the SM 10ID-1 beamline at the Canadian Light Source.

1.2 SCOPE OF TECHNICAL SPECIFICATION

This technical specification establishes the requirements for the fabrication, assembly, testing & acceptance and delivery of the Mirror Manipulators and Vacuum Vessels for M1, M3PEEM, M3STXM and M4PEEM mirrors. The manufacture and assembly of these assemblies is effectively a build-to-print procurement process. The component design is the responsibility of the CLS. The Vendor must demonstrate that the components are manufactured correctly and assembled correctly.

The technical specification does not cover the fabrication of the x-ray mirrors, which are specified elsewhere. For the testing purposes, “dummy” substrates shall be manufactured.

This specification includes, but is not limited to:

- Material requirements
- Detailed drawing requirements
- Fabrication requirements
- Quality Assurance and Testing requirements
- Packaging and Delivery requirements

1.3 BACKGROUND

The Canadian Light Source is a national facility under construction on the University of Saskatchewan campus in Saskatoon, Saskatchewan. This facility is a 3rd generation synchrotron light source, which will produce a high intensity source of infrared, ultraviolet and x-ray radiation.

The SpectroMicroscopy Beamline (SM) is a soft x-ray microscopy dedicated facility, which will provide intense soft x-ray light for a Scanning Transmission X-ray Microscope and a Photoelectron Emission Microscope. It will be built at source point 10ID.1 of the CLS main ring.

The “generic” Mirror Manipulator is a 3-axis in vacuum manipulator for fine pitch, roll, yaw alignment of the mirror. This mechanism is common to all of the mirror boxes. The mirror pole remains fixed in space, as the mirror rotates. For the travel range, accuracy and reproducibility refer to CLS Design Note #6.2.76.13Rev0 “Alignment tolerances and procedure for the SM beamline”. The mirror manipulator includes the mirror cradle, 3-axis motorized mirror rotational stage mounted on the side plate and the side plate with additional flanges for water line. 3-axis motorized mirror rotational stage is common to all mirror manipulators, where cradle and support plate are customized.

The unique feature of M1 mirror manipulator design is its compatibility with the M1 internal water-cooled substrate, so the mirror cradle was modified and the water-cooling assembly added. The other specific feature of the M1 Manipulator is a fixed water-cooled mask, which provides the protection for the M1 mirror leading edge.

M3PEEM, M3STXM and M4PEEM mirror manipulator all have the same cradle and water-cooling assembly for side cooling the mirror block (M4 has no cooling, but the same copper plate).

All vacuum vessels are designed following the same design concept. The main frame holds all necessary flanges for vacuum equipment, including viewport flanges, all metal UHV angular valve for the turbo-pump, UHV gauge, and flanges for connection of the vacuum vessel to other beamline components. The mirror manipulator is mounted on a separate side plate sealed to the main vacuum chamber using sealing wire. To simplify the fabrication the size of all mirror chambers are chosen to be the same, so the only difference between different vacuum vessels is the number of conflat flanges and their location.

In addition, the M3 PEEM vacuum vessel is placed on a translational stage, which shall provide a +/-1" side movement of the vacuum vessel, as its needed to insert M3PEEM mirror into SR beam, or move it out.

Each vacuum vessel shall be equipped with a bake out system, capable of 150°C baking of the vessel. At least two thermocouples shall be installed to monitor the baking temperature. The base vacuum shall be 10^{-10} Torr range after the baking with no trace of hydrocarbon.

The mirror manipulators must be certified to operate within its specifications in an ultra high vacuum (1.33×10^{-8} Pa (10^{-10} Torr)) environment and when subjected to hard x-ray radiation. It should withstand the baking to 150°C for 24 hours, and retain its performance characteristics upon cooling to room temperature.

Further background information can be found in the SM Preliminary Design Review, CLS #6.2.76.10 and in the CLS Design Note #6.2.76.13 Rev 0, "Alignment tolerances and procedure for the SM beamline".

1.4 DEFINITIONS AND ABBREVIATIONS

RMS - root mean square

SM- SpectroMicroscopy beamline.

PGM- Plane Grating soft x-ray Monochromator.

SR – Synchrotron Radiation

EPU – Elliptically Polarized Undulator.

UHV- Ultra high vacuum

IP- ion pump

CLS-Canadian Light Source

ALS- Advanced Light Source, Berkeley, California

2.0 GENERAL REQUIREMENTS

2.1 SAFETY AND ENVIRONMENTAL

- 2.1.1.1** The normal ambient temperature of the experimental hall is 23° C. The expected temperature stability will be better than 1° C during normal operation.
- 2.1.1.2** The expected relative humidity limits under operation are from 25% during the winter months and a maximum of 50% during the summer months. The expected relative humidity range for components under storage will be the same as previously mentioned.

2.2 IDENTIFICATION, TRANSPORTATION AND INSTALLATION

- 2.2.1.1** Each Mirror Box shall have fiduciary marks at the location as shown in the detail drawings. The 1.5" reflected spheres used for alignment will be supplied by CLS. They

will be installed during the commissioning of the beamline by CLS staff, so the Mirror Box shall have only the mounting holes (f8H7), but manufacture of Mirror Box Assemblies shall also provide a precise measurements of the location of the mirror rotation axis with respect to the fiduciary points.

2.2.1.2 The Vendor shall prepare a packing & shipping plan, which comply with the main requirements as outlined below, for review by CLS.

2.2.1.2.1 Each Mirror Box Assembly shall be shipped as a separate assemblies. Each assembly shipped shall be identified by the appropriate purchase order number, assembly number and a sequential identity or serial number. The warning signs and handling instruction shall be clearly visible. Each assembly that is to be shipped separately shall be packaged as per the following:

2.2.1.2.2 The UHV components shall be shipped in sealed container. No plastics are permitted as internal parts of such container. To prevent deformation of delicate internal components, the locks and dampers shall be added, where needed.

2.2.1.2.3 The dummy mirrors shall be removed and water lines drained and dry. The motors shall be removed and the shafts secured. The Roll Flexure Supports shall be installed for transportation.

2.2.1.2.4 The main vacuum vessel shall be shipped under vacuum, with the water lines drained and dried.

2.2.1.2.5 The primary component packaging shall be placed in another outer shipping container. The outer container must contain clean, non-chafing packing material, which prohibits contact between the inner and outer containers during shipment.

2.2.1.2.6 The packaging shall be sufficient to survive a 1.2m drop , in any orientation, and prevent damage or degradation of the assembly performance. The inner and outer packaging must remain intact. Conformance to this requirement shall be confirmed by testing per ASTM D 5276, A2.2.2, Ten Drop Cycle (boxes). Packaging shall be of sufficient size to discourage inappropriate handling.

2.2.1.2.7 The assemblies will be palletized and all assemblies will have suitable lifting points for removal from their packaging.

2.2.1.3 The Vendor shall be permitted to affix their logo to the PGM support structure. Such plate/ identification sign shall not complicate the normal operation of the PGM.

2.2.1.4 The CLS is equipped with a 10 ton overhead crane. The crane has coverage extending from the loading area to beamline sector 10 installment area. The mirror boxes in its transportation case shall be transferred close to its installed location, where it will be unpackaged and reassembled by CLS staff.

2.3 APPLICABLE CODES, STANDARDS AND PROCEDURES

2.3.1.1 In addition to PGM engineering drawings, the following documents shall be considered as part of this specification. All equipment shall be built in strict accordance with the following standards:

- CLS Design Specification 8.4.33.1 - Canadian Light Source High Vacuum Specification
- CLS Technical Procedure 8.7.33.1 - Canadian Light Source Vacuum Component Cleaning Technical Procedure
- CLS Technical Procedure 8.7.33.2 - Canadian Light Source Vacuum Component Leak Test Procedure

2.3.1.2 Unless otherwise specified, the issue date or revision level shall be that in effect on the date of the Request for Proposal. Exceptions to these standards shall be reviewed and accepted by the CLS.

2.4 QUALITY ASSURANCE

2.4.1 General Requirements

2.4.1.1 The selected vendor shall demonstrate that all fabricated parts have been manufactured as per the applicable drawings and specifications. An inspection report shall be provided for all fabricated parts to demonstrate this conformance. Any parts delivered with known non-conformances must have these non-conformances pre-approved by CLS.

2.4.1.2 The Vendor shall complete and execute a set of acceptance test procedures to verify that the mirror vessels and manipulators have been fabricated and assembled correctly. The Vendor acceptance tests for the mirror boxes shall include, but not be limited to, all of the testing procedures specifically outlined in this document.

2.4.1.3 The acceptance test results are subject to review and acceptance by the CLS. Two (2) sets of measurements in hardcopy and an electronic copy shall be sent to CLS after all major assembly and measurement procedures. Frequent data transfer is encouraged. Any review and acceptance process done by the CLS shall not release the vendor from its responsibility to correct errors, oversights and omissions to ensure conformance to the specifications in this document.

2.4.1.4 The vendor shall provide the facilities and instrumentation, if not specified otherwise, to perform all relevant tests to ensure compliance with this specification.

2.4.1.5 The Vendor shall maintain and apply a quality assurance program compliant with ISO-9001 for the design, manufacture, and testing of all components.

3.0 FABRICATION

3.1 MECHANICAL DRAWINGS

3.1.1 Common Manipulator

3.1.1.1 Mirror Manipulator 3DOF, 10ID-1\ME\MNC\0065267

3.1.2 M1

3.1.2.1 Dummy M1 Mirror, 10ID-1\ME\MNC\0071518

3.1.2.2 M1 Manipulator Assembly, 10ID-1\ME\MNC\0065229

3.1.2.3 M1 Cradle Assembly, 10ID-1\ME\MNC\0065223

3.1.2.4 M1 Mirror Cooling Assembly, 10ID-1\ME\MNC\0065224

3.1.2.5 M1 Fixed Mask, 10ID-1\ME\MNC\0065225

3.1.3 M3 PEEM:

3.1.3.1 Dummy M3/M4 Mirror, 10ID-1\ME\MNC\0071519

3.1.3.2 M3 PEEM Manipulator Assembly, 10ID-1\ME\MNC\0065246

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- 3.1.3.3 M3 PEEM Stage Assembly, 10ID-1\ME\MNC\0065292
 - 3.1.3.4 M3/M4 PEEM Mirror Cradle Assembly, 10ID-1\ME\MNC\0065242
 - 3.1.3.5 M3 Mirror Cooling Assembly, 10ID-1\ME\MNC\0065243

3.1.4 M3 STXM

- 3.1.4.1 Dummy M3/M4 Mirror, 10ID-1\ME\MNC\0071519
- 3.1.4.2 M3 STXM Manipulator Assembly, 10ID-1\ME\MNC\0065247
- 3.1.4.3 M3 STXM Mirror Cradle Assembly, 10ID-1\ME\MNC\0065230
- 3.1.4.4 M3 Mirror Cooling Assembly, 10ID-1\ME\MNC\0065243

3.1.5 M4 PEEM

- 3.1.5.1 Dummy M3/M4 Mirror, 10ID-1\ME\MNC\0071519
- 3.1.5.2 M4 PEEM Manipulator Assembly, 10ID-1\ME\MNC\0065248
- 3.1.5.3 M3/M4 PPEEM Mirror Cradle Assembly, 10ID-1\ME\MNC\0065242

3.1.6 Vacuum Vessels

- 3.1.6.1 M1 vacuum vessel with M1 mirror manipulator, 10ID-1\ME\MNC\0065250
- 3.1.6.2 M3PEEM vacuum vessel with M3PEEM mirror manipulator, 10ID-1\ME\MNC\0065274
- 3.1.6.3 M3STXM vacuum vessel with M3PEEM mirror manipulator, 10ID-1\ME\MNC\0065275
- 3.1.6.4 M4PEEM vacuum vessel with M4PEEM mirror manipulator, 10ID-1\ME\MNC\0065278

These drawings will all be provided as part of this RFP. All components required to fabricate the Mirror Boxes will be identified on these drawings.

The X-ray mirrors are not considered part of this RFP.

Detailed fabrication drawings are not provided as part of this RFP, but will be supplied to the successful proponent (Vendor). All detailed drawings will contain all of the information required to generate the entire fabricated assembly. All drawings conform to ASME Y14.5M-1994.

3.2 STANDARD PURCHASED COMPONENTS

The following is a listing of the major purchased components used for the Mirror Box fabrications. A complete listing, which includes all purchased components including shall be provided as a part of a detail drawing package. Any substitutions must be pre-approved by CLS. Appendix A contains indented partlists for the Mirror Boxes including fabricated and purchased parts.

3.2.1 Vacuum system

- 3.2.1.1 The Ion Pump shall be provided by CLS.
- 3.2.1.2 The UHV vacuum gauge shall be provided by CLS.
- 3.2.1.3 The UHV valve for the Turbo Pump connection will be defined in the drawing package.
- 3.2.1.4 All other Conflat flanges shall be sealed with blank flanges or viewport as indicated in the drawings.

3.2.1.5 All electrical connections and wiring shall withstand baking to 150°C for 24h.

3.2.2 Stepper Motors/Stages

3.2.2.1 All stepper motors are Parker Model OS21A-DNFL-YRE Size 23 Stepper motors with rotary encoders.

3.2.2.2 The linear stages for all of the Mirror stages are Parker Daedal Linear Stage Model 402002LND1L1C2M1. Stages require some modification prior to installation.

3.2.3 Linear Stage for M3PEEM vacuum vessel side movement

3.2.3.1 M3PEEM linear stage requires IKO Rail and Linear Rollers

3.2.3.2 The ball screw is driven by the standard stepper motor mounted to a Parker Daedal Rotary stage:

3.2.3.3 The limit switches and home position (for M3PEEM vessel install in the beam) shall be triple magnetic limit/home switch assemblies.

3.2.4 Fasteners and Hardware:

3.2.4.1 The fasteners and hardware should be described on the appropriate assembly drawing or partslist contained in the drawing package. Any additions or substitutions should be discussed with and pre-approved by CLS.

3.2.4.2 All fasteners should be made of Stainless Steel unless specifically defined differently on the partslist. All fasteners that are to be utilized in the UHV environment shall be silver plated. The vendor shall make a provision, where needed, for venting blind holes to relieve all potential internal virtual leaks. No lubricants of any type can be used without CLS approval.

3.2.4.3 Some aluminum parts with threads will utilize heli-coils as described on the appropriate drawings. Heli-coils shall be standard stainless steel heli-coils. Locking type heli-coils are not to be used. Substitutions must be pre-approved by CLS. Lubricants or liquid pre-treatments are not to be used.

3.3 VENDOR SUPPLIED SYSTEMS

3.4 BAKE-OUT SYSTEM

3.4.1 Design/Build:

The vendor shall provide a system for baking out the Mirror Boxes in-situ. The system shall be designed, and installed by the vendor. The system shall be developed in compliance with the Control System Technical Specification, #7.4.39.1. The main features are outlined below:

3.4.1.1 Each vacuum vessel shall be equipped with permanently affixed strip heaters or stand alone heaters, capable of 150°C bake-out of the vessel.

3.4.1.2 A removable thermo-cover (blanket) shall be built to cover the entire vacuum vessel.

3.4.1.3 At least two thermocouples shall be installed to monitor the baking temperature.

3.4.1.4 The system shall allow for a programmable heating of the vacuum vessel, the setting points, determined by the setting of the vacuum gauge as well as signals from the

thermocouples. The design shall permit a programmed baking cycle to be safely performed without an operator.

3.4.1.5 All electrical connectors and wires shall be compatible with a 150°C 24 h bake-out.

3.5 FABRICATION REQUIREMENTS

3.5.1 Materials

3.5.1.1 Materials for all components are as described on the detailed fabrication drawings. Any substitutions must be pre-approved by CLS.

3.5.1.2 Aluminum parts are typically manufactured from 6061-T6 aluminum or 7075-T6/T651. These materials must be provided as specified. If a specific grade is not specified, other grades of aluminum can be substituted.

3.5.1.3 Stainless steels shall be provided as specified. If not specified, a 300 series stainless steel shall be used. Other grades must be pre-approved by CLS.

3.5.1.4 Stainless steel Conflats flanges can be supplied by MDC, Varian, or others provided they meet the material and dimensional requirements.

3.5.1.5 Bellows suppliers and part numbers are specified in the partslists. Substitutions are permissible provided the critical dimensions and design intent are maintained. Discussion with CLS is recommended.

3.5.1.6 The seals are as follows:

3.5.1.6.1 Main Vacuum Chamber: Sealing is accomplished with an wire seal between stainless steel vacuum vessel surfaces.

3.5.1.6.2 Conflats: All conflats are standard stainless steel CF flanges and use standard OFHC copper gaskets. Details and part numbers are contained in the detailed drawings. Several different vendors are available to supply these standard components.

3.5.1.6.3 Water connectors: All of the cooling water supply lines shall be terminated by Swagelok-type stainless steel connections.

3.5.2 Material Surface Treatments

3.5.2.1 Surface treatments are called out on the detailed fabrication drawings. The following is a list of the call-outs from the drawings and the appropriate specifications:

3.5.2.1.1 Electroless Nickel Plate (Electrode less): Standard commercial processing to achieve a uniform coating of 0.008mm to 0.020mm (0.0003" to 0.0008").

3.5.2.1.2 Degrease: Clean using an appropriate process as defined in CLS Technical Procedure 8.7.33.1. These are typically UHV parts.

3.5.2.1.3 Powder Paint Black, Powder Coat Blue, etc.: Using standard commercial process powder paint in colour as specified. Confirm final colour selection with CLS prior to application. Surface application must be complete and even with a consistent colour.

3.5.2.1.4 Anodize Black, Black Anodize, Blue Anodize, etc.: Utilizing a commercial sulfuric anodizing process generate a coating thickness of between 0.0013mm to 0.008mm (0.00005" to 0.0003"). Dye and seal to appropriate colour.

3.5.2.1.5 Bright Dip: This is a process for stainless steel. Passivate as per a commercially acceptable standard and conformance to CLS Technical Procedure 8.7.33.1 if a UHV part.

3.5.2.1.6 **Satin Finish:** Clean using an appropriate process as defined in CLS Technical Procedure 8.7.33.1. These are typically UHV parts.

4.0 ASSEMBLY, VERIFICATION AND CHARACTERIZATION

4.1 PERFORMANCE TESTING

4.1.1 Rationale

- 4.1.1.1** The mirror mechanism design is derived from a unit that was successfully manufactured and installed. To minimize the risk associated with the fabrication of the CLS mechanisms, the following minimum assembly and test sequence is specified as guidance to the Vendor. Although the Vendor shall be responsible for verifying that the unit satisfies all of its requirements, this sequence will be used to evaluate the assembly and test procedures that the Vendor shall propose for approval by CLS.
- 4.1.1.2** Since this is a build-to-print procurement, when it is completed the mirror boxes should have the same mechanical performance as the original unit. As a result, a complete end-to-end verification is not required and can not be conducted since the final mirror will only be available after the unit is delivered. Instead, the verification process shall consist of a number of verification tests of the critical functions that are integral to the successful operation of the mirror box. During assembly, key measurements will be made and recorded such that the process of aligning and calibrating the mirror box is optimized.
- 4.1.1.3** Steps in this procedure that use the word "Verify" shall be considered as verification tests and must satisfy the acceptance criteria.
- 4.1.1.4** Steps in this procedure that use the word "measure" shall be considered as characterizations and although they must be executed do not have an acceptance criteria.
- 4.1.1.5** The Vendor shall allow a representative from CLS to witness, at CLS discretion, each stage of this assembly and test sequence. The Vendor shall provide CLS with at least 14 days notice of the commencement of assembly.

4.1.2 Assembly and Verification Sequence

- 4.1.2.1** Assemble all parts of the Mirror Manipulator in accordance with the assembly drawings and using the approved handling and assembly procedures.
- 4.1.2.2** Install the dummy optics onto the mirror cradles. For M1 mirror manipulator the dummy optic will have water channel that forms a closed circuit such that the water continuously flows from input, through the water-cooling channels to output and then back into the input. For other dummy mirror the water cooling line is a copper tube brazed to the side cooling assembly. In operation, the mirror contact requires gallium in the gap. Cooling is not be verified and the gallium is not required. The dummy mirror is only necessary to provide a mass representative assembly for the mechanical testing.
- 4.1.2.3** Install the mechanical switches, motors and encoders.
- 4.1.2.4** Perform the mechanical tests and water flow/ pressurization test as specified below.
- 4.1.2.5** Assemble the vacuum vessel with mirror manipulator and perform the leak tests. The IP and IP controller, as well as the vacuum gauges will be provided by CLS.
- 4.1.2.6** Disassemble all the parts of mirror manipulator, which are facing the UHV volume. Clean and properly degrease all parts, clean the chamber base and side plates by scrubbing and washing with solvent. Refer to CLS Technical Procedure 8.7.33.1.

4.1.2.7 Assemble all cleaned part back without “dummy” optic but with the Roll Flexure Supports and fasteners, as indicated on drawings, using the approved handling and assembly procedures.

4.1.2.8 Bake up the entire vacuum vessel to 150°C for at least 24h. Verify, that after the final assembly, cleaning and baking the UHV in the main chamber pumped by an Ion Pump alone is better than 5×10^{-10} Torr and verify, that RGA scan has no peaks above mass 40 greater than 1×10^{-12} Torr partial pressure.

4.1.3 Actuation

4.1.3.1 The stepper motors shall be operated to their full extents to verify that the mechanism operates as intended without binding, interference, or excessive torque requirements. Verification of the correct operation of the encoders and limit switches must be verified.

4.1.3.2 The vendor will supply the stages, gearboxes, couplings and motors and defined by the drawings and this specification. However, the stepper motor drivers are not part of this specification and the vendor must provide their own method of operating the stages for this mechanical check-out.

4.1.3.3 Using the stepper motors, drive the stages to the ends of their travels and verify that the limit switches are activated at the required positions.

Note: Do not operate the assembly with the Roll Flexure Support in place.

4.1.3.4 Assemble the M3PEEM vacuum vessel translational stage, install the limit switches and home position indicator and verify the stage performance.

4.1.4 Mechanical tests

To perform the mechanical test, the dial gauge indicator shall be attached to dummy mirror ends. The accuracy of such gauges and their location shall be enough to measure a deflection normal to the surface with 0.2 μ precision and angular deviation (as a differential readout of two gauges placed at the end of the mirror) better than 1 μ rad. Suggested model for gauge is Heidenhain height gauge.

4.1.4.1 Verify that the mirror center pole remains fixed in space for any mirror rotation angle.

4.1.4.2 Verify the reproducibility of angular movement of the mirror, the absence of the backlash and the range of travel for pitch, roll and yaw of the mirror movement. Measure if there is any crosstalk between different degree of freedom.

4.1.4.3 Calibrate the mirror rotations to an absolute scale of μ rad as a function of steps of the stepper motors.

4.1.5 Water flow test

4.1.5.1 This test shall measure any pressure induced displacement of the mirror, as well as verify the absence of leaks between the water circuit and other volumes under pressure. To perform the test, the water flow circuit shall be pressurized to 60psi. Measure deflections and mirror rotations under pressure and provide the results to CLS.

4.1.5.2 Verify that no water leaks exist and that the pressure in the water flow circuit remains steady at 60 psi after closing the valves for at least one hour. For M1 mirror vessel the pressure in the sealed air guard circuit shall be monitored with an accuracy of better than ± 0.01 atmosphere and must show no sign of rising during the measurements.

4.1.6 Leak test

4.1.6.1 The helium leak test shall be performed for all separate volumes as per CLS Technical Specification 8.7.33.2.

The M1 vacuum vessel consists of three separate volumes.

- The main vacuum vessel, which is a UHV volume.
- The internally water-cooled mirror placed inside the vacuum vessel, organizes a water-cooling circuit.
- To prevent direct exposure of the water joints to UHV, there is an evacuated air guard volume which is a protective circuit around water loop.

The M3STXM, M3PEEM and M4PEEM vacuum vessels have only two volumes:

- The main vacuum vessel, which is a UHV volume and
- Water loop made out of copper tube.

4.1.6.2 The system is a leak free, if the result of the helium leak test will shall be less than 2×10^{-8} std atm cc/sec (2.67×10^{-5} Pa L/s) for water-cooling channel volume to air guard volume and 2×10^{-9} std atm cc/sec (2.67×10^{-7} Pa L/s) for test of UHV volume.

5.0 APPENDIX A: PARTSLIST

NOTE: TO CONSTRUCT COMPLETE PART NUMBERS, ADD THE DIRECTORY
 SHOWN IN THE FIRST COLUMN TO THE SHORTENED PART NUMBER
 IE.: PART 0065250 IN FULL FORM READS: 10ID-1\ME\MIR\0065250

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR C	0065267	1	MIRROR MANIPULATOR 3 DOF		
	SA075XT08	1	REAL SLIM BALL BEARING	KAYDON	
	C-1006-A	12	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 10-32UNF x 3/8"LG.	UC-COMP.	
10ID-1\ME\MIR C	0065129	1	BEARING INNER HOUSING	FAB	AL 6061-T6- PLATE
10ID-1\ME\MIR C	0065131	1	BEARING INNER RETAINER	FAB	AL 6061-T6- PLATE
10ID-1\ME\MIR C	0065130	1	BEARING OUTER HOUSING	FAB	AL 6061-T6- PLATE
	C-1008-A	16	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 10-32UNF x 1/2"LG.	UC-COMP.	
10ID-1\ME\MIR C	0065132	1	BEARING OUTER RETAINER	FAB	AL 6061-T6- PLATE
10ID-1\ME\MIR C	0065162	1	DRIVE BELLOWS	FAB	
10ID-1\ME\MIR C	0065160	1	FLANGE 4.62"OD DRIVE BELLOWS	FAB	
	130024	1	CONFLAT FLANGE	MDC	
	386-325-4-EE	1	BELLOWS	STD. BELL.	
10ID-1\ME\MIR C	0065161	1	FLANGE 6.75"OD DRIVE BELLOWS	FAB	
	100027	1	FLANGE, CONFLAT	MDC	
10ID-1\ME\MIR C	0065136	1	JOYSTICK SHAFT WELDMENT	FAB	
10ID-1\ME\MIR C	0065135	1	JOYSTICK CONFLAT FLANGE (2.12")	FAB	
	BLANK	1	FLNAGE, CONFLAT TYPE, 2.12"OD BLANK		

ROTATABLE					
10ID-1\ME\MIR C	0065134	1	JOYSTICK SHAFT	FAB	S.S. 304L- ROUND ROD
	B-275-T-12	4	BOLT, 12PT. HD., S.S., 1-4-28UNF x 7/8" LG. PKG. 25	HUNT	
10ID-1\ME\MIR C	0065133	1	JOYSTICK FLANGE	FAB	S.S.-300 SERIES-PLATE
10ID-1\ME\MIR C	0065137	2	DRIVE BUTTON	FAB	AL BRONZE AMPCO 18
10ID-1\ME\MIR C	0065138	1	BUTTON SPACER	FAB	AL BRONZE AMPCO 18
	C-2012-N	6	SCREW, SOC. HD., S.S., 1/4-20UNC x 3/4"LG.	UC-COMP.	
	MC-516-N	16	SCREW, SOC. HD., S.S. M5-0.8 x 16MM LG.	UC-COMP.	
	MC-510-N	16	SCREW, SOC. HD., S.S. M5-0.8 x 10MM LG.	UC-COMP.	
	MC-525-N	4	SCREW, SOC. HD., S.S. M5-0.8 x 25MM LG.	UC-COMP.	
	C-1008-N	4	SCREW, SOC. HD., S.S., 10-32UNF x 1/2"LG.	UC-COMP.	
	C-2008-N	3	SCREW, SOC. HD., S.S., 1/4-20UNC x 1/2"LG.	UC-COMP.	
10ID-1\ME\MIR C	0065165	1	DRIVE MOUNTING PLATE	FAB	AL 6061-T6- PLATE
10ID-1\ME\MIR C	0065173	1	SPRING HOUSING	FAB	AL 6061-T6- PLATE
	C-1028-N	4	SCREW, SOC. HD., S.S., 10-32UNF x 1-3/4"LG.	UC-COMP.	
	C-608-N	3	SCREW, SOC. HD., S.S., 6-32UNC x 1/2"LG.	UC-COMP.	
10ID-1\ME\MIR C	0065175	1	SPRING PAD	FAB	S.S. ROD DIA .50"
10ID-1\ME\MIR C	0065176	1	PLUNGER	FAB	S.S. ROD DIA .50"
10ID-1\ME\MIR C	0065177	1	SUPPORT BLOCK	FAB	AL 6061-T6
10ID-1\ME\MIR C	0065174	1	CAP	FAB	AL 6061-T6
10ID-1\ME\MIR C	0071515	1	SPRING		
	PITCH ACTUATOR	1	ACTUATOR MOTOR (PITCH)		

		MOTOR	1	MOTOR# 0S21A-DNFL-YRE, SZ. 23 WITH ROTARY ENCODER	PARKER	
		STAGE	1	LINEAR STAGE# 402002LND1L1C2M1, REQUIRES MODS.	PARKER	
10ID-1\ME\MIR C	0065168		1	SWITCH ACTUATOR (PITCH)		AL 6061-T6 PLATE 3/8" THK.
	N-2528		7	NUT, HEX HD., S.S., 1/4-28UNF	UC-COMP.	
	F100 80		6	LIMIT SWITCH	MY-COM	
	C-2020-N		2	SCREW, SOC. HD., S.S., 1/4-20UNC x 1-1/4"LG.	UC-COMP.	
10ID-1\ME\MIR C	0065164		1	HARD STOP (PITCH)	FAB	AL 6061-T6 S.S.-1/4-28 ALL THREAD
10ID-1\ME\MIR C	0065172		7	ADJUSTMENT SCREW	FAB	
	ROLL ACTUATOR		1	ACTUATOR MOTOR (ROLL)		
		MOTOR	1	MOTOR# 0S21A-DNFL-YRE, SZ. 23 WITH ROTARY ENCODER	PARKER	
		STAGE	1	LINEAR STAGE# 402002LND1L1C2M1, REQUIRES MODS.	PARKER	
10ID-1\ME\MIR C	0065169		1	SWITCH ACTUATOR (ROLL)	FAB	AL 6061-T6 PLATE 1.0" THK.
10ID-1\ME\MIR C	0065166		1	HARD STOP (ROLL)	FAB	AL 6061-T6
	C-2032-N		2	SCREW, SOC. HD., S.S., 1/4-20UNC x 2"LG.	UC-COMP.	
	SSS-56		1	SPRING PLUNGER	VLIER	
	YAW ACTUATOR		1	ACTUATOR MOTOR (YAW)		
		MOTOR	1	MOTOR# 0S21A-DNFL-YRE, SZ. 23 WITH ROTARY ENCODER	PARKER	
		STAGE	1	LINEAR STAGE# 402002LND1L1C2M1, REQUIRES MODS.	PARKER	
10ID-1\ME\MIR C	0065170		1	SWITCH ACTUATOR (YAW)	FAB	AL 6061-T6
10ID-1\ME\MIR C	0065171		1	YAW SLIDE SUPPORT	FAB	AL 6061-T6
10ID-1\ME\MIR C	0065167		1	HARD STOP (YAW)	FAB	AL 6061-T6
	N-3124		2	NUT, HEX HD., S.S., 5/16-24UNF	UC-COMP.	

10ID-1\ME\MIR C	0065264	1	ADJUSTMENT SCREW, .3125"	FAB	
10ID-1\ME\MIR C	0065200	2	OPERATIONAL HARD STOP	FAB	AL 6061-T6 PLATE 1/4" THK.
10ID-1\ME\MIR C	0065263	1	FLEXURE MOUNTING PLATE ASSEMBLY	FAB	
10ID-1\ME\MIR C	0065122	1	COLLAR (DRIVE SUPPORT TUBE)	FAB	S.S. 304L OR PRODEC-PLATE S.S.-TUBE- 2.875"ODx2.50" D
10ID-1\ME\MIR C	0065128	1	DRIVE SUPPORT TUBE	FAB	S.S. 304L OR PRODEC-PLATE
10ID-1\ME\MIR C	0065254	1	FLEXURE MOUNTING PLATE	FAB	
10ID-1\ME\MIR C	0065126	1	BELLOWS FLANGE	FAB	
	200-125-4-EE	1	FLANGE, CONFLAT-2.12"OD x 1.00"ID	MDC OR EQ.	
	200-125-4-EE	1	EDGE-WELDED METAL BELLOWS	MDC	
	B-450-T-12	10	BOLT, 12PT. HD., S.S., 5/16-24UNF x 1-1/4" LG. PKG. 25	HUNT	

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR C	0065243	1	M3-M4 MIRROR COOLING ASSEMBLY		
10ID-1\ME\MIR C	0065244	1	M3-M4 MIRROR COOLING HOOKUP	FAB	
10ID-1\ME\MIR C	0065268	1	WATER BLOCK	FAB	S.S. 304, PLATE, 1.0"THK.
	FITTING	2	COOLING FITTING		
	TUBE	2	TUBE, COOLING, .25" OD		
10ID-1\ME\MIR C	0065245	1	M3-M4 MIRROR COOLING WELDMENT		
10ID-1\ME\MIR C	0065237	1	HEAT SINK	FAB	GLIDCOP AL15 (C15715) PLATE
10ID-1\ME\MIR C	0065269	1	LCW COOLING FLANGE	FAB	
	BLANK	1	FLANGE, CONFLAT TYPE, 2.12 OD. BLANK	MDC	
	TUBE	1	TUBE, COOLING, .25" OD, SPIRAL	FAB	
	B-275-T-12		BOLT, 12PT. HD., S.S., 1-4-28UNF x 7/8" LG. PKG. 25	HUNT	
	C-2816-N	2	SCREW, SOC. HD., S.S., 1/4-28UNF x 1"LG.	UC-COMP.	

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR C	0065242	1	M3-M4 PEEM CRADLE ASSEMBLY		
10ID-1\ME\MIR C	0065117	4	CLAMP HALF (PITCH)	FAB	AL 6061-T6
10ID-1\ME\MIR C	0065124	2	ROLL FLEXURE SUPPORT (PRIMARY)	FAB	AL PLATE 6061 AL 6061-T6, .25" THK.
10ID-1\ME\MIR C	0065231	2	FLEXURE BRACE	FAB	
10ID-1\ME\MIR C	0065232	1	M3-M4 CRADLE	FAB	
10ID-1\ME\MIR C	0065233	2	M3-M4 ROLL FLEXURE	FAB	AL 7075-T651
10ID-1\ME\MIR C	0065234	2	HARD STOP (PITCH)	FAB	AL 6061-T6
10ID-1\ME\MIR C	0065235	2	FLEXURE EXTENSION	FAB	
10ID-1\ME\MIR C	0065236	2	HARD STOP ROLL-YAW	FAB	
10ID-1\ME\MIR C	0065238	1	MIRROR MASK	FAB	GLIDCOP AL15 (C15715) PLATE
10ID-1\ME\MIR C	0065239	3	AXIAL CLIP	FAB	S.S. 304
10ID-1\ME\MIR C	0065240	2	STOP CLIP	FAB	
10ID-1\ME\MIR C	0065266	2	ADJUSTMENT SCREW, .25"	FAB	
	5016-40	2	FLEXURE PIVOT	LUCUS	
	SSS-56	6	SPRING PLUNGER	VLIER	
	C-406-A	4	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 4-40UNC x 3/8"LG.	UC-COMP.	
	C-410-A	6	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 4-40UNC x 5/8"LG.	UC-COMP.	
	C-608-A	8	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 6-32UNC x 1/2"LG.	UC-COMP.	
	C-1008-A	18	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 10-32UNF x 1/2"LG.	UC-COMP.	
	C-2008-A	3	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 1/4-20UNC x 1/2"LG.	UC-COMP.	

C-2010-A	4	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 1/4-20UNC X 5/8"LG.	UC-COMP.
C-2012-N	4	SCREW, SOC. HD., S.S., 1/4-20 x 3/4"LG.	UC-COMP.
C-2014-A	12	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 1/4-20UNC x 7/8"LG.	UC-COMP.
N-2520	2	NUT, HEX HD., S.S., 1/4-20UNC	UC-COMP.
N-3118	6	NUT, HEX HD., S.S., 5/16-18UNC	UC-COMP.

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR C	0065241	1	M3-M4 MOUNTING PLATE	FAB	
10ID-1\ME\MIR C	0071528	1	M3-M4 MOUNTING PLATE WELDMENT	FAB	
	0065270	1	M3-M4 MOUNTING PLATE FLANGE	FAB	S.S. 304
	120007	1	FLANGE, 2.12"OD x 1.00"ID	MDC	
	TUBE	1	TUBE, 1.00"OD x .065"WALL		
10ID-1\ME\MIR C	0065149	1	HALF NIPPLE, 6.75"OD	FAB	
	401007	1	FLANGE, HALF NIPPLE, 6.75"OD	MDC	

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR	0065250	1	M1 ASSEMBLY		
10ID-1\ME\MIR	0065229	1	M1 MANIPULATOR ASSEMBLY		
10ID-1\ME\MIR	0071518	1	M1 DUMMY MIRROR ASSEMBLY	FAB	
	0071525	1	DUMMY MIRROR		SS
	SCREW	12	SOC. HD. CAP SCR., 8-32UNC x .75"LG.		
	191000	2	1.33" CFF COPPER GASKET	MDC	
	130000	2	1.33" CFF NON-ROTAT. BLANK	MDC	
10ID-1\ME\MIR	0065210	2	MIRROR COOLANT FITTING	FAB	
10ID-1\ME\MIR	0065109	1	WELD NECK	FAB	S.S. 304
	110004	1	1.33" CONFLAT FLANGE	MDC	
10ID-1\ME\MIR	0065223	1	M1 CRADLE ASSEMBLY	FAB	
	5016-40	2	FLEXURE PIVOT	LUCUS	
10ID-1\ME\MIR C	0065117	4	CLAMP HALF (PITCH)	FAB	AL 6061-T6 AL 7075-T6/T651 (73 ksi YIELD)
10ID-1\ME\MIR	0065123	2	ROLL FLEXURE	FAB	
10ID-1\ME\MIR C	0065124	2	ROLL FLEXURE SUPPORT (PRIMARY)	FAB	AL PLATE 6061 AL 6061-T6- PLATE
10ID-1\ME\MIR	0065118	1	MIRROR CRADLE	FAB	
	C-2010-A	8	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 1/4- 20UNC x 5/8"LG.	UC-COMP.	
	N-3118	3	NUT, HEX HD., S.S., 5/16-18UNC	UC-COMP.	
10ID-1\ME\MIR	0065114	3	MIRROR MOUNTING FOOT	FAB	AL BRONZE AMPCO 18
	C-808-A	6	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 8- 32UNC x 1/2"LG.	UC-COMP.	
10ID-1\ME\MIR	0065115	3	ALIGNMENT SHOULDER	FAB	S.S. 304

	C-606-A	6	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 6-32UNC x 3/8"LG.	UC-COMP.	
10ID-1\ME\MIR	0065265	2	ADJUSTMENT SCREW, .25"	FAB	
	N-2520	2	NUT, HEX. HD., S.S., 1/4-20UNC	UC-COMP.	
10ID-1\ME\MIR	0065120	2	HARD STOP	FAB	AL 6061-T6-PLATE
	C-2014-A	4	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 1/4-20UNC x 7/8"LG.	UC-COMP.	
10ID-1\ME\MIR	0065119	2	ROLL FLEXURE BRACE	FAB	AL 6061-T6-PLATE
	C-612-A	8	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 6-32UNC x 3/4"LG.	UC-COMP.	
	C-1008-A	16	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 10-32UNF x 1/2"LG.	UC-COMP.	
	SSS-56	3	SPRING PLUNGER	VLIER	
10ID-1\ME\MIR	0065116	2	VEE BLOCK	FAB	S.S. 304
10ID-1\ME\MIR	0065222	1	FLAT BLOCK	FAB	S.S. 304
10ID-1\ME\MIR	0065224	1	M1 MIRROR COOLING ASSY	FAB	
10ID-1\ME\MIR	0065260	2	LCW CONNECTOR	FAB	
10ID-1\ME\MIR	0071514	1	FLANGE, LCW	FAB	S.S. 304L
	TUBE	A/R	TUBE-STAINLESS 304 .375"Odx.035"WALL		
10ID-1\ME\MIR	0071523	1	M1 WATER BLOCK COLLING LINE	FAB	
10ID-1\ME\MIR	0065147	2	RETAINING PIN	FAB	S.S. TUBING-PFA (TEFLON) 7/16"OD x 5/16"ID
10ID-1\ME\MIR	0065139	2	WATER DISTRIBUTION TUBE	INTERSTAT.	
10ID-1\ME\MIR	0065146	2	SYSTEM PLUG	FAB	AL 6061-T6-ROD
	2-006	2	O'RING, .125"OD	PARKER	
10ID-1\ME\MIR	0065143	2	BELLOWS, COOLING	FAB	
10ID-1\ME\MIR	0065142	1	GLAND, MINI-FLANGE	FAB	

	103-55-3	1	FLANGE, CONFLAT, MNI (1.33"OD), ROTATABLE MDC OR EQUIVALENT	MDC	
	103-55-3-EE	1	BELLOWS	STD. BELL.	
10ID-1\ME\MIR	0065141 CONFLA T	1	FLANGE BELLOWS, 103-55-3		
		1	FLANGE-CONFLAT-DIA 2.12 MDC OR EQ.	MDC	
	C-812-A	12	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 8-32UNC x 3/4"LG.	UC-COMP.	
	BNP-133	6	BOLT NUT PLATE	HUNT	
	C-1010-N	6	SCREW, SOC. HD., VENTED S.S., 10-32UNF x 5/8"LG.	UC-COMP.	
	2-013	6	O'RING, .437"OD	PARKER	
10ID-1\ME\MIR	0065140	4	RETAINER	FAB	AL 6061-SHEET
	B-275-T-12	8	BOLT, 12PT. HD., S.S., 1-4-28UNF x 7/8" LG. PKG. 25	HUNT	
10ID-1\ME\MIR	0065225	1	FIXED MASK	FAB	
10ID-1\ME\MIR	0065226	1	M1 FIXED MASK SHIELD	FAB	
10ID-1\ME\MIR	0071520	1	M1 MIRROR FIXED MASK		
10ID-1\ME\MIR	0071521	1	M1 FIXED MASK COOLING LINE		
10ID-1\ME\MIR	0071524	1	M1 MASK COOLING FLANGE		
	120005	1	FLANGE, CONFLAT, 2.12"OD	MDC	
10ID-1\ME\MIR	0065227	1	M1 FIXED MASK BRACKET	FAB	S.S. 304
10ID-1\ME\MIR	0065228	1	M1 FIXED MASK COOLING BLOCK	FAB	
10ID-1\ME\MIR	0071522	1	M1 WATER BLOCK	FAB	S.S. 304
10ID-1\ME\MIR	0071523	2	M1 WATER BLOCK COOLING LINE	FAB	
10ID-1\ME\MNC	0065001-1	2	HALF UNION		
	C-3812-N	2	SCREW, SOC. HD., S.S., 3/8-24UNF x 1.5"LG.	UC-COMP.	
	C-1008-A	2	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 10-32UNF x 1/2"LG.	UC-COMP.	
	B-275-T-12	4	BOLT, 12PT. HD., S.S., 1-4-28UNF x 7/8" LG. PKG. 25	HUNT	
	C-2010-A	2	SCREW, SOC. HD., VENTED S.S., SILVER PLATED, 1/4-	UC-COMP.	

		20UNC x 5/8"LG.			
10ID-1\ME\MIR	0065253	1	M1 MOUNTING PLATE	FAB	
10ID-1\ME\MIR	0065252	1	MOUNTING PLATE WELDMENT	FAB	
10ID-1\ME\MIR	0065148	2	FLANGE, CONFLAT, 2.12"OD (VESSEL FLANGE)	FAB	
	130005	1	FLANGE, CONFLAT-2.12"OD	MDC	
10ID-1\ME\MIR	0065149	1	HALF NIPPLE, 6.75"OD	FAB	
	401007	1	FLANGE, HALF NIPPLE, 6.75"OD	MDC	
10ID-1\ME\MIR	0071529	2	CAP (VESSEL FLANGE)	FAB	S.S. 304
					S.S., TUBE
					3.00"OD x
10ID-1\ME\MIR	0065151	2	TUBE 3.0" OD	FAB	.12"WALL
					S.S., TUBE
					.6875"OD x
10ID-1\ME\MIR	0065152	2	TUBE 11/16"OD	FAB	.035"WALL
10ID-1\ME\MIR	0065251	1	MOUNTING PLATE	FAB	S.S. 304 PLATE
	130007	1	FLANGE, CONFLAT, 2.12"OD NON-ROTAT.	MDC	
10ID-1\ME\MIR C	0065267	1	MIRROR MANIPULATOR 3 DOF		
10ID-1\ME\MIR	0065257	1	VACUUM VESSEL (FINAL MACHINING)	FAB	
10ID-1\ME\MIR	0065256	1	VACUUM VESSEL WELDMENT	FAB	
10ID-1\ME\MIR C	0065156	3	VESSEL MOUNTING LUG	FAB	AL 6061-ROD
					DIA 1.125"
10ID-1\ME\MIR	0065255	1	VACUUM VESSEL BODY	FAB	AL 6061-T651,
	WN110025-NRC SS	2	FLANGE, WELD NECK, 6" OD, S.S.	ATLAS	PLATE
	WN110030NRC SS	3	FLANGE, WELD NECK, 8" OD, S.S.	ATLAS	
	FNH01505	2	HALF NIPPLE, 2.75"OD, 62.48 LG	VARIAN	
	FNH02505	2	HALF NIPPLE, 4.5"OD, 85.85 LG	VARIAN	
10ID-1\ME\MIR	0071527	1	M1 BLANK OFF FLANGE WELDMENT	FAB	AL 6061-T6, PLATE -1"THK.

	0065259	1	M1 BLANK OFF FLANGE	FAB	SS
	WN110030NRc SS	1	FLANGE, WELDNECK, 8"OD, SS	ATLAS	
10ID-1\ME\MIR	C-3824-N	44	SCREW, SOC. HD., S.S., 3/8-24UNF x 1.5"LG.	UC-COMP.	

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR 3	0065275	1	M3 STXM ASSEMBLY		
10ID-1\ME\MIR 3	0065247	1	M3 STXM MANIPULATOR ASSEMBLY		
10ID-1\ME\MIR C	0071519	1	DUMMY M3/M4 MIRROR		COPPER
10ID-1\ME\MIR 3	0065230	1	M3 STXM CRADLE ASSEMBLY (SAME BOM AS 0065242)		
10ID-1\ME\MIR C	0065241	1	M3-M4 MOUNTING PLATE	FAB	
10ID-1\ME\MIR C	0065243	1	M3-M4 MIRROR COOLING ASSEMBLY		
10ID-1\ME\MIR C	0065267	1	MIRROR MANIPULATOR 3 DOF		
10ID-1\ME\MIR C	0065271	1	M3, M4 BLANK OFF FLANGE	FAB	S.S. 304
10ID-1\ME\MIR 3	0065277	1	M3 STXM VACUUM VESSEL	FAB	
10ID-1\ME\MIR 3	0065276	1	VACUUM VESSEL BODY	FAB	AL 6061-T6
10ID-1\ME\MIR C	0065156	3	VESSEL MOUNTING LUG	FAB	AL 6061-ROD DIA 1.125"
	FNH0150	2	HALF NIPPLE, CFF 2-3/4"OD 119.63LG.	VAR.	
	WN110025-NRc	1	FLANGE, WELD NECK, 6" OD, S.S.	ATLAS	
	SS				
	WN110030-NRc	3	FLANGE, WELD NECK, 8" OD, S.S.	ATLAS	
	SS				
	C-3824-N	48	SCREW, SOC. HD., S.S., 3/8-24UNF x 1.5"LG.	UC-COMP.	

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR 3	0065274	1	M3 PEEM ASSEMBLY		
10ID-1\ME\MIR C	0065220	4	BUSHING, 1-1/8"OD 17/32"ID	FAB	
10ID-1\ME\MIR 3	0065246	1	M3 PEEM MANIPULATOR ASSEMBLY		
10ID-1\ME\MIR C	0071519	1	DUMMY M3/M4 MIRROR		COPPER
10ID-1\ME\MIR C	0065241	1	M3-M4 MOUNTING PLATE	FAB	
10ID-1\ME\MIR C	0065242	1	M3-M4 PEEM CRADLE ASSEMBLY		
10ID-1\ME\MIR C	0065243	1	M3-M4 MIRROR COOLING ASSEMBLY		
10ID-1\ME\MIR C	0065267	1	MIRROR MANIPULATOR 3 DOF		
10ID-1\ME\MIR C	0065271	1	M3, M4 BLANK OFF FLANGE	FAB	S.S. 304
10ID-1\ME\MIR 3	0065273	1	M3 PEEM VACUUM VESSEL	FAB	
10ID-1\ME\MIR 3	0065272	1	VACUUM VESSEL BODY	FAB	AL 6061-T6
10ID-1\ME\MIR C	0065156	4	VESSEL MOUNTING LUG	FAB	AL 6061-ROD DIA 1.125"
	6" FLANGE	2	FLANGE, WELD NECK, 6" OD, S.S.		
	8" FLANGE	3	FLANGE, WELD NECK, 8" OD, S.S.		
10ID-1\ME\MIR 3	0065292	1	M3 PEEM STAGE ASSEMBLY	FAB	
	C-3824-N	48	SCREW, SOC. HD., S.S., 3/8-24UNF x 1.5"LG.	UC-COMP.	

DIRECTORY	PART NUMBER	QTY.	DESCRIPTION	SUPPLIER	MATERIAL
10ID-1\ME\MIR 3	0065278	1	M4 PEEM ASSEMBLY		
10ID-1\ME\MIR 4	0065248	1	M4 PEEM MANIPULATOR ASSEMBLY		
10ID-1\ME\MIR C	0071519	1	DUMMY M3/M4 MIRROR		COPPER
10ID-1\ME\MIR C	0065241	1	M3-M4 MOUNTING PLATE	FAB	
10ID-1\ME\MIR C	0065242	1	M3-M4 PEEM CRADLE ASSEMBLY		
10ID-1\ME\MIR C	0065243	1	M3-M4 MIRROR COOLING ASSEMBLY		
10ID-1\ME\MIR C	0065267	1	MIRROR MANIPULATOR 3 DOF		
10ID-1\ME\MIR C	0065271	1	M3, M4 BLANK OFF FLANGE	FAB	S.S. 304
10ID-1\ME\MIR 4	0065280	1	M4 PEEM VACUUM VESSEL	FAB	
10ID-1\ME\MIR 4	0065279	1	VACUUM VESSEL BODY	FAB	AL 6061-T6 AL 6061-ROD DIA 1.125"
10ID-1\ME\MIR C	0065156	3	VESSEL MOUNTING LUG	FAB	
	FNH0150	2	HALF NIPPLE, CFF 2-3/4"OD 119.63LG.	VAR.	
	8" FLANGE	3	FLANGE, WELD NECK, 8" OD, S.S.		
	C-3824-N	48	SCREW, SOC. HD., S.S., 3/8-24UNF x 1.5"LG.	UC-COMP.	