

3.2 Medical Requirements Overview**TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW**

MRID# and Title:	MR081L Physical Fitness Evaluation: Handgrip Dynamometry Testing
Sponsor:	Medical Operations
IPT:	Bone, Muscle and Exercise; EVA
Category:	Medical Requirements (MR)
References:	International Space Station Medical Operations Requirements Document (ISS MORD) SSP 50260: Astronaut Medical Evaluation Requirements Document (AMERD) JSC 24834
Purpose/Objectives:	Isometric pinch strength as well as handgrip strength and endurance will be assessed using a Hand Grip/Pinch Force Dynamometer (HGD/PFD)
Measurement Parameters:	Hand strength and endurance
Deliverables:	Assessment of hand muscle strength and endurance.
Flight Duration:	≥ 30 days
Number of Flights:	Every Expedition
Number and Type of Crew Members Required:	All ISS crewmembers. Back-up crew will only complete preflight MATs greater than L-45 days unless specifically waived by crew surgeon. If crew swap does occur, back-up crew will complete all preflight MATs.
Other Flight Characteristics:	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity	Description:	ISS crewmembers will be trained to operate the handgrip and pinch force dynamometer during a portion of the Countermeasure Operations II training class (15-30 minutes). The Handgrip strength and endurance protocol and the Pinch Force Dynamometer protocol will be discussed.			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		CMS Ops II: 2 hrs (Handgrip/Pinch force approx. 15-30 minutes of class)	L-365 days	+/- 2 months, or when crew is in U.S.	Trainer, ASCR, Crew
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:		Test Location:	
	Handgrip / Pinch Force Dynamometer Medical Equipment Computer (MEC)	EVA Hand Grip Log on MEC general software load.		U.S.	
Training Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	8' x 10' room	1-110 outlet	20-25 degrees C	N/A	
	Hot or Cold Running Water:	Privacy Requirements:	Other:		
	N/A	N/A	Table near outlet for computer		
Constraints/Special Requirements:	N/A				
Launch Delay Requirements:	N/A				
Notes:	N/A				

3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	<p><u>Pinch-Force Testing:</u> (assessed using the thumb and forefinger of both the right and left hands) The crewmember will complete three 5-second maximal voluntary isometric contractions with 60 seconds rest between each effort.</p> <p><u>Handgrip Strength Testing:</u> (assessed for both the right and left hands) The crewmember will complete three 5-second maximal voluntary isometric contractions with 60 seconds rest between each effort.</p> <p><u>Handgrip Static Endurance Testing:</u> (assessed on the non-dominant hand) The crewmember will execute a sustained maximal isometric contraction with the non-dominant hand until the contraction diminishes to 50% pre-EVA max. Endurance will be measured as a function of time of contraction to 50% pre-EVA max. Testing post-EVA training will use absolute measures, (i.e., test based on pre-EVA maximal forces).</p> <p><u>Handgrip Dynamic Endurance Testing:</u> (assessed on the dominant hand) The crewmember will execute a series of three-second contractions at 100% pre-EVA max interrupted by a three-second rest until he/she can no longer produce a contraction of 75% pre-EVA max. Endurance will be measured as a function of time of contraction and the number of repetitions at 75% pre-EVA max.</p> <p>Testing will occur during routine exercise time in the astronaut gym.</p>			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		30 min	L-45/30 days	+/- 20 days or when crew in U.S.	Astronaut Trainer (ASCR), Crewmember
Ground Support Requirements Hardware/Software	Preflight Hardware:		Preflight Software:		Test Location:
	Handgrip/Pinch Force Dynamometer Medical Equipment Computer (MEC)		EVA Hand Grip Log on MEC general software load.		U.S.
Testing Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	8' x 10' Room	1 -110 V outlet	20-25°C	N/A	
	Hot or Cold Running Water:	Privacy Requirements:	Vibration/Acoustic Isolation:	Other:	
	N/A	N/A	N/A	Table near outlet for computer	

Constraints/Special Requirements:	No handgrip dynamometry testing within 24 hours of EVA training. Test Termination Criteria: <ul style="list-style-type: none"> ▪ Volitional Fatigue ▪ Discontinue the testing if pain occurs that interferes with performance 		
Launch Delay Requirements:	L-45/30 data collection will be repeated if launch is delayed by more than 3 months.		
Data Delivery	<table border="1" style="width: 100%;"> <tr> <td style="background-color: #e0e0e0;">Data/Report to Designated Recipients (Nominal/Contingency):</td> </tr> <tr> <td> Preliminary MAT reports for all sessions will be delivered to Crew Surgeon via Mission Integration Coordinator (MIC) within 48 hours of test completion. A final report shall be delivered to the Crew Surgeon via the MIC within 14 days following the preflight test session. The MAT data is due to the Data Archivist within 14 days after completion of each session. </td> </tr> </table>	Data/Report to Designated Recipients (Nominal/Contingency):	Preliminary MAT reports for all sessions will be delivered to Crew Surgeon via Mission Integration Coordinator (MIC) within 48 hours of test completion. A final report shall be delivered to the Crew Surgeon via the MIC within 14 days following the preflight test session. The MAT data is due to the Data Archivist within 14 days after completion of each session.
Data/Report to Designated Recipients (Nominal/Contingency):			
Preliminary MAT reports for all sessions will be delivered to Crew Surgeon via Mission Integration Coordinator (MIC) within 48 hours of test completion. A final report shall be delivered to the Crew Surgeon via the MIC within 14 days following the preflight test session. The MAT data is due to the Data Archivist within 14 days after completion of each session.			

3.5 In-Flight Activities

TABLE 3.5.1: IN-FLIGHT ACTIVITIES

In-Flight Activity	Description:	<p><u>Pinch-Force Strength Testing:</u> (assessed using the thumb and forefinger of both the right and left hands) The crewmember will complete three 5-second maximal voluntary isometric contractions with 60 seconds rest between each effort.</p> <p><u>Handgrip Strength Testing:</u> (assessed for both the right and left hands) The crewmember will complete three 5-second maximal voluntary isometric contractions with 60 seconds rest between each effort.</p> <p><u>Handgrip Static Endurance Testing:</u> (assessed on the non-dominant hand) The crewmember will execute a sustained maximal isometric contraction with the non-dominant hand until the contraction diminishes to 50% pre-EVA max. Endurance will be measured as a function of time of contraction to 50% pre-EVA max. Testing post-EVA training will use absolute measures, (i.e., test based on pre-EVA maximal forces).</p> <p><u>Handgrip Dynamic Endurance Testing:</u> (assessed on the dominant hand) The crewmember will execute a series of three-second contractions at 100% pre-EVA max interrupted by a three-second rest until he/she can no longer produce a contraction of 75% pre-EVA max. Endurance will be measured as a function of time of contraction and the number of repetitions at 75% pre-EVA max.</p> <p>Add HGD/PFD data into EVA Handgrip Log on the MEC.</p>												
	Schedule:	<table border="1"> <thead> <tr> <th>Duration:</th> <th>Schedule:</th> <th>Flexibility:</th> <th>Blood Volume:</th> <th>Personnel Required:</th> </tr> </thead> <tbody> <tr> <td>30 min</td> <td>FD 14 (then every 30 days), 10-14 days prior to EVA</td> <td>+/- 2 Days</td> <td>N/A</td> <td>Crewmember</td> </tr> </tbody> </table>	Duration:	Schedule:	Flexibility:	Blood Volume:	Personnel Required:	30 min	FD 14 (then every 30 days), 10-14 days prior to EVA	+/- 2 Days	N/A	Crewmember		
Duration:	Schedule:	Flexibility:	Blood Volume:	Personnel Required:										
30 min	FD 14 (then every 30 days), 10-14 days prior to EVA	+/- 2 Days	N/A	Crewmember										
Procedures:	<p>HGD/PFD procedures are a part of the EVA Ops book. Hand Dynamometry – Nominal Operations</p>													
Constraints / Special Requirements:	<p>No HGD/PFD within 24 hours of an EVA.</p> <p>Test Termination Criteria:</p> <ul style="list-style-type: none"> ▪ Volitional Fatigue ▪ Discontinue the testing if pain occurs that interferes with performance 													
Photo / TV Requirements:	N/A													
Cold Stowage Requirements:	N/A													
Mission Extension Requirements:	N/A													
Landing Wave-Off Requirements:	N/A													
Data Delivery	<p>Data/Report to Designated Recipients (Nominal/Contingency):</p> <p>Data will be downlinked at the next available weekly downlink of medical data from MEC. Data will be delivered to ACSR and a report will be generated and sent to Crew Surgeon within 24 hours. Data will be sent to Data Archivist at the end of the mission.</p>													

In-Flight Activities, (cont.)

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name	P/N
Pinch Force Dynamometer	SDD33111965- XXX
Handgrip Dynamometer	SDD33111968- XXX
Medical Equipment Computer (MEC)	SEG46116031-XXX

3.6 Postflight Activities: Debrief questions as part of the Medical Operations Debrief.

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	BLOOD VOLUME	PERSONNEL REQUIRED	CONSTRAINTS
Preflight Training						
CMS Ops II	2 hrs (Handgrip / Pinch Force 15 – 30 min. of that class)	L-365 days	+/- 2 months or when crew in U.S.	N/A	Trainer, ASCR, crew	N/A
Preflight						
<ul style="list-style-type: none"> ▪ HGD/PFD ▪ Static Endurance testing ▪ Dynamic Endurance testing 	30 min	L-45/30 days	+/- 20 days, or when crew in U.S.	N/A	ASCR/ Crewmember	Test Termination Criteria: <ul style="list-style-type: none"> • Volitional Fatigue • Interfering performance Pain
In-Flight						
<ul style="list-style-type: none"> ▪ HGD/PFD ▪ Static Endurance testing ▪ Dynamic Endurance testing 	30 min	FD 14 (then every 30 days), 10-14 days prior to EVA	+/- 2 days	N/A	Crewmember	Test Termination Criteria: <ul style="list-style-type: none"> • Volitional Fatigue • Interfering performance Pain
Postflight Debrief						
Questions will be included in the Medical Operations Debrief.						