

MEDB 5.3 Isokinetic Testing

3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MEDB# and Title:	MEDB 5.3 Isokinetic Testing
Sponsor:	Medical Operations
Discipline:	Bone, Muscle & Exercise
Category:	Medical Requirements (MR)
References:	International Space Station Medical Operations Requirements Document (ISS MORD), SSP 50260 Medical Evaluation Documents (MED) Volume B 5.3
Purpose/Objectives:	To provide an objective measure of pre- and postflight muscle strength and endurance in select muscle groups for the evaluation of inflight countermeasures and postflight rehabilitation.
Measurement Parameters:	Isokinetic peak torque (strength) and total work (endurance)
Deliverables:	Assessment of muscle strength and endurance
Flight Duration:	≥30 days
Number of Flights:	Every Expedition
Number and Type of Crew Members Required:	All ISS crewmembers.
Other Flight Characteristics:	N/A

3.3 Preflight Training – No Preflight Training

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3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	Muscle performance testing will be administered using a standard clinical isokinetic dynamometer on selected muscle groups. A standard protocol for warm-up prior to testing will be followed for each muscle group. Testing will be performed on the right limb, unless previous injury indicates that the left limb should be utilized for these assessments.			
	Schedule:	▪ Concentric knee extension and flexion - Seated 60°/sec 5 reps 180°/sec 21 reps - endurance ▪ Concentric ankle plantarflexion and dorsiflexion - Prone 30°/sec 5 reps ▪ Eccentric ankle plantarflexion and dorsiflexion - Prone 30° /sec, 5 reps ▪ Concentric trunk extension and flexion - Seated 60° /sec, 5 reps			
		Duration:	Schedule:	Flexibility:	Personnel Required:
		75 minutes 60 minutes	L-9/6 m Familiarization & data collection (leverage AME, if schedule allows) L-90/30 d (during crewmembers last rotation to U.S. prior to flight) MAT	±14 Days ±5 Days	Lab personnel/ Crewmember
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:	Test Location:		
	Isokinetic Dynamometer	NA	U.S. and Russia		
Testing Facilities	Minimum room dimensions:	Number of electrical outlets:	Temperature requirements:	Special lighting:	
	Approximately 15 x 15 feet	One 220V and two 110V (US) Three 220V with two conversion to 110V (Russia)	20 -25 °C	N/A	
	Hot or cold running water:	Privacy requirements:	Other:		
	NA	Access to room must be controlled during testing.			
Constraints/Special Requirements:	▪ Wear workout clothing (shorts, t-shirt, sneakers). ▪ No max exercise 24 hours prior to testing; no regular exercise 8 hours prior to testing. Interaction with other tests (MAT or science), ISSMP experiments, or independent investigations, will be considered on a case by case basis with the crew surgeon. ▪ No large meals 2 hour prior to test. A light meal is permitted up to 60 minutes before test. ▪ Limit caffeine intake to 1 cup (8 oz) of regular coffee or equivalent 60 minutes before test. ▪ No, alcohol, or nicotine 8 hours prior to test ▪ Contraindications: previous musculoskeletal injury (use left limb) ▪ No neutral buoyancy training 48 hours (prefer 72 hours) prior to test (Preflight only); prefer no neutral buoyancy training 24 hours after test. ▪ Speed and torque calibration must be performed per manufacturer’s instructions ▪ No physical testing or physical training will be conducted with the crewmembers within 72 hours of overseas travel. ▪ No physical testing or physical training will be conducted with the crewmembers within 48 hours of domestic travel unless				

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	approved by the Crew Surgeon. Test Termination Criteria: ▪ Volitional Fatigue ▪ Pain ▪ Lightheadedness, dizziness, or other symptoms of orthostatic hypotension. ▪ Muscle strain, joint sprain
Launch Delay Requirements:	▪ L-90/30 data collection will be repeated if launch is delayed by more than 3 months.
Notes:	None
Data Delivery	Preliminary MAT reports will be transferred to the Medical Mission Information System (MMIS) within 48 hours of test completion. A final report will be available in MMIS within 14 days of test completion. If the preliminary report requires no changes, it will serve as the final report. Reports will be delivered to the crew surgeon.

3.5 In-Flight Activities – No In-Flight Activities

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3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity	Description:	Muscle performance testing will be administered using a standard clinical isokinetic dynamometer on selected muscle groups. A standard protocol for warm-up prior to testing will be followed for each muscle group. Testing will be performed on the right limb, unless the left limb was utilized during pre-flight assessments. ▪ Concentric knee extension and flexion - Seated 60°/sec 5 reps 180°/sec 21 reps - endurance ▪ Concentric ankle plantarflexion and dorsiflexion - Prone 30°/sec 5 reps ▪ Eccentric ankle plantarflexion and dorsiflexion - Prone 30° /sec, 5 reps ▪ Concentric trunk extension and flexion - Seated 60° /sec, 5 reps				
	Schedule:	Duration:	Schedule:		Flexibility:	Personnel Required:
		60 minutes 60 minutes 60 minutes	R+5 MAT (Knee, Ankle) R+14* MAT (Knee, Ankle, Trunk) R+30** MAT (Knee, Ankle, Trunk)		± 1 Days ±1 Days ±2 Days	Lab personnel/ Crewmember
	Ground Support Requirements Hardware/Software	Postflight Hardware:	Postflight Software:		Test Location:	
	Isokinetic Dynamometer	NA		U.S and Russia		
Testing Facilities	Minimum room dimensions:	Number of electrical outlets:		Temperature requirements:	Special lighting:	
	Approximately 15 x 15 feet	One 220V and two 110V (US) Three 220V with two conversion to 110V (Russia)		20 -25 °C	N/A	
	Hot or cold running water:	Privacy requirements:		Other:		
	NA	Access to room must be controlled during testing.				

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Constraints/Special Requirements:	* US-agency specific requirement per MED Volume B Appendix A Matrix 3-NASA **If crewmember has not returned to preflight baseline at R+30, testing may be repeated every 15 days at the discretion of the crew surgeon. ▪ Wear workout clothing (shorts, t-shirt, sneakers). ▪ No max exercise 24 hrs prior to testing; no regular exercise 8 hrs prior to testing. Interaction with other tests (MAT or science), ISSMP experiments, or independent investigations, will be considered on a case by case basis with the crew surgeon. ▪ No large meals 2 hrs prior to test. A light meal is permitted up to 60 minutes before test. ▪ Limit caffeine intake to 1 cup (8 oz) of regular coffee or equivalent 60 minutes before test. ▪ No alcohol, or nicotine 8 hrs prior to test • Contraindications: previous musculoskeletal injury or pain (use left limb) ▪ MEDB 5.3 to occur 2-4 hours prior to MEDB 5.1 Functional Fitness ▪ Speed and torque calibration must be performed per manufacturer's instructions ▪ Isokinetic testing will not be conducted with the crew members within 72 hours of returning to Houston from overseas travel or within 48 hours of domestic travel unless approved by the Crew Surgeon Test Termination Criteria: ▪ Volitional Fatigue ▪ Pain ▪ Lightheadedness, dizziness, or other symptoms of orthostatic hypotension. ▪ Muscle strain, joint sprain
Early Destow / Early Return:	N/A
Notes:	N/A
Data Delivery	Preliminary MAT reports will be transferred to the MMIS within 48 hours of test completion. A final report will be available in MMIS within 14 days following test completion. If the preliminary report requires no changes, it will serve as the final report. Reports will be delivered to the crew surgeon.

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3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	PERSONNEL REQUIRED	CONSTRAINTS
Preflight					
Isokinetic Testing	75 minutes	L-9/6 Familiarization & data collection (Knee, Ankle, Trunk) (Leverage AME, if schedule allows)	± 14 Days	Lab personnel/ Crewmember	See Note
	60 minutes	L-90/30 MAT (Knee, Ankle, Trunk)	± 5 days		
Postflight					
Isokinetic Testing	60 minutes	R+5 MAT (Knee, Ankle)	± 1 Days	Lab personnel/ Crewmember	See Note
	60 minutes	R+14* MAT (Knee, Ankle, Trunk)	± 1 Days		
	60 minutes	R+30** MAT (Knee, Ankle, Trunk)	± 2 Days		

* US-agency specific requirement per MED Volume B Appendix A Matrix 3-NASA.

**If crewmember has not returned to preflight baseline at R+30, testing may be repeated every 15 days at the discretion of the crew surgeon.

Note:

- Wear workout clothing (shorts, t-shirt, sneakers).
- No max exercise 24 hrs prior to testing; no regular exercise 8 hrs prior to testing. Interaction with other tests (MAT or science), HRF experiments, or independent investigations, will be considered on a case by case basis with the crew surgeon.
- No large meals 2 hrs prior to test. A light meal is permitted 60 minutes before test.
- Limit caffeine intake to 1 cup (8 oz) of regular coffee or equivalent 60 minutes before test.
- No alcohol, or nicotine 8 hrs prior to test
- Contraindications: previous musculoskeletal injury (use left limb)
 - No neutral buoyancy training 48 hours (prefer 72 hours) prior to test (Preflight only); prefer no neutral buoyancy training 24 hours after test;
- Speed and torque calibration must be performed per manufacturer's instructions
- No physical testing or physical training will be conducted with the crewmembers within 72 hours of overseas travel.
- No physical testing or physical training will be conducted with the crewmembers within 48 hours of domestic travel unless approved by the Crew Surgeon.

Test Termination Criteria:

- Volitional Fatigue
- Pain
- Lightheadedness, dizziness, or other symptoms of orthostatic hypotension.
- Muscle strain, joint sprain