NASA STD-3001, Volume 2, Appendix D
Requirements Compliance Matrix

Purpose

Due to the complexity and uniqueness of spaceflight, all of the requirements in this NASA Technical Standard must be assessed for applicability for each program or project. This assessment should be iterative and based on information available (conops, DRM, vehicle design, crew size, etc.). The Requirements Compliance Matrix (below) is intended to document applicability of the technical requirements with corresponding rationale. This information should support any documentation to the Health and Medical Technical Authority (HMTA) for requirement compliance.

Additionally, each requirement has been reviewed to include human rating association. This matrix is not intended to substitute for the human rating certification process as captured in NPR 8705.2C Human-Rating Requirements for Space Systems and NASA-STD-8719.29 NASA Technical Requirements for Human-Rating, but to provide the reference of NASA-STD-3001 into that process.

During the assessment of each technical requirement, each program should indicate if the requirement is applicable by marking "Yes" or "No" to the "Applicable" column. If the requirement is not considered applicable, then adequate rationale should be documented on that assessment for HMTA reference. The "Rationale or Comments" column should also document information on applicability or tailoring. This matrix can also include other documentation of requirement implementation.

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
3.2	Human-Centered Task Analysis	[V2 3006]	Each human spaceflight program or project shall perform a human-centered task analysis to support systems and operations design.		✓	
3.3	Human Error Analysis	[V2 3102]	Each human spaceflight program or project shall perform a task-based human error analysis (HEA) to support systems and operations design.		✓	
3.4	Iterative Developmental Testing	[V2 3101]	Each human spaceflight program or project shall perform iterative human-in-the-loop (HITL) testing throughout the design and development cycle.		✓	
4.1.1	Functional Anthropometric Accommodation	[V2 4102]	The system shall ensure the range of potential crewmembers can fit, reach, view, and operate the human systems interfaces by accommodating crewmembers with the anthropometric dimensions and ranges of motion as defined in data sets in Appendix E, Physical Characteristics and Capabilities, Sections E.2 and E.3.		✓	
4.1.2	Body Mass, Volume, and Surface Area Data	[V2 4103]	The system shall accommodate the body characteristic data for mass, volume, and surface area as defined in Appendix E, Physical Characteristics and Capabilities, Sections E.4, E.5, and E.6.		✓	
4.1.3.1	Crew Operational Loads	[V2 4104]	The system shall be operable by crew during all phases of flight, including prelaunch, ascent, orbit, entry, and postlanding, with		✓	

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			the lowest anticipated strength as defined in E, Physical Characteristics and Capabilities, Section E.7.			
4.1.3.2	Withstand Crew Loads	[V2 4105]	The system shall withstand forces imparted by the crew during all phases of flight, including but not limited to prelaunch, ascent, orbit, entry, and postlanding, as defined in Appendix E, Physical Characteristics and Capabilities, Section E.7 without sustaining damage.		✓	
4.2	Muscle Effects	[V2 4013]	The effects of muscle endurance and fatigue shall be factored into system design.		✓	
4.3	Aerobic Capacity	[V2 4015]	The system shall be operable by crewmembers with the aerobic capacity as defined in NASA-STD-3001, Volume 1.		✓	
5.1.1	Operability	[V2 10003]	The system shall provide crew interfaces that enable tasks to be performed successfully within the appropriate time limit and degree of accuracy.			
5.1.2	Usability	[V2 10001]	The system shall provide crew interfaces that result in a NASA Modified System Usability Scale (NMSUS) score of 85 or higher.			
5.1.3	Design-Induced Error	[V2 10002]	The system shall provide crew interfaces that do not exceed the maximum observed error rates listed in Table 5.1-1—Maximum Observed Design-Induced Error Rates.		✓	
5.1.4	Cognitive Workload	[V2 5007]	The system shall provide crew interfaces that result in Bedford Workload Scale ratings of 3 or less for nominal tasks and 6 or less for tasks performed under degraded system conditions.		✓	
5.1.5	Physical Workload	[V2 10200]	The system shall provide crew interfaces that result in a Borg-CR10 rating of perceived exertion (RPE) of 4 (somewhat strong) or less.		✓	
5.1.6	Situation Awareness	[V2 5006]	Systems shall provide the Situation Awareness (SA) necessary for efficient and effective task performance and provide the means to recover SA, if lost, for anticipated levels of crewmember capability and anticipated levels of task demands.		✓	
5.1.7	Legibility	[V2 5051]	The system shall provide crew interfaces that are legible under expected operating conditions.		✓	
5.1.8	Controllability and Maneuverability During Manual Control (Handling Qualities – Level 1)	[V2 10004]	The spacecraft shall exhibit Level 1 handling qualities (Handling Qualities Rating (HQR) 1, 2 and 3), as defined by the Cooper-Harper Rating Scale, during manual control of the spacecraft's flight path and attitude when manual control is the primary control mode or automated control is non-operational.		✓	

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5.1.9	Controllability and Maneuverability During Manual Control with Deficiencies (Handling Qualities – Level 2)	[V2 5052]	The system shall exhibit Level 2 (HQR 4-6) or better handling qualities during manual control in all other scenarios not specified in [V2 10004] Handling Qualities – Level 1.		✓	
5.2.1	Controls for Human Error	[V2 5053]	The system shall control for human error according to the following precedence: a. Design the system to prevent human error in the operation and control of the system. b. Design the system to reduce the likelihood of human error and provide the capability for the human to detect and correct or recover from the error. c. Design the system to limit the negative effects of the error.		✓	
5.2.2	Protect Against Unintended Operator Actions	[V2 10027]	The system shall protect against inadvertent activation of controls.		✓	
5.2.3	Error Detection and Recovery	[V2 10028]	The system shall provide the capability to detect and recover from human error and inadvertent changes in system status.		✓	
6.1	Trend Analysis of Environmental and Suit Data	[V2 6001]	The system shall provide environmental and suit monitoring data in formats compatible with performing temporal trend analyses.		✓	
6.2.1.1	Inert Diluent Gas	[V2 6002]	Cabin atmospheric composition shall contain at least 30% diluent gas (assuming balance oxygen).		✓	
6.2.1.2	O2 Partial Pressure Range for Crew Exposure	[V2 6003]	The system shall maintain inspired oxygen partial pressure (PIO2) in accordance with Table 6.2-1—Inspired Oxygen Partial Pressure Exposure Ranges.		✓	
6.2.1.3	Nominal Vehicle/Habitat Carbon Dioxide Levels	[V2 6004]	The system shall limit the average one-hour CO2 partial pressure (ppCO2) in the habitable volume to no more than 3 mmHg.		✓	
6.2.2.1	Total Pressure Tolerance Range for Indefinite Crew Exposure	[V2 6006]	The system shall maintain the pressure to which the crew is exposed to between 34.5 kPa < pressure ≤ 103 kPa (5 psia < pressure ≤ 15.0 psia) for indefinite human exposure without measurable impairments to health or performance.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
6.2.2.2	Rate of Pressure Change	[V2 6007]	For pressure changes >1.0 psi, the rate of change of total internal vehicle pressure shall not exceed 13.5 psi/min.		✓	
6.2.2.3	Barotrauma Prevention	[V2 6150]	During a commanded pressure change, the system shall pause within 1 psi of the pause command being issued by the unsuited or suited crewmember, with ability to increase or decrease pressure as needed after the pause.		✓	
6.2.2.4	Decompression Sickness (DCS) Risk Identification	[V2 6008]	Each program shall define mission unique DCS mitigation strategies to achieve the level of acceptable risk of DCS as defined below within 95% statistical confidence: a. DCS ≤ 15% (includes Type I or isolated cutis marmorata). b. Grade IV venous gas emboli (VGE) ≤ 20%. c. Prevent Type II DCS.		✓	
6.2.2.5	Decompression Sickness Treatment Capability	[V2 6009]	The system shall provide DCS treatment capability.		✓	
6.2.3.1	Crew Health Environmental Limits	[V2 6012]	The system shall maintain levels of cabin humidity and temperature within the boundaries of the Operating Limits as shown in Figure 6.2-2—Crew Health Environmental Limits, to protect for crew health during pressurized operations when crew occupies the cabin, excluding suited operations, ascent, entry, landing, and post landing.		✓	
6.2.3.2	Crew Performance Environmental Zone	[V2 6013]	The system shall be capable of reaching atmospheric humidity and temperatures of nominally occupied habitable volumes within the zone provided in Figure 6.2-3—Crew Performance Environmental Zone, during all nominal operations, excluding suited operations, ascent, entry, landing, and post landing.			
6.2.3.3	Crewmember Heat Storage	[V2 6014]	The system shall prevent the energy stored by each crewmember from exceeding the cognitive deficit onset (CDO) limits defined by the range 4.7 kJ/kg (2.0 Btu/lb) > ΔQ stored > -4.1 kJ/kg (-1.8 Btu/lb) during pre-launch operations, ascent, entry, descent, landing, postlanding, contingency, and suited operations longer than 12 hours, where ΔQ stored is calculated using a validated and NASA-approved thermoregulatory model, such as 41-Node Man (JSC-33124, 41-Node Transient Metabolic Man Computer Program Documentation – A thermal regulatory model of the human body with environmental suit applications) or the Wissler model.		✓	
6.2.3.4	Temperature Selectability	[V2 6151]	The system shall provide selectable set points for internal atmosphere temperature in step sizes no greater than 0.5°C increments with a setpoint error of +/- 1.5°C in the habitable volume.			
6.2.3.5	Temperature Adjustability	[V2 6152]	The system shall be capable of adjusting temperature in the habitable volume by at least 1°C/hr.			

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6.2.3.6	Post Landing Relative Humidity (RH)	[V2 6011]	For nominal post landing operations, the system shall limit RH to the levels in Table 6.2-2—Average Relative Humidity Exposure Limits for Post Landing Operations.		✓	
6.2.4.1	Atmospheric Control	[V2 6017]	The system shall allow for local and remote control of atmospheric pressure, humidity, temperature, ventilation, and ppO2.			
6.2.4.2	Environmental Control During Exercise	[V2 7041]	The system environmental control shall accommodate the increased O2 consumption and additional output of heat, CO2, perspiration droplets, odor, and particulates generated by the crew in an exercise area.		✓	
6.2.5.1	Atmospheric Data Recording	[V2 6020]	For each isolatable, habitable compartment, the system shall automatically record pressure, humidity, temperature, ppO2, and ppCO2 data continuously.			
6.2.5.2	Atmospheric Data Displaying	[V2 6021]	The system shall display real-time values for pressure, humidity, temperature, ppO2, and ppCO2 data to the crew locally and remotely.		✓	
6.2.6.1	Atmospheric Monitoring and Alerting Parameters	[V2 6022]	The system shall alert the crew locally and remotely when atmospheric parameters, including atmospheric pressure, humidity, temperature, ppO2, and ppCO2 are outside safe limits.		✓	
6.2.6.2	Trace Constituent Monitoring and Alerting	[V2 6023]	The system shall monitor trace volatile organic compounds (VOCs) in the cabin atmosphere and alert the crew locally and remotely when they are approaching defined limits.		✓	
6.2.6.3	Combustion Monitoring and Alerting	[V2 6024]	The system shall monitor in real-time the toxic atmospheric components listed in Table 6.2-3—Recommended Combustion Product (CP) Monitoring Ranges, that would result from pre-combustion and combustion events in the ranges and with the accuracy and resolution specified in the table and alert the crew locally and remotely in sufficient time for them to take appropriate action.		✓	
6.2.6.4	Contamination Monitoring and Alerting	[V2 6025]	The system shall monitor and display atmospheric compound levels that result from contamination events, e.g., toxic release, systems leaks, or externally originated, before, during, and after an event and alert the crew locally and remotely in sufficient time for them to take appropriate action.		✓	
6.2.6.5	Celestial Dust Monitoring and Alerting	[V2 6153]	The vehicle shall monitor celestial dust and alert the crew locally and remotely when they are approaching defined limits.		✓	
6.2.7.1	Nominal Vehicle/Habitat Atmospheric Ventilation	[V2 6107]	The system shall maintain a ventilation rate within the internal atmosphere that is sufficient to provide circulation that prevents CO2 and thermal pockets from forming, except during suited operations, toxic cabin events, or when the crew is not inhabiting the vehicle.		✓	

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6.2.7.2	Off-Nominal Vehicle/Habitat Atmospheric Ventilation	[V2 6108]	The system shall control for ppO2, ppCO2, and relative humidity during off-nominal operations, for example during temporary maintenance activities in areas not in the normal habitable volume.		✓	
6.2.8.1	Atmosphere Contamination Limit	[V2 6050]	The system shall limit gaseous pollutant accumulation in the habitable atmosphere below individual chemical concentration limits specified in JSC-20584, Spacecraft Maximum Allowable Concentrations for Airborne Contaminants (SMACs).		✓	
6.2.8.2	Particulate Matter	[V2 6052]	The system shall limit the habitable atmosphere particulate matter concentration for total dust to <3 mg/m3 with a crew generation rate of 1.33 mg/person-minute, and the respirable fraction of the total dust <2.5 μm (micrometer) in aerodynamic diameter to <1 mg/m3 with a crew generation rate of 0.006 mg/person-minute.		✓	
6.2.8.3	Lunar Dust Contamination	[V2 6053]	The system shall limit the levels of lunar dust particles less than 10 μm in size in the habitable atmosphere below a time-weighted average of 0.3 mg/m3 during intermittent daily exposure periods that may persist up to 6 months in duration.		✓	
6.2.8.4	Microbial Air Contamination	[V2 6059]	The system shall provide air in the habitable atmosphere that is microbiologically safe for human health and performance.		✓	
6.3.1.1	Potable Water Quality	[V2 6026]	At the point of crew consumption or contact, the system shall provide aesthetically acceptable potable water that is chemically and microbiologically safe for human use, including drinking, food rehydration, personal hygiene, and medical needs.		✓	
6.3.1.3	Water Contamination Control	[V2 6051]	The system shall prevent potable and hygiene water supply contamination from microbial, atmospheric (including dust), chemical, and non-potable water sources to ensure that potable and hygiene water are provided.		✓	
6.3.1.4	Water Quality Monitoring	[V2 6046]	The system shall provide the capability to monitor water quality and notify the crew locally and remotely when parameters are approaching defined limits.		✓	
6.3.2	Water Quantity	[V2 6109]	The system shall provide a minimum water quantity as specified in Table 6.3-1—Water Quantities and Temperatures, for the expected needs of each mission, which should be considered mutually independent.		✓	
6.3.3	Water Temperature	[V2 6110]	The system shall provide the appropriate water temperature as specified in Table 6.3-1—Water Quantities and Temperatures, for the expected needs of each mission and task.		✓	
6.3.4.1	Potable Water Dispensing Rate	[V2 6039]	Water shall be dispensed at a rate that is compatible with the food system.			
6.3.4.2	Potable Water Dispensing Increments	[V2 6040]	To prevent overflow, water shall be dispensable in specified increments that are compatible with the food preparation instructions and time demands of the allotted meal schedule.			

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6.4.1.1	Toxic Hazard Level Three	[V2 6047]	The system shall use only chemicals that are Toxic Hazard Level Three or below, as defined in JSC-26895, Guidelines for Assessing the Toxic Hazard of Spacecraft Chemicals and Test Materials, in the habitable volume of the spacecraft.		✓	
6.4.1.2	Toxic Hazard Level Four	[V2 6048]	The system shall prevent Toxic Hazard Level Four chemicals, as defined in JSC-26895, Guidelines for Assessing the Toxic Hazard of Spacecraft Chemicals and Test Materials, from entering the habitable volume of the spacecraft.		✓	
6.4.1.3	Chemical Decomposition	[V2 6049]	The system shall use only chemicals that, if released into the habitable volume, do not decompose into hazardous compounds that would threaten health during any phase of operations.		✓	
6.4.2.1	Biological Payloads	[V2 6060]	Biological payloads, as well as the associated operational procedures and supporting personal protective equipment, shall meet the criteria defined by the JSC Biosafety Review Board guidelines contained in JPR-1800.5, Biosafety Review Board Operations and Requirements.		✓	
6.4.2.2	Environment Cross-Contamination	[V2 6061]	The system shall provide controls to prevent or minimize (as appropriate) biological cross-contamination between crew, payloads and vehicles to acceptable levels in accordance with the biosafety levels (BSL) defined in JPR-1800.5, as well between crew, payloads, vehicles and extraterrestrial planetary environments with the extent of application specific to individual planetary bodies and special locations thereon.		✓	
6.4.3	Availability of Environmental Hazards Information	[V2 6062]	The system shall provide toxicological and environmental hazard information in formats accessible by the crew and ground personnel throughout the mission.		✓	
6.4.4	Contamination Cleanup	[V2 6063]	The system shall provide a means to remove or isolate released chemical and biological contaminants and to return the environment to a safe condition.		✓	
6.5.1	Sustained Translational Acceleration Limits	[V2 6064]	The system shall limit the magnitude, direction, and duration of crew exposure to sustained (> 0.5 seconds) translational acceleration by staying below the limits in Figures 6.5-(2-7) and Tables 6.5-(1-6) for seated and standing postures.		✓	
6.5.2.1	Rotational Velocity	[V2 6065]	The system shall limit crew exposure to rotational velocities in yaw, pitch, and roll by staying below the limits specified in Figure 6.5-8—Rotational Velocity Limits and Table 6.5-7—Rotational Velocity Limits.		✓	
6.5.2.2	Sustained Rotational Acceleration Due to Cross-Coupled Rotation	[V2 6066]	The system shall prevent the crew exposure to sustained (>0.5 second) rotational accelerations caused by cross-coupled rotations greater than 2 rad/s2.		✓	

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6.5.2.3	Transient Rotational Acceleration	[V2 6067]	The system shall limit transient (≤0.5 seconds) rotational accelerations in yaw, pitch, or roll as specified in Table 6.5-8—Head CG Rotational Acceleration Limits, to which the crew is exposed.The limits are appropriately scaled for each crewmember size from the 50th percentile male limits of 2,200 rad/s2 for nominal and 3,800 rad/s2 for off-nominal cases.		✓	
6.5.3	Acceleration Injury Prevention	[V2 6069]	The system shall mitigate the risk of injury to crewmembers caused by accelerations during dynamic mission phases per Table 6.5-9—Acceptable Injury Risk Due to Dynamic Loads.		✓	
6.5.4	Injury Risk Criterion	[V2 6070]	The system shall limit crew exposure to transient translational acceleration (≤0.5 seconds) by limiting the injury risk criterion (β/beta) to no greater than 1.0 (Low) for seated or standing crew as defined by Dynamic Response (DR) limits in NASA/TM-20205008198 Table 2 “Updated Dynamic Response Limits for Standing”, while crew are restrained as required in NASA/TM-2013-217380REV1 for seated crew, or NASA/TM – 20205008198 for standing crew.		✓	
6.5.5	Dynamic Mission Phases Monitoring and Analysis	[V2 6111]	The system shall collect vehicle and crewmember acceleration parameters, specific kinematic responses, and associated metadata, during all dynamic mission phases and suited operations (defined as ascent, abort, entry, descent, landing, postlanding, and EVA operations) to correlate with any injuries incurred by crewmembers.		✓	
6.5.6	Hang Time Limit	[V2 6112]	The system shall limit crew exposure to suspension trauma conditions to seven minutes or less.		✓	
6.5.7	Crew Limits in Launch Orientation	[V2 6113]	The time in which crewmembers are on back with feet elevated in a launch configuration shall not exceed 3 hours and 15 minutes, excluding subsequent safing and egress time.		✓	
6.5.8.1	Extraterrestrial Surface Transport Vehicle Sustained Translation Acceleration Limits	[V2 6154]	The extraterrestrial surface transport vehicle (ESTV) system shall limit the magnitude of crewmember exposure to sustained (>0.5 seconds) translational acceleration by staying below the limits in Table 6.5-10—Extraterrestrial Surface Transport Vehicle Sustained Translation Acceleration Limits, which specify the ±Ax, ±Ay, and ±Az translational acceleration limits appropriate for specific restraint conditions.		✓	
6.5.8.2	Extraterrestrial Surface Transport Vehicle Translation Jerk Limits	[V2 6155]	The extraterrestrial surface transport vehicle (ESTV) system shall limit the crewmember exposure to translational jerk to the limits given in Table 6.5-11—Extraterrestrial Surface Transport Vehicle Translation Jerk Limits, which specifies the ±Ax, ±Ay, and ±Az translational jerk limits appropriate for specific restraint conditions.		✓	
6.5.8.3	Blunt Trauma Limits for	[V2 6156]	The system shall limit the crewmember exposure to blunt trauma forces to the limits given in Figure 6.5-9—Performance Blunt Force Maximum Allowable Depth of Compression Limits		✓	

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	Enabling Performance		(Seated or Standing Vehicle Occupants), which specifies the maximum allowable depth of compression across the occupant body (seated or standing), and below 18 pounds-force (lbf) across skeletal locations of concern outlined in Figure 6.5-10—Anthropometric Locations for Blunt Trauma Limits & Skeletal Locations of Concern: a. Manubrium of the Sternum – Point 1 b. Sternum (body) – Point 2 c. Clavicle – Points 10 & 11 d. Lateral aspect of the thorax – Points 22 & 23 e. Vertebral Column – Points 40, 41, & 42 f. Cervical Spine (C7) – Point 48 g. Scapula – Point 31 h. Spine – Point 39 i. Acromion Process – Point 49 j. Elbow (olecranon process) – Point 61			
6.6.1.1	Launch, Entry, and Abort Noise Exposure Limits	[V2 6073]	During launch, entry, and abort operations, the noise exposure level (not including impulse noise) at the crewmember's ear, calculated over any 24-hour period, shall be limited such that the noise dose (D) is ≤100: where: N = the number of noise exposure events during the 24-hour period Cn = the actual duration of the exposure event in minutes Tn = the maximum noise exposure duration allowed, based on the specific sound level (Ln) of an exposure event in dBA, calculated using the following equation: T_n=480/2^((L_n-85)/3)		✓	
6.6.1.2	Ceiling Limit for Launch and Entry	[V2 6074]	During launch and entry operations, the system shall limit the combined A-weighted sound levels (not including impulse noise) at the crewmembers' ears to a maximum of 105 dBA.		✓	
6.6.1.3	Ceiling Limit for Launch Abort	[V2 6075]	During launch abort operations, the system shall limit the combined A-weighted sound levels (not including impulse noise) at the crewmembers' ears to a maximum of 115 dBA.		✓	
6.6.1.4	Launch, Entry, and Abort Impulse Noise Limits	[V2 6076]	During launch, entry, and abort operations, impulse noise measured at the crewmember's ear location shall be limited to less than 140 dB peak SPL.		✓	
6.6.1.5	Hazardous Noise Limits for All Phases Except Launch, Entry, and Abort	[V2 6077]	For off-nominal operations, broadcast communications, pressurization valve noise, and maintenance activities, the A-weighted sound level (excluding impulse noise and alarm signals) shall be less than 85 dBA (using fast exponential-time-averaging), regardless of the measured time interval; except in the case of pressurization valve noise, the noise attenuation		✓	

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			effectiveness of hearing protection or communications headsets may not be used to satisfy this requirement.			
6.6.1.6	24-Hour Noise Exposure Limits	[V2 6115]	The noise exposure level (not including impulse noise) at the crewmember's head, calculated over any 24-hour period, except during launch, entry, and abort operations, shall be limited such that the noise dose (D) is ≤100: D=100∑_(n=1)^N▒C_n/T_n where: N = the number of noise exposure events during the 24-hour period Cn = the actual duration of the exposure event in minutes Tn = the maximum noise exposure duration allowed, based on the specific sound level (Ln) of an exposure event in dBA, calculated using the following equation: T_n=480/2^((L_n-75)/3)		✓	
6.6.1.7	Continuous Noise Limits	[V2 6078]	In spacecraft work areas, where good voice communications and habitability are required, SPLs of continuous noise (not including impulse or intermittent noise sources) shall be limited to the values given by the Noise Criterion (NC)-50 curve in Figure 6.6-1—NC Curves, and Table 6.6-3—Octave Band SPL Limits for Continuous Noise, dB re 20 µPa; hearing protection cannot be used to satisfy this requirement.		✓	
6.6.1.8	Crew Sleep Continuous Noise Limits	[V2 6079]	For missions greater than 30 days, SPLs of continuous noise shall be limited to the values given by the NC-40 curve (see Figure 6.6-1—NC Curves, and Table 6.6-3—Octave Band SPL Limits for Continuous Noise, dB re 20 µPa) in crew quarters and sleep areas. Hearing protection cannot be used to satisfy this requirement.		✓	
6.6.1.9	Intermittent Noise Limits	[V2 6080]	For hardware items that operate for eight hours or less (i.e. intermittent noise), the maximum noise emissions (not including impulse noise), measured 0.6 m from the loudest hardware surface, shall be determined according to Table 6.6-4—Intermittent Noise A-Weighted SPL and Corresponding Operational Duration Limits for Any 24-hour Period (measured at 0.6 m distance from the source or closest distance to crew head, whichever is less). Hearing protection cannot be used to satisfy this requirement.		✓	
6.6.1.10	Alarm Maximum Sound Level Limit	[V2 6081]	The maximum alarm signal A-weighted sound level shall be less than 95 dBA at the operating position of the intended receiver.		✓	

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6.6.1.11	Annoyance Noise Limits for Crew Sleep	[V2 6082]	With the exception of communications and alarms, the system shall limit impulse and intermittent noise levels at the crewmember's head location to 10 dB above background noise levels during crew sleep periods. Hearing protection cannot be used to satisfy this requirement.		✓	
6.6.1.12	Impulse Noise Limit	[V2 6083]	The system shall limit impulse noise measured at the crewmember's head location to less than 140 dB peak SPL during all mission phases except launch, entry, and abort. Hearing protection cannot be used to satisfy this requirement.		✓	
6.6.1.13	Narrow-Band Noise Limits	[V2 6084]	The maximum SPL of narrow-band noise components and tones shall be limited to at least 10 dB less than the broadband SPL of the octave band that contains the component or tone.		✓	
6.6.1.14	Infrasonic Sound Pressure Limits	[V2 6085]	Infrasonic SPLs, including frequencies from 1 to 20 Hz but not including impulse noise, shall be limited to less than 150 dB at the crewmember's head location. Hearing protection cannot be used to satisfy this requirement.		✓	
6.6.1.15	Noise Limit for Personal Audio Devices	[V2 6106]	The system shall limit the maximum A-weighted sound level at the crewmember's ear created by a personal audio device to 115 dBA or less when converted to a diffuse field.		✓	
6.6.2.1	Acoustic and Noise Monitoring	[V2 6087]	Broadband and frequency-dependent SPLs shall be monitored and quantified as needed for crew health and safety.		✓	
6.6.2.2	Individual Noise Exposure Monitoring	[V2 6088]	Noise exposure levels shall be monitored and quantified for each crewmember as needed for crew health and safety.		✓	
6.7.1.1	Vibration during Pre-Flight	[V2 6089]	The system shall limit vibration to the crew such that the frequency-weighted acceleration between 0.1 to 0.5 Hz in each of the X, Y, and Z axes is less than 0.05 g (0.5 m/s2) root mean square (RMS) for each 10-minute interval during prelaunch (when calculated in accordance with ISO 2631-1:1997(E), Mechanical Vibration and Shock - Evaluation of Human Exposure to Whole-Body Vibration - Part 1: General Requirements, Annex D, Equation D-1).		✓	
6.7.1.2	Vibration Exposures during Dynamic Phases of Flight	[V2 6090]	The system shall limit vibration during dynamic phases of flight at interfaces that transmit vibration to the crew such that the vectorial sum of the X, Y, and Z accelerations between 0.5 and 80 Hz, calculated in 1-s intervals and weighted in accordance with ISO 2631-1:1997(E), is less than or equal to the levels for the accumulated durations in Table 6.7-1—Frequency-Weighted Vibration Limits by Exposure Time during Dynamic Phases of Flight, and Figure 6.7-1—Frequency-Weighted Vibration Limits by Exposure Time during Dynamic Phases of Flight.		✓	
6.7.1.3	Long-Duration Vibration Exposure Limits for Health	[V2 6091]	The system shall limit vibration at interfaces that transmit vibration to the crew such that the accumulated dosage of the vectorial sum of the X, Y, and Z frequency-weighted accelerations, as computed according to ISO 2631-1:1997(E),		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
	during Non-Sleep Phases of Mission		does not exceed the minimum health guidance caution zone level defined in Figure 6.7-2—Long-Duration Vibration Dosage Limits for Health during Non-Sleep Phases of Mission..			
6.7.1.4	Vibration Exposure Limits during Sleep	[V2 6092]	The system shall limit vibration to the crew such that the acceleration between 1.0 and 80 Hz in each of the X, Y, and Z axes, weighted in accordance with ISO 20283-5, Mechanical Vibration—Measurement of Vibration on Ships; Part 5 - Guidelines for the Measurement, Evaluation and Reporting of Vibration with Regard to Habitability on Passenger and Merchant Ships, Annex A, is less than 0.01 g (0.1 m/s2) RMS for each two-minute interval during the crew sleep period.		✓	
6.7.1.5	Vibration Limits for Performance	[V2 6093]	The system shall ensure the appropriate level of crew task performance (e.g., motor control accuracy and precision, vision/readability, speech clarity, attentional focus) during vibration by evaluating task performance under all expected (nominal and off-nominal) vibration levels.		✓	
6.7.2	Hand Vibration	[V2 6094]	The system, including tools, equipment, and processes, shall limit vibration to the crewmembers' hands such that the accelerations, as computed according to ANSI/ASA S2.70-2006, Guide for the Measurement and Evaluation of Human Exposure to Vibration Transmitted to the Hand, do not exceed the Daily Exposure Action Value defined by ANSI/ASA S2.70-2006, Annex A, Figure A.1.		✓	
6.7.3	Extraterrestrial Surface Transport Vehicle Vibration Limits for Health and Performance	[V2 6160]	The extraterrestrial surface transport vehicle (ESTV) system shall limit crewmember exposure to vibration such that the vectorial sum of the X, Y, and Z accelerations between 0.5 and 80 Hz, calculated in 1-s intervals and weighted in accordance with ISO 2631-1:1997(E), is less than or equal to the levels given in Figure 6.7-3—Extraterrestrial Surface Transport Vehicle Vibration Limits (Seated or Standing Vehicle Occupants) and Table 6.7-2—Extraterrestrial Surface Transport Vehicle Vibration Limits (Seated or Standing Vehicle Occupants), which specify the allowable accumulated duration (per 24-hour day) of vibration for both standing or seated crewmembers in all restraint conditions.		✓	
6.8.1.1	Radiation Environments	[V2 6098]	The program shall specify the radiation environments to be used for design requirements and verification.		✓	
6.8.1.2	Ionizing Radiation Protection Limit	[V2 6095]	The program shall set system design requirements and operational constraints to prevent crewmembers from exceeding career space permissible exposure limits (PELs) as set forth in Section 4.8 of NASA-STD-3001, Volume 1.		✓	
6.8.1.3	Intravehicular Area Monitoring of Space Radiation Exposure	[V2 6161]	The program shall monitor the radiation exposure produced by galactic cosmic rays, solar energetic particles, trapped radiation, and neutrons in habitable volumes as referenced in Table 6.8-1—Space Radiation Monitoring Requirements Mission Location vs. Required Monitoring.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
6.8.1.4	Personal Monitoring of Space Radiation Exposure	[V2 6162]	The program shall monitor the radiation exposure produced by galactic cosmic rays, solar energetic particles, and trapped radiation received by individual crew members as referenced in Table 6.8-1—Space Radiation Monitoring Requirements Mission Location vs. Required Monitoring.		✓	
6.8.1.5	Area Monitoring of Radiation Exposure from Nuclear Technologies	[V2 6163]	The program shall monitor the crew ionizing radiation exposure from nuclear technologies.		✓	
6.8.1.6	Alerting of Elevated Exposure Rates	[V2 6164]	The radiation monitoring system shall alert the crew and operations teams when radiation exposure rates exceed predefined thresholds.		✓	
6.8.1.7	External Space Weather Monitoring	[V2 6165]	The program shall monitor the in-situ extravehicular space weather environment including the external exposure rates, electron flux spectra, and proton flux spectra.		✓	
6.8.2.1	RF Non-Ionizing Radiation Exposure Limits	[V2 6102]	The system shall maintain the crew exposure to RF electromagnetic fields to or below the limits stated in Table 6.8-2—Maximum Permissible Exposure (MPE) to RF Electromagnetic Fields and shown graphically in Figure 6.8-1—RF Electromagnetic Field Exposure Limits.		✓	
6.8.2.2	Laser Exposure Limits	[V2 6103]	The system shall maintain the crew ocular and dermal exposure to laser systems and the ocular exposure of the uncontrolled ground population to space lasers to or below the limits specified in ANSI Z136.1, 2014, American National Standard for Safe Use of Lasers, Table 5 (ocular) and Table 7 (dermal) without Personal Protective Equipment.		✓	
6.8.2.3	Natural Sunlight Exposure Limits	[V2 6104]	The system shall maintain the crew exposure to natural sunlight for spectral radiance or irradiance (as applicable) within wavelengths between 180 nm and 3000 nm, as noted in Table 6.8-3—Natural Sunlight Exposure Limits for Different Damage Mechanisms.		✓	
6.8.2.4	Artificial Light Exposure Limits	[V2 6117]	The system shall limit crew exposure from Visible, Infrared (IR), near-IR and Ultraviolet (UV) artificial light sources (180 nm to 3000 nm) at or below the threshold limit value (TLV) as calculated per ACGIH version 2022 or later.		✓	
7.1.1.1	Food Quality	[V2 7001]	The food system shall maintain food safety and nutrition during all phases of the mission.		✓	
7.1.1.2	Food Acceptability	[V2 7002]	The system shall provide food that is acceptable to the crew for the duration of the mission.		✓	
7.1.1.3	Food Caloric Content	[V2 7003]	The system shall provide each crewmember with an average of 12,698 kJ (3,035 kcal) per day, else an average energy requirement value is determined using Table 7.1-1—EER		✓	

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			Equations and applying an activity factor appropriate to the mission gravity and planned level of physical activity.			
7.1.1.4	EVA Food Caloric Content	[V2 7004]	For crewmembers performing EVA operations, the food system shall provide an additional 837 kJ (200 kcal) per EVA hour above nominal metabolic intake as defined by [V2 7003] Food Caloric Content, of this NASA Technical Standard.		✓	
7.1.1.5	Food Nutrient Composition	[V2 7100]	The system shall provide a food system with a diet including the nutrient composition that is indicated in the Dietary Reference Intake (DRI) values as recommended by the National Institutes of Health, with the exception of those adjusted for spaceflight as noted in Table 7.1-2—Nutrient Guidelines for Spaceflight.		✓	
7.1.1.6	Food and Impacts to Environmental Systems	[V2 7110]	Food items and packaging shall be evaluated for impacts on vehicle systems.		✓	
7.1.2.1	Food Safety	[V2 7111]	The program shall maintain flight food safety throughout product life cycle.		✓	
7.1.2.2	Food Production Facility	[V2 7112]	The facility where food is prepared, processed, packaged, stowed, and stored shall comply with applicable laws and regulations, or FDA equivalent, as well as industry Good Manufacturing Practice standards.		✓	
7.1.2.3	Food and Production Area Microorganism Levels	[V2 7007]	Microorganism levels in the food and production area shall not exceed those specified in Table 7.1-3—Food Microorganism Levels.		✓	
7.1.2.4	Food Contamination Control	[V2 7010]	The food storage, preparation, and consumption areas within the vehicle shall be designed and located to protect against cross-contamination between food and the environment.		✓	
7.1.2.5	Food System Cleaning and Sanitizing	[V2 7015]	The system shall provide methods for cleaning and sanitizing food facilities, equipment, and work areas.		✓	
7.1.2.6	Food Spill Control	[V2 7014]	The system shall provide the ability to contain and remove food particles and spills.		✓	
7.1.3.1	Food Preparation	[V2 7008]	The system shall provide the capability for preparation, consumption, and stowage of food.		✓	
7.1.3.2	Food Preparation and Cleanup	[V2 7009]	The food system shall allow the crew to unstow supplies, prepare meals, and clean up for all crewmembers within the allotted meal schedule.			
7.1.3.3	Food and Beverage Heating	[V2 7011]	The system shall provide the capability to heat food and beverages to a temperature appropriate for the given item.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
7.1.3.4	Dining Accommodations	[V2 7012]	The system shall provide adequate volume and accommodations for crewmembers to dine together.		✓	
7.2.1	Personal Hygiene Capability	[V2 7016]	Personal hygiene items shall be provided for each crewmember, along with corresponding system capabilities for oral hygiene, personal grooming, and body cleansing.		✓	
7.2.2	Body Cleansing Privacy	[V2 7017]	The system shall provide for privacy during personal hygiene activities.		✓	
7.2.3	Hygiene Maintainability	[V2 7019]	The system shall provide an environmentally compatible sanitization method for personal hygiene facilities and equipment.		✓	
7.3.1.1	Body Waste Management Capability	[V2 7020]	The system shall provide the capability for collection, containment, and disposal of body waste for both males and females.		✓	
7.3.1.2	Body Waste Management System Location	[V2 7021]	The body waste management system shall be isolated from the food preparation and consumption areas for aesthetic and hygienic purposes.		✓	
7.3.1.3	Body Waste Management Privacy	[V2 7022]	The system shall provide privacy during use of the body waste management system.		✓	
7.3.1.4	Body Waste Management Provision	[V2 7023]	Body waste management supplies shall be provided for each crewmember and be located within reach of crewmembers using the body waste management system.		✓	
7.3.1.5	Body Waste Accommodation	[V2 7024]	The body waste management system shall allow a crewmember to urinate and defecate simultaneously without completely removing lower clothing.		✓	
7.3.1.6	Body Waste Containment	[V2 7025]	The system shall prevent the release of body waste from the body waste management system.		✓	
7.3.1.7	Body Waste Odor	[V2 7026]	The system shall provide odor control for the body waste management system.		✓	
7.3.1.8	Body Waste Trash Receptacle Accessibility	[V2 7027]	Body waste management trash collection shall be accessible to and within reach of crewmembers using the body waste management system.		✓	
7.3.1.9	Body Waste Management Maintenance	[V2 7029]	All body waste management facilities and equipment shall be capable of being cleaned, sanitized, and maintained.		✓	
7.3.1.10	Body Waste Isolation	[V2 7101]	For missions greater than 30 days, the system shall provide separate dedicated volumes for body waste management and personal hygiene.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
7.3.2.1	Body Waste Quantities	[V2 7102]	The human body waste management system shall be capable of collecting and containing the various human body waste as specified in Table 7.3-1—Body Waste Quantities, for the expected needs of each mission and task.		✓	
7.3.2.2	Fecal and Urine Elimination Concurrence	[V2 7085]	The body waste management system shall be capable of collecting and containing all waste during simultaneous defecation and urination.		✓	
7.3.2.3	Urine per Crewmember	[V2 7035]	The human body waste management system shall be capable of collecting and containing urine for either processing or disposal of an average total urine output volume of $Vu = 3 + 2.5t$ liters per crewmember, where t is the mission length in days.		✓	
7.4.1	Physiological Countermeasures Capability	[V2 7038]	The system shall provide countermeasures to meet crew bone, muscle, sensorimotor, thermoregulation, and aerobic/cardiovascular requirements defined in NASA-STD-3001, Volume 1.		✓	
7.4.2	Physiological Countermeasure Operations	[V2 7040]	The physiological countermeasure system design shall allow the crew to unstow supplies, perform operations, and stow items within the allotted countermeasure schedule.			
7.4.3	Orthostatic Intolerance Countermeasures	[V2 7042]	The system shall provide countermeasures to mitigate the effects of orthostatic intolerance when transitioning from weightlessness to gravity environments and during Az (head-to-foot) vehicle accelerations defined in the sustained acceleration limits.		✓	
7.5.1	Medical Capability	[V2 7043]	A medical system shall be provided to the crew to meet the medical requirements of NASA-STD-3001, Volume 1.		✓	
7.5.2	Medical Equipment Usability	[V2 7045]	Medical equipment shall be usable by non-physician crewmembers in the event that a physician crewmember is not present or is the one who requires medical treatment.		✓	
7.5.3	Medical Treatment Restraints	[V2 7046]	The medical system shall provide equipment to position and restrain a patient, care provider, and supplies during treatment.		✓	
7.5.4	Medical Treatment, Personal Supplies and Impacts to Environmental Systems	[V2 7115]	Medical treatment, including pharmaceuticals, non-pharmaceutical crew care items, and related supplies, shall be evaluated for impacts on vehicle systems.		✓	
7.6.1.1	Stowage Provisions	[V2 7050]	The system shall provide for the stowage of hardware and supplies, to include location, restraint, and protection for these items.		✓	
7.6.1.2	Personal Stowage	[V2 7051]	The system shall provide a stowage location for personal items and clothing.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
7.6.1.3	Stowage Location	[V2 7052]	All relocatable items, e.g., food, EVA suits, and spare parts, shall have a dedicated stowage location.		✓	
7.6.1.4	Stowage Interference	[V2 7053]	The system shall provide defined stowage locations that do not interfere with crew operations.		✓	
7.6.1.5	Stowage Restraints	[V2 7054]	The system shall provide the capability to restrain hardware, supplies, and crew personal items that are removed or deployed for use as defined by crew task analysis.		✓	
7.6.2.1	Priority of Stowage Accessibility	[V2 7055]	Stowage items shall be accessible in accordance with their use, with the easiest accessibility for mission-critical and most frequently used items.			
7.6.2.2	Stowage Operation without Tools	[V2 7056]	Stowage containers and restraints shall be operable without the use of tools.			
7.6.2.3	Stowage Access while Suited	[V2 7057]	The stowage system shall be accessible by a suited crewmember.		✓	
7.6.3	Identification System	[V2 7058]	The stowage identification system shall be compatible with the inventory management system.		✓	
7.7.1	Inventory Tracking	[V2 7059]	The system shall provide an inventory management system to track the locations and quantities of items (including hazardous trash) throughout the mission.		✓	
7.7.2	Inventory Operations	[V2 7060]	The system shall be designed to allow inventory management functions to be completed within the allotted schedule.		✓	
7.7.3	Nomenclature Consistency	[V2 7061]	The nomenclature used to refer to the items tracked by the inventory management system shall be consistent with procedures and labels.		✓	
7.7.4	Unique Item Identification	[V2 7062]	Items that need to be uniquely identified shall have a unique name.		✓	
7.7.5	Interchangeable Item Nomenclature	[V2 7063]	Items within the inventory management system that are identical and interchangeable shall have identical nomenclature.		✓	
7.8.1.1	Trash Accommodation	[V2 7064]	The system shall provide a trash management system to contain, mitigate odors, prevent release, and dispose of all expected trash.		✓	
7.8.1.2	Trash Volume Allocation	[V2 7065]	Trash stowage volumes shall be allocated for each mission.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
7.8.1.3	Trash Stowage Interference	[V2 7066]	The system shall provide defined trash stowage that does not interfere with crew operations.			
7.8.2	Labeling of Hazardous Waste	[V2 7069]	The hazard response level (HRL) of all liquids, particles, gases and gels shall be labeled on the outermost containment barrier in location(s) visible to crew.		✓	
7.9.1	Sleep Accommodation	[V2 7070]	The system shall provide volume, restraint, accommodations, environmental control (e.g., vibration, lighting, noise, and temperature), and degree of privacy for sleep for each crewmember, to support overall crew health and performance.		✓	
7.9.2	Behavioral Health and Privacy	[V2 7071]	For long duration missions (>30 days), individual privacy facilities shall be provided.		✓	
7.9.3	Partial-g Sleeping	[V2 7073]	The system shall provide for horizontal sleep surface areas for partial-g and 1-g environments.		✓	
7.10.1	Clothing Quantity	[V2 7074]	Clean, durable clothing shall be provided in quantities sufficient to meet crew needs.		✓	
7.10.2	Clothing Exclusive Use	[V2 7075]	Clothing shall be provided for each individual crewmember's exclusive use.		✓	
7.10.3	Clothing Safety and Comfort	[V2 7076]	Clothing shall be comfortable in fit and composition, for the environment, e.g., temperature and humidity, in which it will be worn.		✓	
7.11.1	Accessibility for Cleaning	[V2 7079]	The system shall provide sufficient volume to access areas that need to be cleaned and perform housekeeping duties.		✓	
7.11.2	Particulate Control	[V2 7080]	The system shall be designed for access, inspection, and removal of particulates that can be present before launch or that can result from mission operations.		✓	
7.11.3	Microbial Surface Contamination	[V2 7081]	The system shall provide surfaces that are microbiologically safe for human contact.		✓	
7.11.4	Surface Material Cleaning	[V2 7082]	The system shall contain surface materials that can be easily cleaned and sanitized using planned cleaning methods.		✓	
7.11.5	Cleaning Materials	[V2 7083]	The system shall provide cleaning materials that are effective, safe for human use, and compatible with system water reclamation, air revitalization, waste management systems, spacesuits and other spacecraft materials.		✓	
7.11.6	Condensation Limitation	[V2 6058]	The system shall prevent condensation persistence on surfaces within the vehicle.		✓	

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7.12	Recreational Capabilities	[V2 7084]	The system shall provide individual and team-oriented recreational capabilities for the crew to maintain behavioral and psychological health.		✓	
8.1.1	Volume Allocation	[V2 8001]	The system shall provide the defined habitable volume and layout to physically accommodate crew operations and living.		✓	
8.1.2	Functional Arrangement	[V2 8005]	Habitability functions shall be located based on the use of common equipment, interferences, and the sequence and compatibility of operations.		✓	
8.1.3	Interference	[V2 8006]	The system shall separate functional areas whose functions would detrimentally interfere with each other.		✓	
8.2.1	Spatial and Interface Orientation	[V2 8007]	The system shall have consistent spatial and interface orientations relative to a defined vertical orientation.		✓	
8.2.2	Location Identifiers	[V2 8010]	A standard location coding system shall be provided to uniquely identify each predefined location within the system.			
8.2.3	Location Aids	[V2 8011]	The system shall provide aids to assist crewmembers in locating items or places within the system and orienting themselves in relation to those items or places.			
8.3.1	Intravehicular Translation Paths	[V2 8013]	The system shall provide intravehicular activity (IVA) translation paths that allow for safe and unencumbered movement of suited and unsuited crew and equipment.		✓	
8.3.2	Emergency Escape Paths	[V2 8014]	The system shall provide unimpeded and visible emergency escape routes commensurate with the hazard analyses and response concepts.		✓	
8.3.3	Assisted Ingress and Egress Translation Path	[V2 8020]	The system shall provide translation paths that accommodate the ingress and egress of a crewmember assisted by another crewmember.		✓	
8.3.4	EVA Translation Path Hazard Avoidance	[V2 11005]	EVA translation paths shall be free from hazards.		✓	
8.4.1.1	Hatches and Door Operation without Tools	[V2 8022]	Hatches and doors shall be operable on either side by a single crewmember without the use of tools in expected gravity conditions, orientations, suit configurations, and operational configurations.		✓	
8.4.1.2	Unlatching Hatches	[V2 8023]	Hatches shall require two distinct and sequential operations to unlatch.		✓	
8.4.1.3	Hatch and Door Operating Times	[V2 8024]	For nominal operations, hatches and doors shall be operable by a single crewmember in no more than 60 seconds, from both sides of the hatch.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
8.4.1.4	Hatch and Door Operating Force	[V2 8025]	The forces required to operate each crew interface for the hatches and doors shall be within the crewmember strength defined by requirement [V2 4104] Crew Operational Loads for the worst-case pressure differential and anticipated encumbering equipment and clothing.		✓	
8.4.2.1	Hatchway Size and Shape	[V2 8027]	Hatchways and doorways shall be sized and shaped to accommodate all planned translations, including unrestricted passage of a suited crewmember and crewmembers carrying cargo or equipment.		✓	
8.4.2.2	Pressure Equalization across the Hatch	[V2 8028]	Each side of each hatch shall have manual pressure equalization capability with its opposite side, achievable from that side of the pressure hatch by a suited or unsuited crewmember.		✓	
8.4.2.3	Visibility across the Hatch	[V2 8029]	The system shall provide a window for direct, non-electronic visual observation of the environment on the opposite side of the hatch.		✓	
8.4.3.1	Hatch, Hatch Cover and Door Interference	[V2 8030]	When opened, hatches, hatch covers and doors shall allow for unrestricted flow of traffic.		✓	
8.4.3.2	Hatch Closure and Latching Status Indication	[V2 8031]	Pressure hatches shall indicate closure and latching status on both sides of the hatch.		✓	
8.4.3.3	Hatch Pressure Indication	[V2 8032]	Pressure hatches shall indicate, viewable from both sides of the hatch, pressure differential across the hatch.		✓	
8.4.4	No Drag-Throughs	[V2 8101]	Hatchways shall be clear of drag-throughs.		✓	
8.5.1	Restraints for Crew Tasks	[V2 8033]	The system shall provide restraints for expected crew operations.		✓	
8.5.2	Restraint and Mobility Aid Standardization	[V2 8038]	Restraints and mobility aids shall be standardized, clearly distinguishable, and located to aid crewmembers in starting or stopping movement, changing direction or speed, or translating equipment.		✓	
8.5.3	Mobility Aid for Assisted Ingress and Egress	[V2 8040]	Mobility aids shall be provided for the assisted ingress and egress of suited or unsuited crewmembers.		✓	
8.5.4	Unassisted Ingress, Egress, and Escape Mobility Aids	[V2 8041]	Mobility aids shall be provided for ingress, egress, and escape of crewmembers without assistance from other crew or ground personnel.		✓	
8.5.5	Mobility Aids Provision	[V2 8042]	Mobility aids shall be provided to support all expected suited and unsuited tasks.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
8.6.1	Window Provisioning	[V2 8043]	The system shall provide windows with unobstructed fields of view for expected crew operations.		✓	
8.6.2	Window Optical Properties	[V2 8045]	System windows shall have optical properties commensurate with crew task needs.			
8.6.3	Window Light Blocking	[V2 8049]	Each system window shall provide a means to prevent external light from entering the crew compartment, such that the interior light level can be reduced to 2.0 lux at 0.5 m (20 in) from each window.		✓	
8.6.4	Window Accessory Replacement/Operation without Tools	[V2 8050]	System window accessories designed for routine use shall be operable by one crewmember and be removable or replaceable without the use of tools.			
8.7.1	Illumination Levels	[V2 8051]	For interior architectures and exterior operations that do not include the presence of orbital sunlight, the system shall provide illumination levels to support the range of expected crew tasks, at minimum, per Table 8.7-1—Surface Illuminance Levels, that accommodate both human observers and remote camera systems.		✓	
8.7.2	Environmental Lighting Attenuation	[V2 8103]	The integrated system architecture shall provide countermeasures to attenuate environmental lighting and complement existing active lighting architecture.		✓	
8.7.3	Task-Specific Exterior Lighting for Operational Areas Partially or Fully Lit by Sunlight	[V2 8104]	For operational areas that include shadowed areas and areas illuminated by the Sun and celestial bodies, the system shall provide passive and/or active solutions that reduce the contrast within shadowed areas of worksites/tasks to within 2 orders of magnitude of the predicted maximum surface luminance of objects, that accommodate both human observers and remote camera systems.		✓	
8.7.4	Navigation and Wayfinding (Exterior)	[V2 8105]	The system shall provide luminous powered and passive indicators that assist with proximity, navigation, and object recognition for validation of targets critical to the surface operation.		✓	
8.7.5	Emergency Lighting	[V2 8053]	The system shall provide emergency lighting (interior and exterior) to maintain visibility in the event of a general power failure.		✓	
8.7.6	White Lighting Chromaticity	[V2 8059]	Interior and exterior lighting intended for operational environments requiring human/camera color vision shall have a chromaticity that falls within the chromaticity gamut for white light for the Correlated Color Temperature (CCT) range of 2700 K to 6500 K as defined by ANSI C78-377, Electric Lamps—Specifications for the Chromaticity of Solid-State Lighting Products.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
8.7.7	White Lighting Color Accuracy	[V2 8060]	Interior and exterior lighting intended for human operational environments requiring photopic vision accuracy shall have a score of 90 ±10 on a color fidelity metric that is appropriate for the utilized lighting technology, as designated by the Color Fidelity Metric (Rf) defined by IES TM-30, Method for Evaluating Light Sources Color Rendition methodology.			
8.7.8	Physiological Effects of Light (Circadian Entrainment)	[V2 8055]	The system shall provide the levels of light to support the physiological effects of light in accordance with Table 8.7-2—Physiological Lighting Specifications.			
8.7.9	Lighting Controls	[V2 8056]	Lighting systems shall have on-off controls.		✓	
8.7.10	Lighting Adjustability	[V2 8057]	Interior and exterior lights shall be adjustable (dimmable).			
8.7.11	Glare Prevention	[V2 8058]	The integrated system architecture including surrounding surfaces, support equipment, visualization tools, and supporting lighting systems shall work in conjunction to minimize visibility and eye-safety impacts from direct and indirect glare.		✓	
8.7.12	Extraterrestrial Surface Transport Vehicle (ESTV) Dashboard and Control Lighting	[V2 8106]	The system shall provide active lighting and attenuation of solar light for manual controls (e.g., unpressurized surface transport vehicle joystick controls, switches and dashboard) and display screens to be visible in all potential natural light levels, including complete darkness.		✓	
9.1.1	Crew Interface Commonality	[V2 9001]	Hardware and equipment performing similar functions shall have commonality of crew interfaces.			
9.1.2	Differentiation	[V2 9002]	Hardware and equipment that have the same or similar form but different functions shall be readily identifiable, distinguishable, and not be physically interchangeable.			
9.1.3	Routine Operation	[V2 9003]	Worksites shall be designed to provide rapid access to needed tools and equipment for routine/nominal operations.			
9.2.1	Training Minimization	[V2 9004]	Hardware and equipment with which crew interact shall minimize the time required for training.			
9.2.2	In-Mission Training	[V2 9110]	In-mission training/refreshers, including using tools and test equipment required for maintenance, shall be provided to ensure crew proficiency in performing maintenance activities.			
9.3.1.1	Design for Crew Safety	[V2 9101]	The system shall be designed to minimize physical hazards to the crew.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
9.3.1.2	Mechanical Hazard	[V2 9005]	Systems, hardware, and equipment shall protect the crew from moving parts that may cause injury to the crew.		✓	
9.3.1.3	Entrapment	[V2 9006]	Systems, hardware, and equipment shall protect the crew from entrapment (tangles, snags, catches, etc.).		✓	
9.3.1.4	Potential Energy	[V2 9007]	Hardware and equipment shall not release stored potential energy in a manner that causes injury to the crew.		✓	
9.3.1.5	Protection from Projectiles and Structural Collapse	[V2 9008]	Hardware mounting and habitat enclosures shall be configured such that the crew is protected from projectiles and structural collapse in the event of sudden changes in acceleration or collisions.		✓	
9.3.1.6	Sharp Corners and Edges – Fixed	[V2 9009]	Corners and edges of fixed and handheld equipment to which the bare skin of the crew could be exposed shall be rounded as specified in Table 9.3-1—Corners and Edges.		✓	
9.3.1.7	Protection from Functionally Sharp Items	[V2 9010]	Functionally sharp items shall be prevented from causing injury to the crew or damage to equipment when not in use.		✓	
9.3.1.8	Sharp Corners and Edges - Loose	[V2 9011]	Corners and edges of loose equipment to which the crew could be exposed shall be rounded to radii no less than those given in Table 9.3-2—Loose Equipment Corners and Edges.		✓	
9.3.1.9	Burrs	[V2 9012]	Exposed surfaces shall be free of burrs.		✓	
9.3.1.10	Pinch Points	[V2 9013]	Pinch points shall be covered or otherwise prevented from causing injury to the crew.		✓	
9.3.1.11	Equipment Handling	[V2 9016]	All items designed to be carried or removed and replaced shall have a means for grasping, handling, and carrying while wearing the most encumbering equipment and clothing anticipated.		✓	
9.3.2.1	Skin/Tissue Damage Temperature Limits	[V2 9102]	Any surface to which the bare skin of the crew is exposed shall not cause skin temperature to exceed the injury limits in Table 9.3-4—Skin Temperature Injury Limits.		✓	
9.3.2.2	Pain/Non-Disabling Injury Skin Temperature Limits	[V2 9103]	Any surface to which the bare skin of the crew is exposed shall not cause skin temperature to exceed the injury limits in Table 9.3-5—Range/Limits Pain/Non-Disabling Injury/Possibly Resulting in Illness.		✓	
9.3.3.1	Power Interruption	[V2 9017]	The system shall provide the crew with capability to control the power to an electrical circuit.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
9.3.3.2	Energized Status	[V2 9018]	The system shall provide and display the de-energized status (interruption of electrical power) of a circuit to the crew and within their fields of regard.		✓	
9.3.3.3	Nominal Physiological Electrical Current Limits	[V2 9019]	Under nominal situations (routine human contacts to conductive housing), the program shall limit electrical current through the crewmember to ≤ (less than or equal to) 0.4 mA for Direct Current (DC) and ≤ (less than or equal to) 0.2 mA peak for Alternating Current (AC).		✓	
9.3.3.4.1	Catastrophic Physiological Electrical Current Limits for all Circumstances	[V2 9020]	The program shall limit the electrical current through the crewmember to ≤ (less than or equal to) 40mA for DC and ≤ (less than or equal to) 8 mA peak for AC to avoid catastrophic physiological effects to the crewmember.		✓	
9.3.3.4.2	Catastrophic Physiological Electrical Current Limits for Startle Reaction	[V2 9021]	During critical operations where a startle reaction is possible, the program shall limit electrical current through the crewmember to ≤ (less than or equal to) 2 mA for DC and ≤ (less than or equal to) 0.5 mA for AC to avoid potentially catastrophic conditions.		✓	
9.3.3.5	Body Impedance for Voltage Calculations Utilizing Electrical Current Thresholds	[V2 9022]	The program/project shall use the 5th percentile values for the appropriate conditions (wet/dry, AC/DC, voltage level, large/small contact area) from IEC 60479-1, Effects of current on human beings and livestock - Part 1: General Aspects, to determine the appropriate body impedance to calculate the voltage associated with any current limit analysis.		✓	
9.3.3.6	Leakage Currents – Medical and Bioinstrumentation Equipment	[V2 9023]	For equipment such as bioinstrumentation and medical devices, that are specifically designed to contact the human body, electrical leakage currents caused by contact with exposed surfaces (including in worst-case fault scenarios) shall be kept below the levels specified in Table 9.3-11—Leakage Currents-Medical and Bioinstrumentation Equipment.		✓	
9.3.4.1	Fluid/Gas Release	[V2 9024]	Hardware and equipment shall not release stored fluids or gases in a manner that causes injury to the crew.		✓	
9.3.4.2	Fluid/Gas Isolation	[V2 9025]	The system shall provide for the isolation or shutoff of fluids in hardware and equipment.		✓	
9.3.4.3	Fluid/Gas Containment	[V2 9026]	The system shall provide for containment and disposal of fluids that might be released during operation or maintenance.		✓	
9.4.1	Equipment Protection	[V2 9027]	Systems, hardware, and equipment shall be protected from and be capable of withstanding forces imposed intentionally or unintentionally by the crew.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
9.4.2	Isolation of Crew from Spacecraft Equipment	[V2 9028]	Protective provisions, e.g., close-out panels, shall be provided to isolate and separate equipment from the crew within the habitable volume.		✓	
9.5.1	Hardware and Equipment Mounting and Installation	[V2 9029]	System hardware and equipment shall be designed so that it cannot be mounted or installed improperly.		✓	
9.5.2.1	Connector Spacing	[V2 9030]	The spacing between connectors shall permit mating and demating by crewmembers wearing expected clothing.		✓	
9.5.2.2	Connector Actuation without Tools	[V2 9031]	Connectors shall be operable without tools for mating and demating while wearing the most encumbering equipment and clothing anticipated.		✓	
9.5.2.3	Incorrect Mating, Demating Prevention	[V2 9032]	Cable, gas and fluid lines, and electrical umbilical connectors shall prevent potential mismating and damage associated with mating or demating tasks.		✓	
9.5.2.4	Mating, Demating Hazards	[V2 9033]	The system shall not subject personnel and equipment to hazards, including spills, electrical shocks, and the release of stored energy, during mating or demating.		✓	
9.6.1	Cable Management	[V2 9034]	The system shall manage cable, wire, and hose location, protection, routing, and retention to prevent physical interference with crew operations and safety.		✓	
9.7.1.1	Maintenance Concept of Operations	[V2 9111]	For each maintenance-level item, the human spaceflight program shall define and document a maintenance operational concept considering the following factors, as a minimum, and updated throughout the design lifecycle: a. Mission work natural environment (e.g., dust, lighting, heating, atmosphere, gravity) as specified in program requirements for natural environments (e.g., SLS-SPEC-159 Cross Program Design Specification for Natural Environments (DSNE)). b. Tools, aids, and support equipment available to the maintainers in-situ. c. Skill-level of the maintainers (i.e., crewmembers). d. Access needed to equipment – considering mission-criticality, urgency of repair, anticipated frequency of servicing, and complexity of approach. e. Reliability- or performance-driven preventive maintenance schedule. f. Preventive and corrective maintenance plans. g. Total crew time and number of crew needed.			
9.7.1.2	Availability of Critical Systems	[V2 9112]	System repairs and/or replacements shall be designed to be completed within the time-to-effect margin.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
9.7.1.3	Damage Prevention	[V2 9113]	The system shall be designed to prevent damage during maintenance.		✓	
9.7.1.4	In-Mission Maintenance	[V2 9114]	The program shall design all flight hardware and software to facilitate in-mission preventive and corrective maintenance and check-out.		✓	
9.7.1.5	Design for Maintenance	[V2 9036]	The system shall provide the means necessary for the crew to safely and efficiently perform routine service, maintenance, and anticipated unscheduled maintenance activities while wearing the most encumbering equipment and clothing anticipated.		✓	
9.7.1.6	Commercial Off-the-Shelf (COTS) Equipment Maintenance	[V2 9037]	Maintenance for commercial off-the-shelf equipment shall be suitable to the spaceflight environment.		✓	
9.7.2.1	In-Mission Tool Set	[V2 9038]	The program shall establish a common set of in-mission tools and test equipment for spaceflight and surface systems.			
9.7.2.2	Maintenance Tools Usability	[V2 9115]	Tools and test equipment shall be usable by the full range of crew sizes and strengths wearing any personal protective equipment (PPE).			
9.7.2.3	Tool and Test Equipment Commonality	[V2 9116]	Systems and units of equipment shall be designed so that maintenance can be accomplished with the set of in-mission tools and test equipment.			
9.7.2.4	Tool Clearance	[V2 9050]	The system shall provide tool clearances for tool installation and actuation for all tool interfaces during in-mission maintenance.			
9.7.3.1	Maintenance Time	[V2 9039]	Planned maintenance for systems and associated hardware and equipment shall be capable of being performed within the allotted crew schedule while wearing the most encumbering equipment and clothing anticipated.			
9.7.3.2	Captive Fasteners	[V2 9042]	Fasteners used by the crew during maintenance shall be captive.			
9.7.3.3	Minimum Number of Fasteners - Item	[V2 9043]	For items that may be serviceable by the crew, the number of fasteners used shall be the minimum required to meet structural engineering integrity requirements.			
9.7.3.4	Minimum Variety of Fasteners - System	[V2 9044]	The system shall be serviceable with a common set of fasteners that meet structural integrity requirements.			
9.7.4.1	Access Using Available Tools	[V2 9117]	Systems and units of equipment that require maintenance shall be accessible and openable during the mission using the on-board tool set.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
9.7.4.2	Maintenance Item Location	[V2 9045]	The system shall ensure maintenance access to the items prioritized [V2 9111] Maintenance Concept of Operations, so that the maintenance task does not require the removal or disabling of other systems or components (excluding access panels).			
9.7.4.3	Check and Service Point Accessibility	[V2 9046]	Check points and service points for systems, hardware, and equipment shall be directly accessible while wearing the most encumbering equipment and clothing anticipated.			
9.7.4.4	Maintenance Accommodation	[V2 9047]	Physical work access envelopes shall accommodate the crew, required tools, and any protective equipment needed to perform maintenance.			
9.7.4.5	Visual Access for Maintenance	[V2 9048]	Maintenance tasks that require visual feedback shall be directly visible during task performance while wearing the most encumbering equipment and clothing anticipated.			
9.7.5.1	Component Identification	[V2 9118]	Flight systems shall include information and labeling that enables the crew to correctly locate, handle, and identify the systems components.			
9.7.5.2	Cable Identification	[V2 9035]	All maintainable cables, wires, and hoses shall be uniquely and consistently identified at the maintenance point.			
9.7.5.3	Visual Aids for Maintenance	[V2 9119]	For maintenance activities, visual aids shall be provided with appropriate scale, orientation, and context to enable crew to locate and identify components and execute the task.			
9.7.6.1	Fault Detection	[V2 9051]	Unit of equipment undergoing maintenance shall provide rapid and positive fault detection and isolation of defective items.		✓	
9.7.6.2	Failure Notification	[V2 9052]	The system shall alert the crew when critical equipment has failed or is not operating within tolerance limits.		✓	
9.7.7.1	Condition Monitoring	[V2 9120]	The system shall be designed to provide condition-monitoring data to an information system that can be accessed by the crew, to maintenance data systems or mission control. (See also 10.2.1 System Health and Status.)			
9.7.7.2	Maintenance Management Information	[V2 9121]	For each maintenance-level item, as a minimum, the following data shall be captured and made/available to the crew: a. Procedures b. Visual aids c. Functional state data (e.g., power, temperature, pressure, standby) d. Active indication of critical procedure step completion e. Active indication of restored functionality f. Replacement unit maintenance history g. Procedure execution records		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
9.7.7.3	Fault Management Information	[V2 9122]	For maintenance-level items experiencing off-nominal performance, the following data shall be made available to the crew in real-time: a. Live diagnostic sensor data b. Troubleshooting steps and decision trees c. Description of possible faults and locations d. Description of test points and normal reading ranges e. Test result interpretations and corrective action recommendations		✓	
9.7.8.1	Maintenance Activities	[V2 9123]	Maintenance activities shall be designed to the skillset common to all crewmembers at the time of maintenance.		✓	
9.7.8.2	Maintenance Decision Aids	[V2 9124]	For corrective maintenance activities, decision aids shall be provided to support diagnosis, troubleshooting, and procedure execution at the expertise-level common to all crewmembers.		✓	
9.7.8.3	Verification of Repair	[V2 9125]	Preventive and corrective maintenance shall include means for verification of successful completion.		✓	
9.7.9.1	Contamination Prevention	[V2 9126]	For planetary surface missions, maintenance tasks shall be designed to prevent environmental contamination (e.g., dust) of maintenance items and EVA systems.		✓	
9.7.9.2	Extreme Environment (EE)	[V2 9127]	Equipment, including tools and instruments, that are maintained on the planetary surface shall be designed to meet all performance requirements specified in NASA-STD-5017A Design and Development Requirements for Mechanisms during and after exposure to the expected natural environmental conditions specified in the SLS-SPEC-159 Cross-Program Design Specification for Natural Environments (DSNE).		✓	
9.7.9.3	Dust Tolerance	[V2 9128]	Tool and equipment functionality shall not reduce below minimum performance specifications due to dust exposure when designs cannot prevent its intrusion.		✓	
9.7.9.4	Dust Removal	[V2 9129]	Any item exposed to extraterrestrial surface dust brought into the pressurized environments shall withstand the planned cleaning methods without damage.		✓	
9.8.1.1.1	Protective Equipment	[V2 9053]	Protective equipment shall be provided to protect the crew from expected hazards.		✓	
9.8.1.1.2	Protective Equipment Use	[V2 9054]	Protective equipment shall not interfere with the crew's ability to conduct the nominal or contingency operations that the crew is expected to perform while employing the protective equipment, including communication among crewmembers and with ground personnel.		✓	
9.8.1.1.3	Equipment Automation of Rescue Aids	[V2 9055]	Automation of protective equipment rescue aids shall be provided when the crew cannot perform assigned life-saving tasks.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
9.8.1.2.1	Use of Hearing Protection	[V2 9056]	The system shall meet SPL limits of section 6.6, Acoustics, in this NASA Technical Standard, except where otherwise specified in this NASA Technical Standard, without requiring the use of personal hearing protection.		✓	
9.8.1.2.2	Hearing Protection Provision	[V2 9057]	Appropriate personal hearing protection shall be provided to the crew during all mission phases for contingency or personal preference.		✓	
9.8.1.2.3	Hearing Protection Interference	[V2 9058]	The system shall be designed so that hearing protection does not inhibit voice communication, monitoring of systems, and detection of alerts.		✓	
9.8.2.1	Fire Detecting, Warning, and Extinguishing	[V2 9059]	The vehicle shall have a fire protection system composed of detecting, warning, and extinguishing devices that do not create a hazardous environment to all spacecraft volumes during all mission phases.		✓	
9.8.2.2	Fire Protection System Health and Status	[V2 9060]	The fire protection system health and status data shall be provided to the crew and other mission systems.		✓	
9.8.2.3	Fire Protection System Failure Alerting	[V2 9061]	The vehicle shall be alert the crew of failures to the fire protection system.		✓	
9.8.2.4	Fire Protection System Activation	[V2 9062]	The fire protection system shall be capable of being manually activated and deactivated.		✓	
9.8.2.5	Portable Fire Extinguishers	[V2 9063]	A fire protection system shall include manually operated portable fire extinguishers usable while wearing the most encumbering equipment and clothing anticipated.		✓	
9.8.3	Emergency Equipment Accessibility	[V2 9064]	Emergency equipment shall be clearly identified, accessible, and useable to complete emergency response in the time required during all mission phases where the corresponding emergency may occur while wearing the most encumbering equipment and clothing anticipated.		✓	
10.1.1	Crew Interface Consistency	[V2 10005]	The system shall provide crew interfaces that are consistent in appearance, arrangement, location, and operation throughout systems.			
10.1.2	Operations Nomenclature Standardization	[V2 10006]	Operational nomenclature shall be standardized throughout a system.			
10.1.3	Display Standards	[V2 10150]	The system shall meet the Display Standard in Appendix F.			
10.1.4	Labeling Plan and Icon Library	[V2 10151]	The system shall provide labels that are consistent with a Labeling Plan and Icon Library as established by the program.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
10.2.1	Stale, Missing, or Unavailable Data	[V2 10020]	The system shall provide visual indication when a data parameter is stale, missing, unavailable, or unknown.			
10.2.2	Maximum System Response Times	[V2 10022]	The system shall provide positive indication of crew-initiated control within the times specified in Table 10.2-1—Maximum System Response Time(s).			
10.2.3	System Latency for Piloting	[V2 10152]	The system shall provide a display system latency for information elements used in vehicle manual flight control tasks and the monitoring of time critical automated flight control tasks, including translation and rotation, that does not exceed a delay of 50ms.		✓	
10.2.4	Command Confirmation	[V2 10080]	The system shall require operator confirmation before completing critical, hazardous, irreversible, or destructive commands.		✓	
10.2.5	Mode Change Command	[V2 10153]	The system shall require an explicit command to change between simulation, test, or operational mode.		✓	
10.2.6	Critical Information Design	[V2 10113]	The system shall provide data critical to mission planning, mission operations, system maintenance, and system health and status at an appropriate level of detail in a form that does not require mental transposition or computation, memory, or repetitive navigation.			
10.2.7	Data Update Rates	[V2 10123]	The system shall operate at a rate that enables the crew to perform tasks effectively and efficiently, e.g., within acceptable error limits and scheduled operating times.			
10.2.8	Data Availability	[V2 10124]	The system shall provide the crew with data to perform tasks at each workstation where those tasks are to be performed.			
10.2.9	Information Management Security	[V2 10125]	The system shall have features for the protection of sensitive and private data, transmission, secure viewing, and sender verification.		✓	
10.2.10	Information Management Ground Access	[V2 10126]	The system shall allow for ground access to perform all onboard database functions without crew intervention.			
10.2.11	Information Backup and Restoration	[V2 10129]	The system shall provide for 1) automatic backup and crew restoration of information essential for system functionality, and 2) crew-initiated backup and restoration of information that can be generated or changed by crew during the mission.			
10.2.12	Alternative Information Sources	[V2 10130]	The system shall provide alternative information sources for use in the event of the loss of the information management system.			
10.2.13	Software System Recovery	[V2 10131]	The system shall be rapidly recoverable from a software system crash.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
10.3.1	Distinguishable and Consistent Alerts	[V2 10114]	The system shall provide distinct visual and audio annunciations to the human operators for emergency, warning, and caution events which require human operator action, and advisory alerts that are necessary for human operator situation awareness as specified in Table 10.3-1—Table Alert Type and Annunciation Table.		✓	
10.3.2	Alert Prioritization	[V2 10175]	The System shall prioritize alerts per Table 10.3-1—Table Alert Type and Annunciation Table.		✓	
10.3.3	Reduced Initial Alert Annunciation Level	[V2 10176]	The System shall provide a “pre-alert” for auditory annunciations whereby the same alarm is annunciated 10dB lower than its final calibrated level.			
10.3.4	Parameter Notifications	[V2 10115]	The system shall notify the human operators if the selected system parameters are outside of tolerance.		✓	
10.3.5	Alert Signal Enable	[V2 10154]	The system shall allow alert functions to be enabled by human operator.		✓	
10.3.6	Alert Signal Inhibit	[V2 10155]	The system shall allow the human operator to inhibit alert functions that are Out-of-Service (OoSVC).		✓	
10.3.7	Alert Inhibit Audit	[V2 10156]	The system shall perform an audit and report all alerts that are in inhibited status to the human operators.		✓	
10.3.8	Alert Signal Suppress	[V2 10177]	The system shall allow the human operator to suppress the audio and visual alert annunciations.		✓	
10.3.9	Manual Activation of Emergency Responses	[V2 10178]	The system shall provide manual activation of emergency responses that is independent of display function.		✓	
10.3.10	Alert Silencing	[V2 10116]	The system shall provide a manual silencing feature for active audio annunciations.			
10.3.11	Crew Test for Annunciation Failures	[V2 10117]	The system shall test for a failure of the visual and auditory annunciators upon crew request.			
10.3.12	Auditory Alert Frequency	[V2 10058]	Frequency content of auditory alerts shall correspond to maximal human sensitivity (200 Hz to 4 kHz).		✓	
10.3.13	Alert Sound Level	[V2 10056]	The system shall produce non-speech auditory annunciations with an SPL that meets at least one of the following criteria: a. Using measurements of A-weighted sound levels (ISO		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
			7731:2003(E), Ergonomics – Danger signals for public and work areas – Auditory danger signals, method a in section 5.2.2.1), the difference between the two A-weighted SPLs of the signal and the ambient noise is greater than 15 dBA (LS,A to LN,A > 15 dBA). This method must be used for alarms intended to wake sleeping crewmembers, with the loudspeaker alarm volume adjusted to its minimum setting. b. Using measurements of octave band SPLs (ISO 7731:2003(E), method b in section 5.2.3.1), the SPL of the signal in one or more octave bands is greater than the effective masked threshold by at least 10 dB in the frequency range from 250 Hz to 4,000 Hz (LSi,oct to Lti,oct > 10 dB). c. Using measurements of 1/3-octave band SPLs (ISO 7731:2003(E), method c in section 5.2.3.2), the SPL of the signal in one or more 1/3-octave bands is greater than the effective masked threshold by 13 dB in the frequency range from 250 Hz to 4,000 Hz (LSi,1/3oct to LTi,1/3oct > 13 dB).			
10.4.1.1	Display and Control Grouping	[V2 10032]	The system shall provide displays and controls whose relationships are logical, explicit, and/or grouped according to purpose, function, or sequence.			
10.4.1.2	Display and Control Movement Compatibility	[V2 10034]	Displays shall be compatible with control movement and the resulting system response as defined in Table 10.4-1—Hardware and Software Controls.			
10.4.2.1	Simultaneous Display of Critical Information	[V2 10037]	The system shall provide the display area to simultaneously present all critical task information required within the operator's field of regard.			
10.4.2.2	Color Coding Redundancy	[V2 10045]	The system shall provide an additional cue when color is issued to convey meaning for critical information or for a critical task.		✓	
10.4.2.3	Measurement Units	[V2 10046]	The system shall use consistent units of measure that are displayed for each numerical value, or for each group of numeric values where the units are the same.			
10.4.2.4	Visual Display Parameters	[V2 10048]	The system shall provide IVA displays that meet the visual display requirements in Table 10.4-2—Visual Display Parameters.			
10.4.2.5	Indicator Light Characteristics	[V2 10201]	The system shall implement indicator lights that meet the characteristics shown in Table 10.4-3—Indicator Light Characteristics.		✓	
10.4.3.1	Label Provision	[V2 10060]	The system shall provide labels for the crew to identify items, interpret and follow nominal and contingency procedures, and avoid hazards.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
10.4.3.2	Label Location	[V2 10063]	The system shall provide labels that are positioned on or directly adjacent to the item they are labeling.			
10.4.3.3	Label Font Height	[V2 10066]	The system shall provide labels that have a minimum font height of 12-point or 0.4 degrees in expected operating positions.			
10.4.4.1	Out-of-View Control Identification	[V2 10068]	Controls that are intended for out-of-view operation shall be spatially or tactually distinct from one another.			
10.4.4.2	Hazardous Control Coding	[V2 10069]	The system shall provide coding for hazardous or irreversible controls that are distinguishable from non-emergency controls.		✓	
10.4.4.3	Control Spacing	[V2 10070]	The system shall provide spacing between IVA controls that meets the criteria in Table 10.4-4—Control Spacing.			
10.4.4.4	Connector Spacing	[V2 10157]	The system shall provide spacing between IVA connecters that is at least: a. 25 mm (1 in) if operated with bare fingers, b. 32 mm (1.25 in) if operated with unpressurized gloved fingers, c. 64 mm (2.5 in) if must be "gripped firmly" with multiple fingers.			
10.4.4.5	Control Operation Supports and Restraints	[V2 10073]	The system shall provide body or limb supports and restraints that enable accurate crew control of applicable interfaces and prevent inadvertent control inputs during expected gravity, acceleration, and vibration conditions.		✓	
10.4.4.6	Moderate-g Control Configuration	[V2 10158]	The system shall place controls used during accelerations between 2g and 3g so that the operator can make control inputs via hand/wrist movements and forward reached within +/- 30-degree cone.		✓	
10.4.4.7	High-g Control Configuration	[V2 10159]	The system shall place controls during accelerations above 3g so that the operator can make control inputs via hand/wrist movements without reaching.		✓	
10.4.4.8	Manual Piloting Control Latency	[V2 10076]	The system shall provide controls for the execution of manual piloting such that latencies will be less than 100ms for high gain tasks and less than 200ms for low gain piloting tasks.		✓	
10.4.4.9	Manual Piloting Control Latency Variability	[V2 10160]	The system shall provide controls for the execution of manual piloting such that latencies have a minimum variability.		✓	
10.4.4.10	Control Resistive Force	[V2 10077]	Control resistive force shall prevent unintended drifting or changing of position.		✓	
10.4.4.11	Detent Controls	[V2 10078]	The system shall provide detent controls when control movements occur in discrete steps.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
10.4.4.12	Stops Controls	[V2 10079]	The system shall provide stops at the beginning and end of a range of control positions, if the control is not required to be operated beyond the end positions or specified limits.			
10.5.1.1	Intelligibility of Electronically Stored Speech Messages	[V2 10052]	Electronically stored speech messages from audio displays shall have 100% intelligibility and discriminability between the ensemble of different messages the audio display is programmed to produce (as measured under realistic background noise conditions and at locations where the display will be used).			
10.5.1.2	Reverberation Time	[V2 10057]	The system shall provide a reverberation time of less than 0.6 seconds within the 500-Hz, 1-kHz, and 2-kHz octave bands.		✓	
10.5.2.1	Communication System Design	[V2 10083]	Communication systems shall be designed to support coordinated and collaborative distributed teamwork.		✓	
10.5.2.2	Communication Capability	[V2 10084]	The system shall provide the capability to send and receive communication among crewmembers, spacecraft systems, and ground systems to support crew performance, behavioral health, and safety.		✓	
10.5.2.3	Communication Speech Levels	[V2 10085]	Audio communication systems shall allow crew to communicate with one another and with the ground at normal speech levels and with expected background SPLs.		✓	
10.5.2.4	Speech Intelligibility	[V2 10091]	For critical communications, the system shall ensure 90% English word recognition, using ANSI/ASA S3.2-2009, Method for Measuring the Intelligibility of Speech over Communication Systems.		✓	
10.5.2.5	Private Audio Communication	[V2 10093]	The system shall provide the capability for two-way private audio communication with the ground.		✓	
10.5.3.1	Video Communications Visual Quality	[V2 10094]	Video communications shall employ digital encoding or alternate coding of equivalent visual quality.			
10.5.3.2	Video Communications Spatial Resolution	[V2 10095]	Video communications shall provide sufficient spatial resolution (width and height in pixels) to accomplish relevant tasks.			
10.5.3.3	Video Communications Temporal Resolution	[V2 10096]	Video communications shall provide sufficient temporal resolution (frames/s) to accomplish relevant tasks.			
10.5.3.4	Video Communications Color and Intensity	[V2 10097]	Video communications shall provide sufficient color and intensity levels to accomplish relevant tasks.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
10.5.3.5	Video Communications Bit Rate	[V2 10098]	Video communications systems shall support bit rates high enough to ensure that compression artifacts are as low as reasonably achievable.			
10.5.3.6	Audio-Visual Lag Time	[V2 10099]	Communications systems that carry sound and video that are intended to be synchronized shall ensure that the sound program does not lead the video program by more than 15 ms or lag the video program by more than 45 ms.			
10.6.1	Automation System Status Provision	[V2 10161]	The automated system shall provide the human operator with the following information: a. system state (e.g., position, location, hazardous condition, running, paused, faulted, completed, overridden, stopped, readiness) b. projection of future state, including failure or decrements in performance (e.g., battery power versus traverse distance and assessment of uncertainty in projection of future state) and mode (e.g., Full/Partial/Manual/Test) c. system health d. configuration information (e.g., setup/input parameters, initial conditions, and terminating conditions)		✓	
10.6.2	Automation Mode Change Notification	[V2 10162]	The system shall notify the human operator of mode changes of any safety-critical operations.			
10.6.3	Automation Data Availability	[V2 10163]	Automated or robotic systems shall record and make available operational and performance data to both crew and ground support personnel.			
10.6.4	Automation System Responsibility Delineation	[V2 10164]	Automated systems shall indicate whether a human operator or system is expected to perform a particular operation at a specific time.			
10.6.5	Automation and Robotics Override and Shut-Down Capabilities	[V2 10165]	Automated or robotic systems shall provide the human operator the ability to modify system configuration within the safety and performance limits of the system.		✓	
10.6.6	Automation System Configuration	[V2 10166]	Automated or robotic systems shall provide the human operator the ability to modify system configuration within the safety and performance limits of the system.		✓	
10.6.7	Range of Control	[V2 10167]	Automated or robotic systems shall provide the human operator with a range of control options that accommodates the expected operating conditions.		✓	
10.6.8	Automation Failure Recovery	[V2 10168]	The automated or robotic system shall enable the human operator to safely assume control of the system if a failure occurs or there is an inability to function (e.g., beyond designed ability).		✓	

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10.6.9	Decision Support	[V2 10169]	The automated or robotic system shall allow the human operator to determine when to use a decision aid and which decision aiding strategy to employ.			
10.6.10	Decision Aid Clarity	[V2 10170]	Decision aid systems shall provide explanations and rationales, and consequences of potential actions.		✓	
10.6.11	Decision Aid Failure Notification	[V2 10171]	Decision aids shall notify the human operator when a problem or situation is beyond the aid's capability.		✓	
10.6.12	Automation Safe Mode	[V2 10172]	The automated or robotic system shall take protective action (e.g., avoidance maneuver, protective stop) or request that the operator safely take control if the system's operational safety threshold is exceeded.		✓	
10.6.13	Safety Default	[V2 10173]	The automated or robotic system shall maintain safe operations if the human operator does not assume control when requested.		✓	
10.6.14	System Initiation	[V2 10174]	Autonomous robotic systems shall be initiated only by human operators, including restart after an emergency or protective stop.		✓	
11.1.1	Suited Donning and Doffing	[V2 11001]	The system shall accommodate efficient and effective donning and doffing of spacesuits for both nominal and contingency operations.		✓	
11.1.2	Suit Materials Compatibility	[V2 11125]	Pharmaceuticals, topical treatments and cleaning materials shall be compatible with suit materials (internally and externally).		✓	
11.1.3	Suit Materials Cleanability	[V2 11126]	The suit materials (internally and externally) shall be compatible with the expected cleaning materials and methods.		✓	
11.1.4.1	Suit Pressure Set-Points	[V2 11006]	The suit shall provide the capability for the crewmember to select discrete suit pressure set-points within the suit operating pressure ranges during pressurized and unpressurized suited operations.			
11.1.4.2	Suit Equilibrium Pressure	[V2 11007]	Suits shall maintain pressure within 1.72 kPa (0.25 psi) after the suit has achieved an equilibrium pressure for a set-point.		✓	
11.1.4.3	Continuous Noise in Spacesuits	[V2 11009]	Suits shall limit suit-induced continuous noise exposure at the ear to NC-50 or below without the use of auxiliary hearing protection.		✓	
11.1.4.4	EVA Suit Radiation Monitoring	[V2 11010]	The suit shall provide or accommodate radiation monitoring and alerting functions to allow the crew to take appropriate actions.		✓	
11.1.4.5	Suited Crewmember Heat Storage	[V2 11011]	The system shall prevent the energy stored by each crewmember during nominal suited operations from exceeding the limits defined by the range 3.0 kJ/kg (1.3 Btu/lb) > ΔQ stored > 1.9		✓	

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			kJ/kg (-0.8 Btu/lb), where ΔQ stored is calculated using the 41 Node Man or Wissler model.			
11.1.5.1	Suited Body Waste Management – Provision	[V2 11013]	Suits shall provide for management of urine, feces, menses, and vomitus of suited crewmembers.		✓	
11.1.5.2	EVA Suit Urine Collection	[V2 11028]	EVA suits shall be capable of collecting a total urine volume of Vu = 0.5 +2.24t/24 L, where t is suited duration in hours.		✓	
11.1.5.3	LEA Suit Urine Collection	[V2 11014]	LEA suits shall be capable of collecting a total urine volume of Vu = 0.5 + 2t/24 L throughout suited operations, where t is suited duration in hours.		✓	
11.1.5.4	Suit Urine Collection per Day – Contingency	[V2 11015]	For contingency suited operations lasting longer than 24 hours, suits shall be capable of collecting and containing 1 L (33.8 fl oz) of urine per crewmember per day.		✓	
11.1.5.5	Suit Feces Collection per Day – Contingency	[V2 11016]	During contingency suited operations, suits shall be capable of collecting 75 g (0.17 lb) (by mass) and 75 mL (2.5 fl oz) (by volume) of fecal matter per crewmember per day.		✓	
11.1.5.6	Suit Isolation of Vomitus	[V2 11017]	Suits shall be shown to not create any catastrophic hazards in the event of vomitus from the crewmember.		✓	
11.1.6.1	Suited Field of Regard	[V2 11018]	Suits shall provide a field of regard sufficient to allow the crewmember to accomplish required suited tasks.		✓	
11.1.6.2	Suit Helmet Optical Quality	[V2 11019]	Suit helmets shall have sufficient optical qualities to allow the crewmember to accomplish required suited tasks and maintain a level of SA necessary to maintain safety.		✓	
11.1.6.3	Suit Helmet Luminance Shielding	[V2 11020]	Suit helmets shall provide protection to suited crewmembers from viewing objects with luminance that could prevent successful completion of required suited tasks.			
11.1.6.4	Suit Helmet Visual Distortions	[V2 11021]	Suit helmets shall be free from visual distortion.		✓	
11.1.6.5	Suit Helmet Displays	[V2 11022]	Suit helmet field of regard shall be unencumbered if helmet- or head-mounted displays are provided.			
11.1.7	Suit Information Management	[V2 11023]	The system shall allow the crewmember to effectively input, store, receive, display, process, distribute, update, monitor and dispose of relevant information on consumable levels, suit status and alerts, and biomedical data.			

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
11.1.8	Pressure Suits for Protection from Cabin Depressurization	[V2 11100]	The system shall provide the capability for crewmembers to wear pressure suits for sufficient duration during launch, entry, descent (to/from Earth, or other celestial body) and any operation deemed high risk for loss of crew life due to loss of cabin pressurization (such as in mission dockings, operations during periods of high incidence of micrometeoroids and orbital debris (MMOD) or complex vehicle maneuvers).		✓	
11.2.1	Ability to Work in Suits	[V2 11024]	Suits shall provide mobility, dexterity, and tactility to enable the crewmember to accomplish suited tasks within acceptable physical workload and fatigue limits while minimizing the risk of injury.		✓	
11.2.2	Suited Nutrition	[V2 11025]	The system shall provide a means for crewmember nutrition in pressure suits designed for surface (e.g., Moon or Mars) EVAs of more than 4 hours in duration or any suited activities greater than 12 hours in duration.		✓	
11.2.3.1	LEA Suited Hydration	[V2 11029]	The system shall provide a means for on-demand crewmember hydration while suited, including a minimum quantity of potable water of 2 L (67.6 fl oz) per 24 hours for the LEA suit.		✓	
11.2.3.2	EVA Suited Hydration	[V2 11030]	The system shall provide a means for on-demand crewmember hydration while suited, including a minimum quantity of potable water of 240 mL (8.1 fl oz) per hour for EVA suited operations.		✓	
11.2.4	Suited Medication Administration	[V2 11027]	The system shall provide a means for administration of medication to a suited, pressurized crewmember for pressurized suited exposures greater than 12 hours.		✓	
11.2.5	Suited Relative Humidity	[V2 11031]	For suited operations, the system shall limit RH to the levels in Table 11.2-1—Average Relative Humidity Exposure Limits for Suited Operations.		✓	
11.2.6	LEA Suited Decompression Sickness Prevention Capability	[V2 11032]	LEA spacesuits shall be capable of operating at sufficient pressure to protect against Type II decompression sickness in the event of a cabin depressurization.		✓	
11.3.1	Suited Thermal Control	[V2 11033]	The suit shall allow the suited crewmembers and remote operators to adjust the suit thermal control system.		✓	
11.3.2	Suited Atmospheric Data Recording	[V2 11034]	Systems shall automatically record suit pressure, ppO2, and ppCO2.		✓	
11.3.3	Suited Atmospheric Data Displaying	[V2 11035]	Suits shall display suit pressure, ppO2, and ppCO2 data to the suited crewmember.		✓	
11.3.4	Suited Atmospheric Monitoring and Alerting	[V2 11036]	Suits shall monitor suit pressure, ppO2, and ppCO2 and alert the crewmember when they are outside safe limits.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
11.3.5	Nominal Spacesuit Carbon Dioxide Levels	[V2 11039]	The spacesuit shall limit the inspired CO2 partial pressure (PICO2) in accordance with Table 11.3-1—Spacesuit Inspired Partial Pressure of CO2 (PICO2) Limits.		✓	
11.3.6	Contingency Spacesuit Carbon Dioxide Levels for Partial Gravity Scenarios	[V2 11040]	The spacesuit inspired CO2 partial pressure (PiCO2) shall not exceed 20 mmHg during contingency scenarios up to a duration of 1-hour.			
11.4.1	EVA Suited Metabolic Rate Measurement	[V2 11037]	The system shall measure or calculate metabolic rates of suited EVA crewmembers.			
11.4.2	EVA Suited Metabolic Data Display	[V2 11038]	The system shall display metabolic data of suited EVA crewmembers to the crew.			
11.5	Incapacitated Crew Rescue (ICR)	[V2 11101]	Resources shall be provided to rescue an incapacitated suited crewmember(s).		✓	
12.1.1	System Assumptions	[V2 12003]	Each human spaceflight program shall document the system support design and environment: a. Work environment (e.g., lighting, heating, atmosphere, gravity) b. Tools and support equipment c. Ground support personnel characteristics (e.g., size, training, experience, number, physical and cognitive capabilities, skills, ergonomics) d. Ground support personnel tasks (e.g. environment, complexity, scheduling)			
12.1.2.1	Anthropometry, Biomechanics, Range of Motion, and Strength	[V2 12004]	Each program shall identify an anthropometry, biomechanics, range of motion, and strength data set for the ground support population to be accommodated in support of all requirements in this section of this NASA Technical Standard.		✓	
12.1.2.2	Protective Equipment	[V2 12005]	The system shall accommodate ground personnel protective equipment and attire.		✓	
12.1.2.3	Volume Accommodation	[V2 12006]	The system shall provide the volume necessary for the ground support personnel to perform all ground processing tasks using the required tools and equipment.		✓	
12.1.2.4	Ground Processing – Induced Forces	[V2 12007]	Systems, hardware, and equipment shall be protected from or be capable of withstanding forces imposed by the ground support personnel or ground support equipment (GSE), in a 1-g environment.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
12.1.2.5	Systems Accessibility	[V2 12008]	System components, hardware, and/or equipment that requires ground support personnel inspection or interaction shall be accessible.		✓	
12.1.2.6	Tool Clearance	[V2 12009]	The system shall provide tool clearances for tool installation and actuation for all tool interfaces during ground processing.		✓	
12.1.3.1	Flight Hardware Differentiation	[V2 12010]	Flight system components that have the same or similar form, but different functions shall not be physically interchangeable.			
12.1.3.2	Hardware Protection	[V2 12011]	The system shall provide a means of protecting flight hardware and equipment from damage during ground processing.		✓	
12.1.3.3	Mobility Aids	[V2 12012]	The system shall provide mobility aids to support expected ground support personnel tasks.		✓	
12.1.3.4	Equipment Handling Design	[V2 12013]	All items designed to be carried, supported, or removed and replaced shall have a means for grasping, handling, and carrying.		✓	
12.1.3.5	Inadvertent Operation Prevention	[V2 12014]	The system shall be designed to prevent inadvertent operation of controls during ground processing.		✓	
12.1.3.6	Incorrect Installation Prevention	[V2 12015]	System hardware and equipment shall be designed to prevent incorrect mounting or installation.		✓	
12.1.3.7	Pre-Defined Tool Set	[V2 12016]	The system shall be designed to be assembled, prepared for launch, maintained, and reconfigured using a pre-defined set of standard tools and lesser set of any pre-established set of specialized tools.			
12.1.3.8	Captive Fasteners	[V2 12017]	Fasteners on installable units shall be captive.			
12.1.3.9	Ground Processing Without Damage	[V2 12018]	The system shall be designed for assembly, testing and checkout, troubleshooting, and maintenance that prevents damage to other components.		✓	
12.1.3.10	Replaceable Items	[V2 12019]	The system shall locate maintenance items so that a planned ground processing or corrective or preventive maintenance task does not require the deintegration or demating of other systems or components.		✓	
12.1.3.11	Visual Access for Ground Processing	[V2 12020]	The system shall provide direct line-of-sight visual access to all flight system components requiring inspections or other human-system interactions, except self-mating connectors, on which ground processing is performed by ground personnel.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
12.1.3.12	Lighting	[V2 12021]	The flight system in combination with ground support equipment shall provide lighting to perform ground processing tasks in the vehicle.		✓	
12.1.3.13	Supplemental Systems	[V2 12022]	The system shall be designed to support any supplemental systems that are required to assist ground support personnel when an assigned task cannot reliably, safely, or effectively be performed by ground support personnel alone.			
12.1.3.14	Operational Consistency	[V2 12023]	The system shall be designed for consistent operation across ground processing tasks.			
12.1.3.15	Restraints and Platforms	[V2 12024]	The system shall accommodate restraint and platform placement that ensures the reach and work envelope of the suited or unsuited ground support personnel for the required tasks.		✓	
12.1.3.16	System Feedback	[V2 12025]	The system shall provide feedback to the operator indicating successful task completion.		✓	
12.1.3.17	Stowage Access	[V2 12026]	The system shall provide access for ground support personnel to spacecraft stowage volumes that require late loading and early unloading of items.		✓	
12.1.3.18	Flight Software Systems	[V2 12027]	The system shall allow the ground support personnel safe operation of flight software systems for ground processing.		✓	
12.1.4.1	Sharp Edge and Burr Injury Prevention	[V2 12028]	The system shall protect ground support personnel from injury resulting from sharp edges and burrs.		✓	
12.1.4.2	Pinch Point Prevention	[V2 12029]	The system shall be designed to protect ground personnel from injury due to pinch points.		✓	
12.1.4.3	Hazard Controls	[V2 12030]	The system shall be designed to prevent unnecessary exposure of ground support personnel and equipment to hazards, including spills, electrical shocks, and the release of stored energy.		✓	
12.1.4.4	System Safing for Ground Operations	[V2 12031]	The system shall alert and allow ground personnel to safe the system before performing any ground operation.		✓	
12.1.4.5	Contamination Controls	[V2 12032]	The system shall have controls in place to prevent the introduction of contaminants to the flight vehicle.		✓	
12.1.4.6	Containment of Fluids and Gases	[V2 12033]	The system shall provide for containment and disposal of fluids and gases inadvertently released into the flight system.		✓	
12.1.4.7	Safe Weight Limit	[V2 12034]	Hardware and equipment installed or removed by ground support personnel without ground support equipment shall be less than a safe weight limit.		✓	

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Section	**Title**	**Number**	**Requirement Text**	**Applicable (Enter Yes or No)**	**Human-Rating**	**Rationale**
12.1.4.8	Safe Flight System Component Arrangement	[V2 12035]	Flight system components shall be arranged, or located to prevent hazards, interference, or errors during concurrent ground processing tasks.		✓	
12.1.5.1	Connector Design and Spacing	[V2 12036]	Connectors shall be designed and spaced to allow for accurate, damage-free mating and demating by ground support personnel.		✓	
12.1.5.2	Connector Incorrect Mating Prevention	[V2 12037]	Connectors shall have physical features to preclude incorrect mating and mismating. This can be accomplished by differing connector shell sizes, differing connector keyway arrangements, and having different contact arrangements (these are listed in order of most preferred to least preferred).		✓	
12.1.6.1	Label Provisions	[V2 12038]	Labels and placards shall be provided for the ground support personnel to identify items, interpret and follow procedures, and avoid hazards.			
12.1.6.2	Label Standardization	[V2 12039]	Labels and placards shall be consistent and standardized throughout the system.			
12.1.6.3	Label Content	[V2 12040]	The content of labels and placards shall be of sufficient size, color contrast, and character height and style to support readability.			
12.1.6.4	Readable Label Positioning	[V2 12041]	Labels and placards shall be located such that they are readable by the operator, considering ambient lighting conditions, orientation in the integrated configuration, and position of the operator relative to the label.			
12.1.6.5	Non-Obstructive Labels	[V2 12042]	Labels, placards, or part markings used for ground processing shall not visually or operationally interfere with spaceflight crew interface labeling.			
12.2.1	Emergency Egress at the Launch Site	[V2 12043]	The system shall be designed such that the spaceflight crew and ground support personnel can egress within the time required to preserve the health and safety of all spaceflight crew and ground support personnel in the event of an emergency.		✓	
12.2.2	Emergency Egress to Medical Care	[V2 12044]	The system shall be designed to ensure spaceflight crew and ground support personnel can egress to a location providing advanced pre-hospital life support.		✓	
12.2.3	Nominal Timely Egress	[V2 12045]	Following a post mission nominal landing, launch scrub, or abort scenario, crew egress from the system shall be expedited to ensure crew health.		✓	
12.2.4	Emergency Egress Acceleration Limits	[V2 12046]	For ground emergency egress systems (EES), the system shall limit the magnitude and direction of crew exposure to accelerations according to Table 12.1-1—EES Acceleration Limits – Sustained, and Table 12.1-2—EES Acceleration Limits – Jerk.		✓	