

Team #:	P19105	Team Name: Team LITT	Sample MSD Project
Date:	9/11/18 8:22	Document Owner: Julian Caputo	Team Member
Revision #:	1		

rqmt. #	Importance	Source	Function	Engr. Requirement (metric)	Unit of Measure	Marginal Value	Ideal Value	Actual Value	Test Result	Direction of Improvement	Comments/Status	Test Number
ENG-01		CR-19105-01	Fit Test Stand In Bunker with room for 2 technicians.	Test stand dimensions must not exceed: width = 7 ft, length = 13 ft, height = 7.5 ft, wall thickness = 6 in								
ENG-02		CR-19105-02	Horizontal Test Stand Configuration	If test stand is configured horizontally then the fire must be exhausted outside of the bunker to ensure safety								
ENG-03		CR-19105-03	Ensure Safety Requirements are met	Review safety requirements for every phase of design and construction. Calculate preliminary factors of safety using previous years model.	N/A							
ENG-04		CR-19105-04	High energy or explosive events must be contained	Cover 3-ft diameter holes on bunker top with concrete plate. Reinforce front door by bolting down steel plate on door.								
ENG-05		CR-19105-05	Safety mechanism	Concrete plates for holes on bunker top	ft	3 x 3						
ENG-06		CR-19105-06	Ensure that the natural frequencies of the test stand are not excited by engine vibrations	All natural frequencies of the test stand are greater than or equal to 2,000Hz	Hz							
ENG-07	5	CR-19105-07	Maintain structural integrity in all directions	Withstand 1300lbf of thrust force in all directions	lbf							
ENG-08		CR-19105-08	Prevent rotation of the combustion chamber about its axis of symmetry	Ensure bearings on linear tracks can withstand 720 lbf for dynamic loading	lbf	720					Perform torque calculations & check with ozzy on previous year's torque calculations	
ENG-09		CR-19105-09	Stand can handle the static load of the engine thrust.	Withstand a minimum of 1300lbf of thrust with a safety factor of 5.	lbf	6500	9100					
ENG-10		CR-19105-10	Stand can handle the the wall temperatures of the combustion chamber & nozzle during testing events	Should be able to withstand a minimum of 330F as previous teams wall temperature	Degrees Fahrenheit	800	1000				Perform heat transfer calculations OR check with previous team on the exterior temperature of the combustion chamber. NOTE** FOS reduced because most materials would not be suitable if FOS is applied	
ENG-11		CR-19105-11	The test stand stays function for test duration	Withstand upto 10 seconds of testing time per test	seconds	7	10					
ENG-12		CR-19105-12	Sensors can measure pressure, temperature and mass flow rate	Pressure transducers must have range 0-1200 psi. K-type thermocouple has range -454 to 2300 F								
ENG-13		CR-19105-13	Sensors can measure pressure, temperature and mass flow rate	Pressure transducers must have range 0-1200 psi. K-type thermocouple has range -454 to 2300 F								
ENG-14		CR-19105-14	Sensors can measure pressure, temperature and mass flow rate	Pressure transducers must have range 0-1200 psi. K-type thermocouple has range -454 to 2300 F								
ENG-15		CR-19105-15	Sensors can measure thrust & frequency	Thrust sensor must read at least 1300 lbf and oscilloscope must read at least 2000 Hz								
ENG-16		CR-19105-16	Ensure each test satisfies test durations	An accurate manual stopwatch should be able to measure the test time for each test.	s	7-10						
ENG-17		CR-19105-17	Sensors shall accomodate proof pressure test	The sensors shall measure pressure up to 750 psi	psi	750	1000				Check with Ozzy about their slides on pressure values	
ENG-18		CR-19105-18	Complete system leak test	Ensure oxidizer passes leak test by staying with pressure range	psi							
ENG-19		CR-19105-19	Complete cold flow test	Ensure atomization of oxidizer so that combustion is stable								
ENG-20		CR-19105-20	Complete hot fire test	Ensure chamber pressure and/or thrust requirements are met								
ENG-21		CR-19105-21	Should be able to withstand all necessary tests required by the engine	Should be able to withstand each test multiple times if necessary for the prescribed amount of time								
ENG-22		CR-19105-22	The test stand is fully built	The test stand is completely constructed by Fall 2018								
ENG-23		CR-19105-23	Clamps and bearings hold rocket engine in place during and after test.	The engine can be mounted and dismounted on the test stand for multiple tests								
ENG-24		CR-19105-24	Test stand does not conflict with function of engine	The engine is safely used during testing. There are no extraneous points of contact or rubbing of parts.								
ENG-25		CR-19105-25	The project should stay within budget.	Cost of the entire project should be less than \$4000	USD	\$4,000	\$3,000					
ENG-26		CR-19105-26	Store oxidizer tanks	Ensure bunker can house oxidizer tanks (width = 7 ft, length = 13 ft, height = 7.5 ft, wall thickness = 6 in)								
ENG-27		CR-19105-27	Test stand must withstand engine testing force, stress, pressure, temperature	Test stand must have factor of safety = 5 for all applicable components								
ENG-28		CR-19105-28	Bunker has capability of holding all required tests	There's enough space for engine and test stand. The bunker can withstand high energy outputs.								
ENG-29		CR-19105-29										
ENG-30		CR-19105-30										
ENG-31		CR-19105-31										
ENG-32		CR-19105-32										
ENG-33		CR-19105-33										
ENG-34		CR-19105-34										
ENG-35		CR-19105-35										
ENG-36		CR-19105-36										
ENG-37		CR-19105-37										
ENG-38		CR-19105-38										
ENG-39		CR-19105-39										
ENG-40		CR-19105-40										
ENG-41		CR-19105-41										
ENG-42		CR-19105-42										

Rqmt. #: enables cross-referencing (traceability) and allows mapping to lower level requirements within separate documents

Source: Customer requirement #, regulatory standard (eg. EN 60601), and/or "implied" (must exist but doesn't have an associated customer rqmt), constraint

Description: quantitative, measurable, testable details

TEST RESULT KEY	
X	Does not meet expectation
Δ	Caution-Undetermined if specification is met
○	Meets specification

DIRECTION OF IMPROVEMENT KEY	
X	Must be within a specified range.
↑	Improvement occurs with increasing test value.
↓	Improvement occurs with decreasing test value.