



DoubleSShot

Boilerplate Rocket Motor

Assembly and Firing Instructions

Rev. 2011/09/08

Introduction

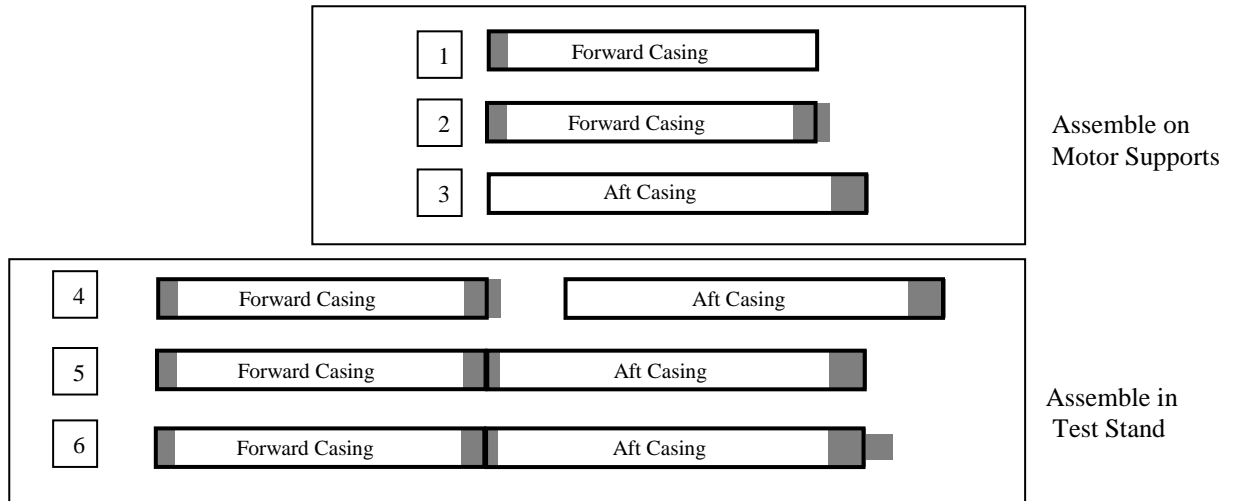
This document describes the sequences to be followed for assembling the DSS Boilerplate rocket motor, including set up in the static test stand. Pre-firing checks, firing instructions and anomaly procedures are also provided. It is assumed that setup and firing will take place over a period of two days, with grain assembly on the first day, followed by motor assembly, mounting in Test Stand, and firing occurring on the second day.

Day 1

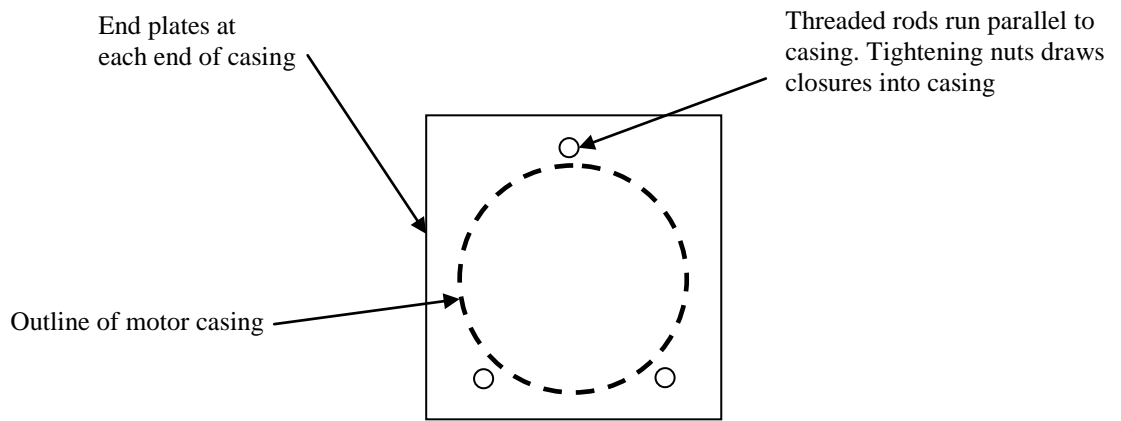
1. Assemble Forward Grains using Grain Assembly Support jig.
(per Ref. 1, steps 33-46)
2. Slide Forward Casing over grains and allow epoxy to cure for a minimum of 1 hour.
3. Lower the Forward Grain/Casing assembly from vertical to horizontal onto the Transport Cradle. Install clamps at each end of casing to prevent grain from sliding.
4. Assemble Aft Grains using Grain Assembly Support jig.
(per Ref. 1, steps 33-46)
5. Slide Aft Casing over grains and allow epoxy to cure a minimum of 1 hour.
6. Meanwhile transport the Forward Grain/Casing assembly to the Assembly Station and place onto pair of Motor Supports.
7. Using the Closure Installation Tool (CIT), install the Midbulkhead complete with two o-rings well lubricated with silicone grease. Use CIT per reference 2.
8. Verify forward igniter continuity, then shunt leads. Using the CIT install the Forward Bulkhead & Igniter complete with two o-rings well lubricated with silicone grease. Do **not** install any attachment screws at this time. Make certain Deluge Plug fitting assembly is installed and that the Guide Pipe and the mid BH pressure port are aligned correctly.
9. Retain Forward Bulkhead with Temporary Screws (nylon), 3 maximum.
10. Using the Cradle, transport Forward Grain/Casing assembly to secure storage location.
11. Lower the Aft Grain/Casing assembly from vertical to horizontal onto the Transport Cradle. Install clamps at each end of casing to prevent grain from sliding.
12. Transport the Aft Grain/Casing assembly to the Assembly Station and place onto pair of Motor Supports.
13. Using the CIT, install the Nozzle complete with two o-rings well lubricated with silicone grease.. Do not install Nozzle Cone at this time.
14. Install grain retention clamp at the forward end of the casing to prevent grain assembly from sliding.
15. Using the Cradle, transport Aft Grain/Casing assembly to secure storage location

Day 2

- 16. Verify aft igniter continuity, then shunt leads. Install the aft chamber igniter.
- 17. Using the Cradle, transport Forward Grain/Casing assembly onto Test Stand.
- 18. Using the Cradle, transport Aft Grain/Casing assembly onto Test Stand.
- 19. Using the CIT, join the two casings at the Midbulkhead complete with two o-rings well lubricated with silicone grease.
- 20. Remove Temporary Screws and install all Forward Bulkhead attachment screws.
- 21. Install the Nozzle Cone.
- 22. Install thermal labels.
- 23. Connect up Deluge System to motor.
- 24. Install pressure transducers and position load cells; adjust motor position such that Thrust Fitting contacts load cell.



Motor Assembly Sequence



Closure Installation Tool (CIT)

Pre-Firing Checks

- 1. Verify motor Thrust Fitting is located in contact with and concentric with the load cell button.
- 2. Verify load cell signal is acquired by applying forward force to motor.
- 3. Verify thermal labels are mounted.
- 4. Verify Deluge System is pressurized and all set to activate and that Plug Fitting is fully seated forward in the Forward Bulkhead.
- 5. Verify motor is properly secured in Test Stand.
- 6. Set video cameras to record mode.
- 7. Connect igniter leads to launch controllers.

Firing Instructions

- A. Initiate data acquisition for load cells and pressure transducers.
- B. Commence countdown from 10; press aft chamber firing button on Zero.
- C. At burnout of 1st phase, initiate 15 second 'coast delay'.
- D. At the 15 second count, press forward chamber firing button.
- E. As soon as practical following burnout, activate the Deluge System
 - a. Insert the spray tube fully into the motor
 - b. Turn on water supply valve
 - c. Slowly rotate the spray rod to direct spray over all surfaces of motor interior
 - d. Allow flow to run for a minimum of 30 seconds or until pressure or water supply is depleted.

References

- 1. *DoubleSShot* Boilerplate Motor Propellant Casting & Grain Assembly Rev. 2011/08/29
- 2. *DoubleSShot* Boilerplate Rocket Motor Closure Installation Tool User Manual Rev. 2011/08/22

Anomaly Procedures

#	Anomaly	Procedure
1	1 st phase ignition failure	Wait 10 minutes before approaching motor. Disconnect & shunt igniter leads. Utilizing CIT, open up motor at Midbulkhead (aft attachments) & replace igniter and/or pyrogen unit. Re-cycle data acquisition if required. Attempt re-fire.
2	2 nd phase ignition failure	Wait 20 minutes before approaching motor. Disconnect & shunt igniter leads. Douse hot external surface with water until cool, followed by careful flooding of motor interior through nozzle (Caution: beware of possible steam hazard). Utilizing CIT, disassemble motor and safely dispose of propellant.
3	1 st phase burn <i>serious</i> anomaly (Example: nozzle blowout, burn-through – motor remains in Test Stand)	Abort 2 nd phase ignition. Wait 20 minutes before approaching motor. Disconnect & shunt igniter leads. Douse hot external surface with water until cool, followed by careful flooding of motor interior through nozzle (Caution: beware of possible steam hazard). Utilizing CIT, disassemble motor and safely dispose of propellant.
4	1 st phase burn <i>major</i> anomaly (Example: CATO – motor departs Test Stand)	Wait 20 minutes before approaching Forward Chamber. Disconnect & shunt igniter leads. Flood any hot surfaces with water until cool. Utilizing CIT, open up motor at Midbulkhead (forward attachments) or Forward Bulkhead. Unload and safely dispose of any remaining propellant.