

## MIXTURES OF FUELS AND PROCEDURE FOR THEIR ESTABLISHMENT, CHANGEOVER IN A GAS TURBINE

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**DOI : 10.48047/IJFANS/11/ISS4/119**

**Abstract:** We are going to deal with various liquid or gaseous fuels and obtain mixed fuel combinations in a desired ratio based on economics in a gas turbine for combustion to give exhaust gases that would hit the blades of turbine to generate mechanical energy that can be converted to electrical energy

**Keywords:** High Speed Diesel (HSD), Naphtha, Regassified Liquefied Natural Gas (RLNG), Mark-6E

### 1. Introduction

In a gas turbine three different fuels are used for combustion for generating exhaust gas (the driving force for turbine) namely: HSD, Naphtha and RLNG. Each fuel will be choosed based on dynamical viability on economical basis in frequent intervals, in turn each fuel has different calorific values with RLNG having the highest among them. Moreover, RLNG is called a cleaner fuel as life time of gas turbine increases with its use.

### 2. Mixed Fuel change over procedure

#### A) Machine running in RLNG go for RLNG+HSD mixing

- 1) Ensure HSD pump is running and pressure kept at 5.0 kg
- 2) Ensure Reserve HSD pump availability and keep in auto
- 3) Ensure HSD supply & R/C PCV in cascade mode
- 4) Keep load at 5.0 mw
- 5) Give HSD selection
- 6) Fill timer will start and run for 30 seconds
- 7) After fill timer start check whether Fuel stop valve 20FL & 20 VS got opened and warren pump suction pressure reaches 5.0 kg

- 8) After fill time of 30 seconds warren pump clutch engages/IMO start and Liquid FSR increases
- 9) Once Liquid FSR reaches 20% select MIX this will keep RLNG+HSD MIX
- 10) Adjust mix split as per requirement (split selection refers to liquid side)

#### **RLNG+HSD mix to HSD**

- 1) Suppose HSD: RLNG is 20:80 now, slightly keep raising liquid % so that gas % reduces
- 2) Now we can keep raising in steps, liquid % to 80 % or raise till 100 % (to allow slow transfer of remaining gas to liquid)
- 3) In either of above ways click HSD option so that control of fuel moves from MIX to HSD completely
- 4) Ensure gas FSR becomes zero

#### **B) RLNG to RLNG+Naphtha mix**

We can't directly go for RLNG+Naphtha. First RLNG+HSD to be selected then only we can go for Naphtha

- 1) Ensure HSD pump is running and pressure kept at 5.0 kg
- 2) Ensure Reserve HSD pump availability and keep in auto
- 3) Ensure HSD supply & R/C PCV in cascade mode
- 4) Keep load at 5.0 mw
- 5) Give HSD selection
- 6) Fill timer will start and run for 30 seconds
- 7) After fill timer start check whether Fuel stop valve 20FL & 20 VS got opened and warren pump suction pressure reaches 5.0 kg
- 8) After fill time of 30 seconds warren pump clutch engages/IMO start and Liquid FSR increases
- 9) Once Liquid FSR reaches 20% select MIX this will keep RLNG+HSD MIX
- 10) Adjust mix split as per requirement (split selection refers to liquid side)
- 11) Ensure Naphtha pump is running and pressure kept at 6.0 kg
- 12) Ensure Reserve naphtha pump availability and keep in auto
- 13) Ensure Naphtha PCV in AUTO mode

- 14) Establish Hi-tech flow
- 15) Ensure atomizing air pressure is normal
- 16) Ensure naphtha system OK in Mark-6E panel
- 17) Select naphtha Fuel in panel
- 18) once again select MIX
- 19) Adjust mix split as per requirement (split selection refers to liquid side)

#### **RLNG + Naphtha mix to naphtha**

- 1) If Naphtha: RLNG is 20:80 now, slightly keep raising liquid % so that gas % reduces
- 2) Now we can keep raising in steps, liquid % to 80 % or raise till 100 % (to allow slow transfer of remaining gas to liquid)
- 3) In either of above ways later click Naphtha option so that control of fuel moves from MIX to Naphtha completely
- 4) Ensure gas FSR becomes zero

#### **C) Machine Running in HSD go for RLNG+ HSD Mix**

- 1) Ensure RLNG lined up to GVM I/L
- 2) Ensure GVM I/L RLNG SOV opened and vent SOV closed
- 3) Ensure GVM I/L block valve in open condition
- 4) Ensure P1 pressure is normal (21Kg)
- 5) Reduce load to 5.0Mw
- 6) Give Fuel selection to GAS in mark-6E panel
- 7) Fill timer will start and run for 30 seconds
- 8) Gas will enter gas FSR increase & Liquid FSR will reduce
- 9) Once Liquid FSR reduced to 80% select MIX selection
- 10) Adjust mix split as per requirement (split selection refers to liquid side)

#### **D) Machine Running in naphtha go for RLNG+ naphtha Mix**

We cannot directly go for RLNG from naphtha. First we have to C/O to HSD then we have to go for Naphtha +RLNG

- 1) Follow naphtha to HSD fuel Change over procedure and keep machine in HSD

- 2) Ensure RLNG lined up to GVM I/L
- 3) Ensure GVM I/L RLNG SOV opened and vent SOV closed
- 4) Ensure GVM I/L block valve in open condition
- 5) Ensure P1 pressure is normal (21Kg)
- 6) Reduce load to 5.0Mw
- 7) Give Fuel selection to GAS in mark-6E panel
- 8) Fill timer will start and run for 30 seconds
- 9) Gas will enter, gas FSR increase & Liquid FSR will reduce
- 10) Once Liquid FSR reduced to 80% select MIX selection
- 11) Adjust mix split as per requirement (split selection refers to liquid side)
- 12) Ensure Naphtha system is in lined up condition
- 13) Ensure naphtha pressure is 6.0kg and C/V in Auto mode
- 14) Select naphtha fuel selection in mark-6E
- 15) once again select MIX (**Now if m/c is in 80% HSD immediately on selecting naphtha liquid FSR may reach 100%, so better keep 50% HSD to get sufficient time to select MIX (as liquid FSR increases from 50% to 80%) after selecting Naphtha**)
- 16) Adjust mix split as per requirement (split selection refers to liquid side)

### Abbreviations

High Speed Diesel (HSD)

Regassified Liquefied Natural Gas (RLNG)

Distributed Control System (DCS)

Fuel flow rate feedback (FQL)

Fuel Stroke Reference (FSR)

Gas Control Valve (GCV)

Recirculation (R/C)

Pressure Control Valve (PCV)

Solenoid Operated Valve (SOV)

Gas Valve Module (GVM)

Changeover (C/O)

**CONCLUSION:**

In this paper, we are going to deal with various liquid or gaseous fuels and obtain mixed fuel combinations in a desired ratio based on economics in a gas turbine for combustion to give exhaust gases that would hit the blades of turbine to generate mechanical energy that can be converted to electrical energy, and there is so much further scope for research in this subject.

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