

05-2018-90

Georgia Power  
POWER GENERATION DEPARTMENT  
VOGTLE ELECTRIC GENERATING PLANT



TRAINING LESSON PLAN

TITLE:	EMERGENCY DIESEL GENERATOR AUXILIARIES FUEL OIL SYSTEM	NUMBER:	NL-LP-11202-01-C
PROGRAM:	OUTSIDE AREA OPERATOR	REVISION:	1
AUTHOR:	G.D. STONE	DATE:	10/12/88
APPROVED:	<i>Robert J. Brown</i>	DATE:	10/31/88
INSTRUCTOR GUIDELINES:			

**FOR INFORMATION ONLY**

- I. LESSON FORMAT
  - A. Lecture with Visual Aids
- II. MATERIALS
  - A. Slides and Slide Projector
  - B. Transparencies and Overhead Projector
  - C. Dry Erase Board and Markers
- III. EVALUATION
  - A. Written or Oral Exam in conjunction with other Lesson Plans
- IV. REMARKS
  - A. Performance-based instructional units (IUs) are attached to the lesson plan as student handouts. After the lecture instruction should be provided for the attached instructional units. The instructor should be available to answer questions that may arise concerning the IU material. After instruction on the IU, the student will perform, simulate, observe or discuss (as identified on the cluster signoff criteria list) the task covered in the instructional unit in the presence of an evaluator.

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## I. PURPOSE STATEMENT:

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UPON COMPLETION OF THIS LESSON, THE STUDENT WILL HAVE AN UNDERSTANDING OF THE FUNCTIONS AND OPERATIONS OF THE FUEL OIL STORAGE AND TRANSFER SYSTEM, AND OF THE SKID-MOUNTED FUEL OIL SYSTEM

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## II. LIST OF OBJECTIVES:

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1. State the functions of the Fuel Oil Storage and Transfer System.
2. Beginning at the DFO day tank, list the correct sequence which fuel will pass on its way to the combustion chambers.
  - a. DFO day tank
  - b. Duplex strainer
  - c. Fuel oil pump (engine-driven)
  - d. Duplex fuel filter
  - e. Supply header
3. State the capacities and functions, and number of the following Fuel Oil Storage and Transfer System components:
  - a. Diesel fuel oil storage tanks
  - b. Diesel fuel oil transfer pumps
4. State the functions and describe the basic operation of the following fuel oil components:
  - a. Eductor
  - b. Shrouded line leakage tank
  - c. Pressure-regulating valve
  - d. Injector pumps
  - e. Injectors
  - f. Engine-driven fuel oil pump
  - g. Fuel oil strainers
  - h. Fuel oil filters
5. List the electrical power supplies for the fuel oil transfer pumps for each emergency diesel generator.
6. State the start/stop permissives for the DB FOST pumps including the day tank level program, and state the location of the control switches.
7. List the instrumentation in the fuel oil storage building from which a local reading can be taken.
8. List two places DFO day tank level can be read in the DB building.
9. Make a drawing of the Fuel Oil Transfer System for one unit,

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## II. LIST OF OBJECTIVES

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including DFO storage tanks, DFO day tanks, pumps, and piping to and from the Auxiliary Boiler FOST and the other unit's tanks. Indicate the correct position for locked valves to achieve the following flowpaths:

- a. Recirculation of DFO Storage System
  - b. Supply Train A day tank from Train B DB FOST
  - c. Supply Train B day tank from Train A DB FOST
  - d. Transfer fuel oil from DB FOST to aux boiler FOST
  - e. Normal alignment, DB FOST to its day tank
10. State the following about water in the Fuel Oil System:
    - a. Problems caused
    - b. How to check for it
    - c. How to prevent it
  11. State the actions necessary for internal and external contact with fuel oil.
  12. State two safety precautions which are observed to prevent or mitigate the consequences of a fuel oil fire during fuel oil transfer.
  13. List the safety equipment to be worn when transferring fuel oil.
  14. State how oil storage areas are to be posted during fuel oil delivery.

## REFERENCES:

1. Plant Vogtle Procedures:
  - 13145 "Diesel Generator" (Rev B)
  - 13146 "Diesel Generator Fuel Oil Transfer System" (Rev 1)
  - 14980 "Diesel Generator Operability Test"
  - 13427 "4160 VAC 1E Electrical Distribution System"
  - 17035, Annunciator Response Procedures (Rev 3)
  - 17038, Annunciator Response Procedures (Rev 3)
2. Technical Specifications:
  - 3.B.1 Electrical Power Systems, AC sources
3. "Standby (Emergency) Diesel Generator" Vogtle Training Text Chapter 16C
4. Plant Manual Chapter 23 (Rev 0)
5. P&IDs, Logics and Other Drawings
  - Piping and Instrument Diagrams
    - 1X4DB170-1 (Rev 21)
    - 1X4DB170-2 (Rev 21)
  - Vendor Drawings
    - AX4AK01-27 (Lube Oil)
    - AX4AK01-26 (Jacket Water)
    - AX4AK01-29 (Starting Air)
    - AX4AK01-28 (Fuel Oil)
  - Control Logic Diagrams:
    - 1X5DN107-1 (DB Fuel Oil System) (Rev 6)
    - 1X5DN107-2 (DB Unit Engine) (Rev 3)
    - 1X5DN107-3 (Generator) (Rev 2)
  - Elementary Diagrams
    - 1X3D-BH-603C (Rev 2)
    - 1X3D-BH-603D (Rev 1)
    - 1X3D-BH-603E (Rev 2)
    - 1X3D-BH-603F (Rev 2)
    - 1X3D-BH-603B (Rev 1)
    - 1X3D-BH-603H (Rev 3)
    - 1X3D-BH-603I (Rev 2)
    - 1X3D-BH-603J (Rev 3)
  - One Line Diagrams
    - 1X3D-AA-A01A (Rev 12)
    - 1X3D-AA-K01A (Rev 7)
6. Vendor Manuals
  - AX4AK01-509 (Rev 0)
  - AX4AK01-510 (Rev 2)
  - AX4AK01-563 (Rev 6)
7. FSAR: 8.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8

## REFERENCES:

- B. DAP Commitments:
- SDER 83.006 "Unavailability of emergency power caused by diesel and breaker unavailability"
  - SDER 83.001 "Diesel generator failures"
  - SER 84.042 "System interdependency oversights results in loss of redundant safeguards functions"
  - IEN 85.028 "Partial loss of AC power and diesel generator degradation"
  - IEN 84.069 "Operation of emergency diesel generators"
  - DHR 297 "Grid high voltage and under-voltage trip relays contribute to EDG output breaker lockout"
  - NUREG 1216.000 "Safety evaluation report-related to operability and reliability of emergency diesel generators manufactured by Transamerica DeLaval Inc." (Not an DAP action item, but a training commitment)
9. INSTRUCTIONAL UNITS:
- NL-IU-11202-C-001 Fill the Fuel Oil Storage Tank
  - NL-IU-11202-C-002 Transfer Emergency Diesel Generator Fuel Oil to the Aux Boiler Fuel Oil Storage Tank
  - NL-IU-11202-C-003 Respond to Emergency Diesel Generator Fuel Oil System Alarms
10. TRANSPARENCIES:
- NL-TP-11202-001 Train A - normal
  - NL-TP-11202-002 Normal Alignment DFOST's to Day Tanks
  - NL-TP-11202-003 Recirculation
  - NL-TP-11202-004 Supplying Train A Day Tank from Train B DFOST
  - NL-TP-11202-005 Supplying Train B Day Tank from Train A DFOST
  - NL-TP-11202-006 Transfer of Train A DFOST contents to Aux Boiler FOST
  - NL-TP-11202-007 Basic Fuel Oil Components, Day Tanks to Injectors
  - NL-TP-11202-008 Typical Fuel Injection System
  - NL-TP-11202-009 Injector Pump Plunger Operation
  - NL-TP-11202-010 Exploded View of Injector Pumps
  - NL-TP-11202-011 Typical Fuel Injection Systems (cross section)
  - NL-TP-11202-012 Educator
11. Student Handouts
- NL-HD-11202-001 Emergency Diesel Generator Fuel Oil Storage, Transfer and Supply

### III. LESSON OUTLINE:

### NOTES

#### I. INTRODUCTION

- A. This lesson describes how the Fuel Oil System functions in providing fuel oil for combustion by the Emergency Diesel Generators

For convenience, the lesson is separated into:

1. Fuel Oil Storage and Transfer
2. Fuel Oil Injection System

- B. Present the Objectives

In handout

#### II. LESSON PRESENTATION

##### A. General Overview

##### 1. Purpose of Fuel Oil System

- a. Stores and delivers fuel oil for combustion by the diesel engine

##### 2. Functions of the Fuel Oil System

- a. Store enough fuel oil to allow at least 7 days EDG operation with ESF loads (plus additional amount for periodic testing)
- b. Transfer fuel oil from the DFOST to the day tank
- c. Provide a continual supply of fuel to the engine-driven pump
- d. Provide fuel to the injector pumps
- e. Clean the fuel oil
- f. Inject fuel oil into each cylinder for combustion

Objective 1

##### B. Fuel Oil Storage and Transfer

1. Four independent fuel storage and transfer systems - one per DG
2. Each consisting of:
  - a. Fuel oil storage tank
    - 1) Filled by truck connection
  - b. DFO Storage tank pumps - 2

NL-TP-11202-C-001

### III. LESSON OUTLINE:

### NOTES

- 1) Sometimes called transfer pumps
- c. Supply and return piping
  - 1) DFOST to day tank
  - 2) Day tank overflow to DFOST
  - 3) Trains isolated by locked valves
  - 4) Provisions for alignment:
    - Aux Boiler FOST
    - Opposite train
    - Other unit (later now capped)
- d. day tank
  - 1) One per engine
  - 2) In room in DB building
  - 3) Level maintained by DFOST pumps
- C. Component Description
  1. DB fuel oil storage tanks
    - a) 80,000 gal. capacity each
    - b) One per diesel/two per unit
    - c) Functions:
 

Store enough fuel oil for approx. 7 days of operation of the safety-related loads, assuring a loss of offsite power
    - d) Filled from truck fill connection
      - 1) 3" quick disconnect
      - 2) Basket strainer on fill line
    - e) Vented
      - 1) Flow converter on vent line
      - 2) Two vents to outside - roof and side of valve house
    - f) Dewatering provisions
      - 1) Water drain pipe from above tank to

Objective 3a

End Objective 3a  
 Students see  
 1X4DB-170-1 or -2

### III. LESSON OUTLINE:

### NOTES

low point

#### 2. DFD Storage Tank Pumps

- a. Function: transfer fuel oil from DFOST to day tank
- b. Number of pumps - 2
- c. 25 gpm, 95 ft head
- d. Pumps in tank, motors on tank (1.5 hp)
- e. 480V MCC 1ABF:
  - 1) Both Unit 1 Train A pumps (001 and 002) 480V MCC 1BBF
  - 2) Both unit Train B pumps (003 or 004)
- f. One pump approx 3 times max. DG consumption rate
- g. Auto Start/Auto Stop by day tank level, and alternate with each makeup cycle
- h. Unit 2 DFOST pump controls
  - 1) A Train same as Unit 1
  - 2) B Train different
    - a) Local/Remote transfer switches to transfer control out of CR in case of fire
    - b) In "REMOTE" operation from DEAB; STOP/AUTO/START
    - c) In "LOCAL" pump will run in auto mode only
  - 3) Fuel oil day tank
    - a) Function: provides a continual supply of fuel to the engine drain pump
      - (1) Positive suction head - tank elevated above power
    - b) Located in DB building, in a fire-rated room

Objective 3b

Unit 1/Unit 2  
Difference

No D.C.  
Priming pump necessary



### III. LESSON OUTLINE:

### NOTES

- c) 1250 gallon capacity
  - d) How long DG will run without makeup to day tank
    - (1) .0678 gal/kwh, or as example
    - (2) Approximately 1.36 hr @ 700KW, if at 650 gal with no makeup (650 gal min Tech Spec vol)
    - (3) Time longer at lower loads and if day tank fuller initially
    - (4) DG inoperable if day tank makeup isolated or not available
  - e) Unit 2 day tanks can be drained back to FOST
  - f) Unit 1 day tanks drained to floor drains
- D. Instrumentation and Control: Fuel Oil Storage and Transfer
- 1. Day tank level control
    - a. First DFOST pump starts: approx 62% level decreasing
    - b. First pump shuts off: approx 92% level increasing
    - c. Second pump starts:
      - 1) When level drops to approx 62% again
      - 2) Alternator swaps pumps with each cycle
    - d. No level alarms when pumps normally cycling the level
    - e. Low low day tank level
      - 1) Second pump starts
    - f. Running pump discharge pressure low for 10 seconds - second pump starts

FBARD 430.16

Unit 1/Unit 2  
DifferenceObjective 6 begin  
assuming DG is running  
CR switches in AUTO

### III. LESSON OUTLINE:

### NOTES

- g. DB HIGH OR LOW LEVEL DAY TANK alarm
  - 1) Continual room annunc.
  - 2) DB panel annunc.
  - 3) HIGH setpoint above pump shut-off
  - 4) LOW setpoint slightly below second pump start, but still above Tech Spec minimum
- h. Tech Spec minimum
  - 1) 52% day tank level (650 gal.)
  - 2) Read on LI 9018, 9019
- i. Location of DFST pump switches
  - 1) Control Room 9-EAB, near DB controls
  - 2) No local control switch
2. Fuel oil storage building instrumentation
  - a. Flow indicator - DFST pump return to DFST (testing)
    - 1) (FI 19104, Tr. A, 19105, Tr. B)
  - b. Pump discharge pressure gauges
  - c. DFST level indicating switch
    - 1) (LIS-9-22 Tr A; LIS-9023 Tr. B)
3. Day tank level gauges (local)
  - a. Level indicating transmitter in day tank room
 

(LIT 9018, Tr. A, 9019, Tr B)
  - b. "PUSH-TO-READ" level gauge on DSL control panel
 

"bubbler" type - uses diesel control air
4. Control Room gauges
  - a. DFST, 0-100%, each diesel
  - b. Day tank, 0-100%, each diesel

Objective 6 - end

Objective 7  
See P&ID 170-1

Objective 8

### III. LESSON OUTLINE:

### NOTES

- | III. LESSON OUTLINE:  | NOTES   |
|---|---|
| <p>5. Alarms (both Control Room and Local)</p> <ul style="list-style-type: none"> <li>a. "CONTROL SW NOT IN AUTO"           <ul style="list-style-type: none"> <li>1) DFOST pump(s) c.s. not in AUTO</li> <li>2) Other switches cause alarm, also</li> </ul> </li> <li>b. "HIGH OR LOW LEVEL DAY TANK"           <ul style="list-style-type: none"> <li>1) Dual function alarm</li> <li>2) Should not occur if pumps operating normally</li> </ul> </li> <li>c. "LOW LEVEL MAIN TANK"           <ul style="list-style-type: none"> <li>Alarm setpoint above Tech Spec minimum</li> </ul> </li> <li>d. "HIGH LEVEL MAIN TANK"</li> </ul>     |   |
| <p>E. Operations - Fuel Oil Storage and Transfer</p> <ul style="list-style-type: none"> <li>1. Filling DFOST           <ul style="list-style-type: none"> <li>a. Procedure 13146-1</li> <li>b. If FOST level 68% or less, its day tank must be aligned to receive from opposite train's DFOST</li> <li>c. Tech Spec - 76% (68,000 gal) minimum</li> <li>d. Sampling of truck tank               <ul style="list-style-type: none"> <li>Filling begins after sample checks OK</li> </ul> </li> <li>e. Accomplish fuel oil receiving checklist</li> <li>f. Possible to gravity feed (slow) or pump, using truck's pump</li> </ul> </li> </ul> | <p>Discuss procedures with students<br/>13146-1</p>                           |
| <ul style="list-style-type: none"> <li>2. Safety Precautions during fillings:           <ul style="list-style-type: none"> <li>a. Posting area for fuel oil delivery               <ul style="list-style-type: none"> <li>1) "NO SMOKING OR OPEN FLAMES" working tape set up at least 25 feet from tanker fill connections, and enclosing tanker</li> <li>2) Grounding tanker trucks to sta. ground</li> </ul> </li> </ul> </li> </ul>  | <p>Objective 14</p> <p>There is a ground cable to right of outside stairs</p> |

### III. LESSON OUTLINE:

### NOTES

- b. Mitigating Fires:
- 1) Ensure fuel truck is grounded
  - 2) Use of drip pans
  - 3) Fire extinguishers available
  - 4) Ensure dripped fuel oil disposed of
  - 5) Post the area with warning signs
    - \* "DANGER - FLAMMABLE MATERIAL - NO SMOKING, SPARKS OR OPEN FLAME WITHIN 25 ft.
  - 6) Fuel oil should not be transferred from trucks in electrical stores, high winds (50 mph), tornado warning, hail storms
  - 7) Notify SS of spillage of any fuel oil
- c. Actions necessary for contact with fuel oil
- 1) Soap and water if external
  - 2) Notify Safety Department if internal (ingestion)
- Warning in 00261-C
- PROLONGED CONTACT WITH SKIN MAY CAUSE OPEN SORES OR BURNS TO APPEAR ON THE SKIN
- d. Grounding
- 1) Prior to connecting fuel oil transfer hose
  - 2) Grounding strap shall be connected between piping to permanent storage tanks, tank trucks, and to ground
  - 3) Wire-covered hose may be used otherwise
- e. Personal protective equipment worn by individuals transferring fuel oil:
- 1) Full face shield, goggles, or safety glasses

Objective 12

(At least two 20 lb dry chemical extinguishers

Area also roped off

Objective 11

Ref: 00261-C  
"Should" be worn

Objective 13

### III. LESSON OUTLINE:

### NOTES

- |   |                           |
|---|---------------------------|
| 2) Rubber gloves  |                           |
| 3. Sampling day tank for water  | Objective 10b             |
| a. Required if DG has run for one hour or greater, or every 31 days on a surveillance                             |                           |
| b. During that hour, the DFOST pumps may have pumped fuel containing moisture                                     |                           |
| c. Visual check of DFOST drain F.O.   |                           |
| d. Obtain clear container (1 liter or greater)  |                           |
| Drain small amount into container via day tank drain. If water is found, repeat sampling until no water is found. | DG Operability Test 14980 |
| e. Water in fuel oil system   | Objective 10a             |
| 1) Problems caused  |                           |
| Displace fuel oil, starving engine  |                           |
| 2) Prevented by:  |                           |
| Dewatering, or draining from tank bottom  | Objective 10c             |
| Having Chemistry Department sample any fuel oil going to the tanks  |                           |
| 4. Major flowpaths of Fuel Oil Storage and Transfer System  |                           |
| a. Students must be able to draw basic flows  | Objective 9               |
| b. Normal alignment   | NL-TP-11202-002           |
| 1) Crossties between trains closed/locked   |                           |
| 2) No valves open to Aux Boiler SOFT or Unit 2  |                           |
| 3) Each day tank supplied from its DFOST  |                           |
| c. Recirculation  |                           |
| 1) Control Room starts one pump - manual  | NL-TP-11202-003           |
| 2) Day tank fills, overflows to its DFOST   |                           |
| d. Supplying Train A day tank from Train B DFOST  | NL-TP-11202-004           |

### III. LESSON OUTLINE:

### NOTES

- 1) Train A DFOST or pumps not available
  - 2) Train crosstie valves open
  - 3) Pump from Train B DFOST to Train A day tank
  - 4) Train B day tank should overflow
  - 5) Manually start/stop pump to maintain Train A day tank level
  - 6) Done only in emergency or low DFOST level
  - 7) Helps keep sediment from being pumped to day tank
- e. Supplying Train B day tank from Train A DFOST
- 1) Same concepts as above
- f. Transfer fuel oil from DBFOST to Aux Boiler FOST
- 1) If DFOST contents have degraded
  - 2) Day tanks isolated to transfer
  - 3) DB inoperable

NL-TP-11202-006

### III. FUEL INJECTION

#### A. General Description

1. Each cylinder fitted with individual fuel injection pump and injection nozzle
2. Engine-driven pump takes suction from F.O. day tank via duplex strainer and filter to ensure cleanliness
3. Sequence of components from day tank
  - a. DFO day tank
  - b. Duplex strainer
  - c. Fuel oil pump (engine driven)
  - d. Duplex fuel filter
  - e. Supply header

a - e,  
Objective 2

NL-TP-11202-007

### III. LESSON OUTLINE:

### NOTES

- f. Injector pumps and injection
- g. Combustion chambers
- B. Component Description
  - 1. Engine-driven fuel oil pump
    - a. Driven by engine gearset
    - b. Internal pressure relief 70 psig
    - c. Mounted on same drive as the overspeed trip device
    - d. Gear-type pump
    - e. Function:
      - 1) Provide pressurized fuel oil to the injection pumps when the engine is running
    - f. Basic operation
      - 1) Pump suction below day tank level - slight positive head
      - 2) Pressurizes supply header when engine is running
      - 3) Engine inoperable without it
  - 2. Pressure-regulating valve
    - a. Description:
      - 40 psig
    - b. Function
      - 1) Regulate supply header pressure
    - c. Basic operation
      - 1) Fuel pressure provided by engine-driven pump
      - 2) Relieves to day tank
      - 3) If fails open (low fuel pressure), loss of DB Train
      - 4) If fails closed - high fuel pressure,

Objective 4f

Objective 4c

### III. LESSON OUTLINE:

### NOTES

- DG can run
3. Injector pumps
    - a. Description
      - 1) Constant stroke, positive displacement plunger pump
      - 2) "Effective stroke" varies output high pressure, 3000 psig and greater
      - 3) One per cylinder
      - 4) Located beside each head
    - b. Functions:
      - 1) Provide fuel oil at high pressure to injector
      - 2) Control amount per stroke
    - c. Operation:
      - 1) Spring-loaded plunger moves up, pushed by camshaft tappet
      - 2) Plunger rides in barrel
      - 3) Rack has teeth which engage teeth of control sleeve - rack direction back-and-forth
      - 4) Control sleeve rotation also rotates plunger
      - 5) Plunger crossbar rides in two slots in control sleeve
      - 6) Plunger rising seals off inlet ports, pressurizing fuel supply to injector
      - 7) Injector needle valve "pops" open at approx. 3000 psig, spraying into cylinder
      - 8) Fuel delivery to injector ends when helical port opens up to the spill port
      - 9) Rotation of plunger caused by rotation of control sleeve, in turn caused by change of rack position

Objective 4d

NL-TP-11202-008

NL-TP-11202-009

NL-TP-11202-010

NL-TP-11202-011



### III. LESSON OUTLINE:

### NOTES

- 10) Rack position determined by output shaft on Woodward governor, via linkage
  - 11) Fuel delivery "timed" by camshaft to inject when heat of combustion will ignite fuel
4. Fuel Injectors
- a. Description
    - 1) One per cylinder, mounted in a holder, installed in engine head
    - 2) Provided fuel by its injection pump
  - b. Function
    - 1) Atomize fuel as it is sprayed into the cylinder for more complete combustion
  - c. Operation
    - 1) Supplied fuel pressure lifts internal spring-loaded needle valve
    - 2) Valve lifts at approx. 3000 psig, spraying into cylinder
    - 3) Small amount of fuel oil lubricated needle valve and internals - seal line tapped into injector
5. Shrouded line leakage tank
- a. Description
    - 1) Seal reservoir
    - 2) At engine foundation, near barring device and lube oil cooler
  - b. Function
    - 1) Receive fuel oil leaks from high pressure fuel injection tubing
    - 2) Level switch to cause alarm
    - 3) Shrouded line keeps fuel oil off hot components should HP fuel oil pipe burst

Objective 4e

See P&amp;ID 170-1

Objective 4b

### III. LESSON OUTLINE:

### NOTES

#### c. Operation

- 1) "DG FUEL OIL INJECTION LINE BREAK" alarm
- 2) Threaded cap on top - can see high level inside
- 3) Provisions for draining leakage tank

#### 6. Eductor

##### a. Description

- 1) Device similar to an ejector for mixing two fluids

##### b. Function

- 1) Return fuel oil from drip header to the day tank

##### c. Operation

- 1) Motive force from supply header
- 2) Discharges to day tank
- 3) With pneumatic shutoff open, picks up fuel oil from drip header
- 4) If eductor fails (pneumatic shutoff valve did not open on start) engine still runs OK. Drip rate is small
- 5) Fuel oil puddling at injector pump bases can indicate eductor is not working

#### 7. Fuel Strainers

##### a. Description

- 1) Duplex-type, with change valve

##### b. Function

- 1) Remove fine particles from fuel oil before it enters engine-driven pump and filter

##### c. Operation

- 1) If blocked, engine will stall or will

NL-TP-11202-012

Objective 4a

Objective 4g

### III. LESSON OUTLINE:

### NOTES

- not start
- 2) High differential pressure across strainer indicates blockage
  - 3) Low pressure fuel oil alarm
  - 4) Manually swapped to other strainer
  - 5) Diff press. checked hourly in log 11885-C
- B. Fuel Filters
- a. Description
    - 1) Duplex-type, with change valve
    - 2) Located to right of engine FO pump, engine front, "HILCO" brand
  - b. Function
    - 1) Remove finer particles from fuel air before it enters the engine for injection
  - c. Operation
    - 1) Full flow, not bypassed
    - 2) Can be changed to other filter when engine is running
    - 3) Procedures 13145-1, 4.4.6
      - venting of standby filter
      - moving handle slowly
    - 4) Indications of plugging:
      - High diff. pressure, gauge at engine front
      - High diff. pressure, gauge on engine control panel
      - Low pressure, fuel oil gauge on engine control panel
      - "LOW PRESS FUEL OIL" alarm
      - "HI DIFF PRESS FUEL OIL FILTER" alarm
      - If plugged badly enough, engine misfiring or quits

Objective 4h

Discuss with class

### IV. SUMMARY

**III. LESSON OUTLINE:**

**NOTES**

A. Review Objectives