ISO 12345:2021 (E)

Diesel engines — Cleanliness assessment of fuel injection equipment

Contents

Foreword

Introduction

1 Scope

2 Normative references

3 Terms and definitions

4 Test apparatus

4.1 Pressure source
4.1.1 Fuel injection pump test bench
4.1.2 Hand-lever-operated testing and setting apparatus
4.1.3 High-pressure pulsating flow rig
4.1.4 Verification low-pressure pump
4.1.5 Verification high-pressure delivery pump
4.1.6 Pressure vessel
4.1.7 Flushing pump
4.2 Verification high-pressure pipe assembly
4.3 Verification test injector
4.4 Collecting vessel
4.5 Verification rail
4.6 Equipment for contamination measurement
4.6.1 Gravimetric analysis apparatus
4.6.1.1 Non-ventilated drying oven
4.6.1.2 Filter holder
4.6.1.3 Vacuum flask
4.6.1.4 Vacuum device
4.6.1.5 Solvent dispenser (syringe)
4.6.1.6 Tweezers
4.6.1.7 Graduated cylinders
4.6.1.8 Sample bottles
4.6.1.9 Plastic film
4.6.1.10 Filter membranes
4.6.1.11 Petri dishes
4.6.1.12 Analytical balance
4.6.1.13 Alpha-ray ionizer
4.6.1.14 Air dryer
4.6.1.15 Collecting vessel
4.6.2 Microscopic analysis apparatus
4.6.2.1 Filter membrane
4.7 Test fluid
4.7.1 Calibration fluid
4.7.2 Solvent, aliphatic hydrocarbon
4.7.3 Water, de-mineralised
4.8 Clean-up filter
4.9 Pressure gauge

5 Procedure

5.1 General
5.2 High-pressure supply pumps (common rail fuel injection system)
5.2.1 General
5.2.2 Dynamic test with the test pump running
5.2.2.1 Equipment set up and verification (qualification test and blank level) of cleanliness

5.2.2.2 Test procedure
5.2.3 Flushing test at low speed with the test pump running by hand
5.2.3.1 Equipment set up and verification of cleanliness
5.2.3.2 Test procedure
5.3 Unit injectors
5.3.1 General
5.3.2 Equipment set up and verification of cleanliness
5.3.3 Test procedure
5.4 Fuel injection pumps
5.4.1 General
5.4.2 Equipment set up and verification of cleanliness
5.4.3 Test procedure
5.5 CR fuel injectors
5.5.1 General
5.5.2 Dynamic test
5.5.2.1 Equipment set up and verification (qualification test and blank level) of cleanliness
5.5.2.2 Test procedure
5.5.3 Continuous high-pressure flow test
5.5.3.1 Equipment set up and verification (qualification test and blank level) of cleanliness
5.5.3.2 Test procedure
5.6 Fuel injectors (nozzle holder assemblies)
5.6.1 General
5.6.2 Dynamic test
5.6.2.1 Equipment set up and verification of cleanliness
5.6.2.2 Test procedure
5.6.3 Syringe test (washing out injectors)
5.6.3.1 Equipment set up and verification of cleanliness
5.6.3.2 Test procedure
5.7 High-pressure fuel injection pipes
5.7.1 General
5.7.2 Dynamic test
5.7.2.1 Equipment set up and verification of cleanliness
5.7.2.2 Test procedure
5.7.3 High-pressure flushing test
5.7.3.1 Equipment set up and verification of cleanliness
5.7.3.2 Test procedure
5.7.4 Syringe (solvent dispenser) or hand flush test
5.7.4.1 Equipment set up and verification of cleanliness
5.7.4.2 Test procedure
5.8 Rails
5.8.1 General
5.8.2 Pressure vessel flushing test
5.8.2.1 Equipment set up and verification of cleanliness
5.8.2.2 Test procedure
5.8.2.2.1 Preparation of the complete rail
5.8.2.2.2 Inflow process (step 1)
5.8.2.2.3 Draining process (step 1)
5.8.2.2.4 Inflow and draining processes (step 2)
5.8.2.3 Analysis of contaminated filter membrane
5.8.3 Low-pressure flushing test
5.8.3.1 Equipment set up and verification of cleanliness
5.8.3.2 Test procedure
5.8.3.2.1 Preparation of the complete rail
5.8.3.2.2 Flushing of the inner surface of the complete rail (step 1)
5.8.3.2.3 Flushing of the ports (pump and injector connections) (step 2 and 3)
5.8.3.2.3.1 Flushing of outlet ports (injector connections) (step 2)
5.8.3.2.3.2 Flushing of the “last” outlet port (injector connection) and the inlet port (pump connection) (step 3)
5.8.3.2.4 Collection of contaminants (step 4)
5.8.4 Syringe or hand flush test
5.8.4.1 Equipment set up and verification of cleanliness
5.8.4.2 Test procedure
5.9 Low-pressure systems
5.9.1 General

5.9.2 Equipment set up and verification of cleanliness
5.9.3 Test procedure

6 Sample analysis

6.1 General
6.2 Gravimetric analysis
6.3 Particle size distribution

7 Reporting of the inspection results

8 Designation of cleanliness requirements

Annex A (normative) Typical test equipment for measuring fuel injection equipment cleanliness

A.1 General
A.2 Basic principle of test equipment
A.2.1 Components of basic test equipment:
A.2.2 Deviations from the basic principle of a test equipment
A.3 Test equipment for syringe or hand flushing test
A.4 Test rig components for high-pressure supply pumps (test pump running by hand)
A.5 Rail pressure vessel flushing test (dynamic procedure)

Annex B (normative) Rail low-pressure flushing test

Annex C (normative) Procedure for verifying test equipment initial cleanliness

C.1 Initial cleanliness verification procedures
C.2 Blank level test
C.2.1 Sources of blank contamination
C.2.2 System blank level test
C.2.3 Cleanliness level CL
C.2.3.1 Gravimetric analysis
C.2.3.2 Particle counting and sizing
C.3 Criteria for acceptance

Annex D (normative) Determination of flushing parameters for rail pressure vessel flushing test

D.1 Blowhole and particle collection point
D.2 Different flushing configurations to avoid blowholes and particle collection points

Annex E (informative) Comparison of CCC (component cleanliness code, ISO 16232) to FIECC (fuel injection equipment cleanliness code, ISO 12345:2013)

Page count: 37