

Status of PC-9 Matrix Testing

Presented to HDEOCP

May 10, 2001

John L. Zalar

T-10

- **Planned Tests: 28**
- **Total Starts: 27**
- **Completed Tests**
 - **Verified and posted on TMC web site: 16**
 - **EOT and being reviewed/verified: 4**
 - **Aborted/Invalid: 3**
- **Tests Currently Running: 4**
- **Best case matrix completion date: 6/1/01**

M11-EGR

- **Planned Tests: 26**
- **Total Starts: 26**
- **Completed Tests**
 - **Verified and posted on TMC web site: 14**
 - **EOT and being reviewed/verified: 4**
 - **Aborted/Invalid: 2**
- **Tests Currently Running: 6**
- **Best case matrix completion date: 6/18/01**

1Q

- **Planned Tests: 28**
- **Total Starts: 20**
- **Completed Tests**
 - **Verified and posted on TMC web site: 5**
 - **EOT and being reviewed/verified: 6**
 - **Aborted/Invalid: 5**
- **Tests Currently Running: 4**
- **Best case matrix completion date: 8/10/01**

1Q Aborted Tests

- **PC-9A - high oil consumption (being rerun)**
- **PC-9D - aborted following shutdown at 403 hours to replace air filter**
- **PC-9E - coolant hose failure (being rerun)**
- **PC-9M (1005-1) - scuffed**
- **PC-9M (1005-1) - scuffed**

T-10 STATUS

PC-9 MATRIX											
TEST TYPE	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10
MATRIX LAB NO.	4	2	1	5	4	2	1	3	4	3	2
MATRIX STAND NO.	6	3	1	7	6	3	1	4	6	5	3
PC-9 OIL CODE	PC-9A	PC-9A	PC-9A	PC-9A	PC-9H	PC-9F	PC-9C	PC-9H	PC-9A	PC-9A	PC-9B
BASE OIL CODE	1	1	1	1	2	3	3	2	1	1	2
TECHNOLOGY CODE	X	X	X	X	Z	Y	X	Z	X	X	X
MATRIX RUN NO.	1	1	1	1	2	2	2	--	3	1	3
START DATE	27-Nov-00	11-Dec-00	6-Dec-00	15-Dec-00	2-Feb-01	2-Feb-01	20-Feb-01	28-Feb-01	2-Mar-01	8-Mar-01	15-Mar-01
EOT DATE	11-Dec-00	24-Dec-00	19-Dec-00	31-Dec-00	17-Feb-01	15-Feb-01	5-Mar-01	18-Mar-01	15-Mar-01	30-Mar-01	1-Apr-01
VALID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FAX BACK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ASTM NOTIFIED	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RESULTS											
LINER WEAR	36.3	38.0	35.1	24.4	33.3	27.0	25.3	34.0	48.2	33.0	31.2
TOP RING WEIGHT LOSS	139	139	158	349	150	69	116	156	171	125	125
DELTA Pb	33	12	23	11	73	21	33	115	35	37	17
SOOT - 75 HR	4.9	4.9	5.0	5.1	4.9	5.0	4.9	5.0	5.0	4.7	4.6
SOOT - EOT	5.7	5.5	6.0	6.6	--	5.3	5.4	7.1	5.8	5.9	5.1
OIL CONSUMPTION	0.238	0.193	0.149	0.107	0.157	0.157	0.137	0.195	0.213	0.199	0.152

T-10 STATUS

PC-9 MATRIX											
TEST TYPE	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10	T-10
MATRIX LAB NO.	1	1	3	3	1						
MATRIX STAND NO.	2	1	4	5	2						
PC-9 OIL CODE	PC-9A	PC-9E	PC-9C	PC-9J	PC-9A						
BASE OIL CODE	1	2	3	3	1						
TECHNOLOGY CODE	X	Y	X	Z	X						
MATRIX RUN NO.	1	3	--	2	2						
START DATE	23-Feb-01	16-Mar-01	2-Apr-01	4-May-01	26-Mar-01						
EOT DATE	13-Mar-01	29-Mar-01	20-Apr-01	19-Apr-01	8-Apr-01						
VALID	Yes	Yes	Yes	Yes	Yes						
FAX BACK	Yes	Yes	Yes	Yes	Yes						
ASTM NOTIFIED	Yes	Yes									
RESULTS											
LINER WEAR	38.0	21.2	35.1	35.4	27.4						
TOP RING WEIGHT LOSS	168	118	133	119	87						
DELTA Pb	19	18	77	90	16						
SOOT - 75 HR	5.0	4.5	5.3	4.8	4.6						
SOOT - EOT	6.0	4.8	7.6	5.7	4.8						
OIL CONSUMPTION	0.161	0.105	0.212	0.118	0.111						

M11 EGR STATUS

PC-9 MATRIX											
TEST TYPE	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR
MATRIX LAB NO.	2	3	3	1	4	3	1	1	2	1	1
MATRIX STAND NO.	3	4	5	1	6	4	2	1	3	1	2
PC-9 OIL CODE	PC-9E	PC-9E	PC-9E	PC-9E	PC-9E	PC-9B	PC-9E	PC-9F	PC-9D	PC-9E	PC-9E
BASE OIL CODE	2	2	2	2	2	2	2	3	1	2	2
TECHNOLOGY CODE	Y	Y	Y	Y	Y	X	Y	Y	Y	Y	Y
MATRIX RUN NO.	1	1	1	1	1	2	2	2	2	3	1
START DATE	7-Dec-00	14-Dec-00	11-Jan-01	11-Jan-01	18-Jan-01	20-Feb-01	23-Feb-01	6-Mar-01	11-Mar-01	27-Mar-01	12-Jan-01
EOT DATE	21-Dec-00	27-Dec-00	27-Jan-01	29-Jan-01	2-Feb-01	6-Mar-01	11-Mar-01	21-Mar-01	26-Mar-01	10-Apr-01	26-Jan-01
VALID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes*
FAX BACK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ASTM NOTIFIED	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RESULTS											
CROSSHEAD WEAR	23.4	51.0	28.8	20.7	42.3	23.8	22.6	15.8	16.5	18.7	17.7
OIL FILTER DELTA P	210	204	330	706	407	675	144	310	301	417	204
AVERAGE SLUDGE	9.1	7.4	8.0	9.0	8.7	8.8	8.8	8.2	7.8	8.4	8.9
SOOT - 250 HR	8.2	9.1	8.0	9.1	8.5	8.2	9.0	8.8	8.7	8.7	7.9*
INJ. SCREW WT. LOSS	98.9	108.4	51.2	160.5	116.6	43.7	404.0	160.9	136.1	96.6	110.2
TOP RING WEIGHT LOSS	113	172	116	104	147	125	19	197	163	148	144

M11 EGR STATUS

PC-9 MATRIX											
TEST TYPE	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR	M11 EGR
MATRIX LAB NO.	3	3	3								
MATRIX STAND NO.	4	5	5								
PC-9 OIL CODE	PC-9G	PC-9J	PC-9E								
BASE OIL CODE	1	3	2								
TECHNOLOGY CODE	Z	Z	Y								
MATRIX RUN NO.	3	2	3								
START DATE	15-Mar-01	21-Feb-01	20-Mar-01								
EOT DATE	1-Apr-01	10-Mar-01	6-Apr-01								
VALID	Yes	Yes	Yes								
FAX BACK	Yes	Yes	Yes								
ASTM NOTIFIED											
RESULTS											
CROSSHEAD WEAR	13.6	27.7	19.4								
OIL FILTER DELTA P	304	535	332								
AVERAGE SLUDGE	7.3	7.7	7.6								
SOOT - 250 HR	8.2	8.2	8.2								
INJ. SCREW WT. LOSS	68.2	71.8	82.1								
TOP RING WEIGHT LOSS	125	170	139								

1Q STATUS

PC-9 MATRIX											
TEST TYPE	1Q	1Q	1Q	1Q	1Q	1Q	1Q	1Q	1Q	1Q	1Q
MATRIX LAB NO.	3	2	1	4	5	1	1	3	4	3	1
MATRIX STAND NO.	4	3	2	6	7	1	2	4	6	5	1
PC-9 OIL CODE	PC-9M	PC-9M	PC-9M	PC-9M	PC-9M	PC-9M	PC-9A	PC-9B	PC-9B	PC-9E	PC-9E
BASE OIL CODE	4	4	4	4	4	4	1	2	2	2	2
TECHNOLOGY CODE	W	W	W	W	W	W	X	X	X	Y	Y
MATRIX RUN NO.	1	1	1	1	1	1	2	2	2	1	2
START DATE	5-Jun-00	3-Aug-00	22-Jun-00	14-Jun-00	11-May-00	2-Feb-01	23-Mar-01	24-Mar-01	2-Apr-01	28-Mar-01	13-Apr-01
EOT DATE	28-Jun-00	29-Aug-00	16-Jul-00	17-Aug-00	24-Jun-00	25-Feb-01	14-Apr-01	17-Apr-01	25-Apr-01	18-Apr-01	
VALID	Yes	Yes	Yes	Yes	Yes						
FAX BACK	Yes	Yes	Yes	Yes	Yes						
ASTM NOTIFIED	Yes	Yes	Yes	Yes	Yes						
RESULTS											
WEIGHTED DEMERITS	402.4	450.4	417.5	381.2	419.9	405.8	420.7	247.5	482.3		
TOP GROOVE CARBON	30.50	36.50	26.00	29.25	24.00	33.50	36.50	33.75	31.25		
TOP LAND CARBON	18.75	7.75	18.00	19.50	8.25	21.25	14.75	20.25	14.25		
AVE. OIL CONSUMPTION	9.9	9.3	8.6	9.1	10.5	9.6	9.2	7.5	8.4	6.9	
EOT OIL CONSUMPTION	6.9	7.7	7.0	7.4	9.0	7.8	9.3	7.4	8.3	6.6	

Summary of Events Required for PC-9 Licensing

J. L. Zalar 5/10/01

ID	Task Name	Start	Finish	1999			2000			2001			2002		
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Define PC-9 Performance Parameters	3/16/99	3/16/99												
2	Design Precision Matrix	3/17/99	5/31/00												
3	PC-9 Funding MOA Signed	1/3/00	11/10/00												
4	1Q & M11EGR Adequate for Oil Devel.	5/15/00	5/15/00												
5	Finalize Base Oil Selections for Prec. Mtx.	5/31/00	5/31/00												
6	Finalize Additive Selections for Prec. Mtx.	1/6/00	6/30/00												
7	Base Oils Recd. by Additive Companies	7/3/00	9/20/00												
8	Blend Matrix Oils > TMC > Labs	9/21/00	11/27/00												
9	Final Acceptance of New Engine Tests	12/5/00	12/5/00												
10	PC-9 Matrix Testing *	3/27/01	8/10/01												
11	Precision Matrix Data Analysis	8/13/01	8/24/01												
12	HDEOCP Post Matrix Test Acceptance	7/11/01	9/5/01												
13	Subcommittee B Ballot	9/10/01	10/10/01												
14	Finalize Pass/Fail Criteria (Sub B Mtg)	10/22/01	10/31/01												
15	New Product Development	11/1/01	7/31/02												
16	API Licensing Allowed	8/1/02	8/1/02												