(ACkits.com)

Test Laboratory Division

Various Performance Tests
Alternative Refrigerants and Oils

Comments to Web Development Team
info@ackits.com

DATA SHEET

Objective: Register performance capabilities

Test Setup: See System Flow Diagram

Test Criteria:

1. Refrigerant----------Various (see graphs)
2. Compressor - Seltec DKS-15CH----------9.0 cu. in.
3. Compressor Speed----------2,240 RPM
4. Expansion Valve----------Parker 2-ton Valve
5. Temperature Control----------Pre-set Thermostatic Control
6. Supply air to condenser----------100,110 and 120 degrees Farenheit
7. Evaporator heat load----------80 to 140 degrees Farenheit in 10 degree increments
8. Air flow through condenser----------2,500 CFM
9. Calculated vehicle speed----------Approximately 25 MPH

Results at test criteria:
See data sheet and graphs

Test points:

Data	Measurement	Media	Component
ch 01	Temp	Air in	Condenser
ch 02	Temp	Air out	Condenser
ch 03	Temp	Liquid out	Condenser (leaving)
ch 04	Temp	Vapor in	Condenser (entering)
ch 05	PSI	Discharge	Compressor (high side)
ch 06	PSI	Suction	Compressor (low side)
ch 07	Temp	Suction	Evaporator (leaving)
ch 08	Temp	Air In	Evaporator
ch 09	Temp	Air Out	Evaporator
ch 10	GPM	Liquid flow rate	Condenser

General:

This report gives the results of twelve performance tests to determine the cooling capabilites of the products supplied. These products were FR-12, Freeze 12, Autofrost, Qwickboost, Cooltop, ICE32 and an oil miscibility test using Polymax 2 oil. R-12 and R-134a were also run under the same test methods in order to provide a baseline for comparison.

Test Methods:

The test was performed in accordance with Standard 20-70, "Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Condensers and Evaporators", published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., and by instructions from AMA Inc.

Description of Test Setup:

The products were installed in a system utilizing a plate and fin evaporator and a tube and fin condenser to simulate use in retrofitted systems, and a plate and fin evaporator and parallel flow condenser to simulate use in a R-134A a/c system, and air flow measured. The refrigerants were supplied to the coil from a fixed CFM compressor running at 2,240 RPM. Calorimeter heat input was supplied by electrical strip heating elements to match desired evaporator heat load (interior vehicle temperature). Condenser is mounted in a recirculating air room with a water cooled heat exchanger to select desired heat load on the condenser (outside ambient temperature). Eight thermocouple points and two pressure points were selected (see data sheet for locations).

Test Conditions were conducted for outside ambient at 100 to 120 degree farenheit, and interior car temperature from 80 to 140 degrees farenheit. A digital data-logger gathered information at each test point every 15 seconds. Total test duration was 4 hours per test. Each test was posted to its own data sheet, including graphs, and the results of these data sheets were promulgated and collated into the comparison sheets provided.

OVERVIEW

These tests are not to be construed as clinical, as each test was a one-time run (except for the R-12 and R-134A tests which over the years have been tested innumerable times) as a simulation of installing these products in the same vehicle under the same conditions. There are also other variables that would affect the results listed, such as running the tests as a CCOT system, that would have prevented most of these products from reaching the coldest temperatures listed as a thermostat cycles at lower coil temperatures than a pressure cycle switch . Had the evaporator been a tube and fin, the products compared would not have performed as well overall. AMA does not endorse any product listed, as these tests were performed strictly to provide performance data for AMA.

Each product performed comparable to the refrigerant it was tested against, whether R-12 or R-134A, as far as vent temperature and pressures, though many did not perform as advertised, promising colder vent temperatures as much as ten degrees. FR-12 performed best as the R-12 replacement. Freeze-12 worked well as a drop-in replacement with the only concern being that oil miscibility was barely adequate using mineral oil. Cooltop was advertised as a R-134a replacement that would work better than R-134a. In this test, it did not. Autofrost is a blend advertised as a drop-in replacement for R-12. Its performance was comparable to R-12, although head pressure was higher than R-12 during high heat loads, and its claim of colder vent temperatures was not noted. Qwickboost is also an oil additive that is advertised to help lower temperatures and pressures in systems that had been converted to R-134a from R-12 where performance was poor. Vent temperatures were better from one to seven degrees in the tube and fin condenser test, although pressures were higher; the parallel flow condenser test showed improvement in vent temperature, and lower pressures (see diagrams).

A PAO oil was advertised as a quality replacement for POE and PAG. The data shows vent temperature similar to the BVA Auto 100 POE oil used in the R-134a test, but head pressure was significantly higher, and it was observed that misciblity was poor. In fact, at higher ambient temperatures, the compressor was being slugged, meaning the oil would gather into large globs instead of mixing into the refrigerant and then back pressure would eventually force these globs into the compressor, sending a “slug” of oil.

The manufacture of ICE 32 asked AMA Inc to retest their product do to a few issues they had with the original results. Before retesting ICE 32 pointed out that ICE 32 is a compressor lubricant, which is designed to prolong the life of the compressor. ICE 32 suggested as a result of this process it may increase the over all performance in some vehicles. For the secondary tests all new components were used and a new baseline was created. Performance is recorded in the “Secondary Tests” section.

SUMMARY

Most products tested performed adequately, but none were observed to make such an incredible impact as to replace the industry standard of R-134A, and in fact these products can cause a significant environmental impact on places of business that do not have adequate testing equipment to prevent accidental recovery of blends into R-134a recovery systems. Another concern was the exact composition of the oil blends introduced into the system that may have a negative effect on metal and/or rubber components. Data shows that a high-efficiency R-134a system can perform better than a tube and fin R-12 system. If R-12 conversions include the installation of a high-efficiency condenser, then other compensators would be unnecessary .

TUBE AND FIN CONDENSER

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	80	39	22	210
R-134A	80	37	20	257
FR-12	80	37	15	204
FREEZE-12	80	38	15	204
AUTOFROST	80	39	18	217
Qwickboost	80	41	21	255

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	80	41	24	240
R-134A	80	39	23	296
FR-12	80	38	16	227
FREEZE-12	80	39	17	235
AUTOFROST	80	41	21	248
Qwickboost	80	38	21	274

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	80	44	26	269
R-134A	80	40	26	325
FR-12	80	41	18	255
FREEZE-12	80	43	20	255
AUTOFROST	80	45	24	280
Qwickboost	80	41	23	310

TUBE AND FIN CONDENSER

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	100	48	22	234
R-134A	100	46	20	287
FR-12	100	46	15	222
FREEZE-12	100	47	15	225
AUTOFROST	100	51	22	288
Qwickboost	100	41	22	310

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	100	50	28	234
R-134A	100	49	32	321
FR-12	100	49	24	251
FREEZE-12	100	50	24	255
AUTOFROST	100	51	29	267
Qwickboost	100	46	27	300

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	100	52	31	278
R-134A	100	55	35	359
FR-12	100	52	24	274
FREEZE-12	100	54	27	290
AUTOFROST	100	55	30	291
Qwickboost	100	49	30	336

TUBE AND FIN CONDENSER

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	120	55	32	244
R-134A	120	54	34	307
FR-12	120	55	27	240
FREEZE-12	120	57	28	245
AUTOFROST	120	55	30	247
Qwickboost	120	52	31	284

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	120	55	32	259
R-134A	120	59	36	346
FR-12	120	60	31	275
FREEZE-12	120	60	31	270
AUTOFROST	120	62	31	273
Qwickboost	120	55	35	325

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	120	63	33	290
R-134A	120	63	39	382
FR-12	120	64	34	302
FREEZE-12	120	63	33	304
AUTOFROST	120	65	32	301
Qwickboost	120	60	38	366

TUBE AND FIN CONDENSER

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	140	62	33	252
R-134A	140	61	37	322
FR-12	140	66	27	240
FREEZE-12	140	67	32	256
AUTOFROST	140	66	31	254
Qwickboost	140	60	35	305

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	140	68	33	264
R-134A	140	68	41	371
FR-12	140	68	35	284
FREEZE-12	140	67	33	282
AUTOFROST	140	70	32	278
Qwickboost	140	60	37	337

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-12	140	74	35	294
R-134A	140	*	*	*
FR-12	140	71	36	311
FREEZE-12	140	73	34	315
AUTOFROST	140	77	34	309
Qwickboost	140	65	39	376

*** Shut Down on High Pressure**

PARALLEL FLOW CONDENSER (Primary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	80	29	12	182
COOLTOP	80	35	20	202
Qwickboost	80	30	12	170
PAO Oil	80	32	14	231

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	80	37	20	234
COOLTOP	80	37	23	231
Qwickboost	80	33	15	198
PAO Oil	80	35	17	253

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure

PARALLEL FLOW CONDENSER (Primary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	100	39	22	219
COOLTOP	100	43	20	203
Qwickboost	100	39	16	177
PAO Oil	100	36	18	237

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	100	42	27	240
COOLTOP	100	44	26	237
Qwickboost	100	40	21	208
PAO Oil	100	40	21	271

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	100	45	30	273
COOLTOP	100	53	29	278
Qwickboost	100	43	24	256
PAO Oil	100	45	27	311

PARALLEL FLOW CONDENSER (Primary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	120	47	27	227
COOLTOP	120	53	20	202
Qwickboost	120	45	20	186
PAO Oil	120	43	25	246

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	120	49	30	258
COOLTOP	120	55	29	253
Qwickboost	120	46	26	220
PAO Oil	120	43	31	235

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure

PARALLEL FLOW CONDENSER (Primary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	140	52	31	234
COOLTOP	140	61	19	202
Qwickboost	140	50	29	202
PAO Oil	140	51	33	273

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	140	54	32	263
COOLTOP	140	64	30	255
Qwickboost	140	53	33	232
PAO Oil	140	53	36	307

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure

PARALLEL FLOW CONDENSER (Secondary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	80	34	15	166.7
ICE 32	80	33.9	15.1	175.1

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	80	36.3	17.2	198.9
ICE 32	80	36.4	16.6	204.9

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	80	37.9	21.7	231.5
ICE 32	80	37.7	18.5	236.4

PARALLEL FLOW CONDENSER (Secondary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	100	40.8	20.3	182.9
ICE 32	100	43.5	16.4	181.5

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	100	43.1	21.7	217.9
ICE 32	100	43.8	25	217.9

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	100	46.3	25.5	247.9
ICE 32	100	45.5	25.8	257.7

PARALLEL FLOW CONDENSER (Secondary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	120	48.4	29	207.4
ICE 32	120	48.8	26	207.4

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	120	50.4	29.3	230
ICE 32	120	51.2	29.6	225.5

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	120	51.7	30.5	260
ICE 32	120	52.9	32.2	267.3

PARALLEL FLOW CONDENSER (Secondary Test)

100 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	140	52.4	30	210.4
ICE 32	140	53.9	30.8	211

110 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	140	56	30.3	252.2
ICE 32	140	55.3	31.6	236.4

120 Degree Outside Ambient

Product	In-car Temp.	Vent Temp.	Low Side Pressure	High Side Pressure
R-134A	140	55.5	31.1	262.2
ICE 32	140	58.1	33.4	268.4