General Motors
2027 MY Common Section Document
Freedom Of Information Act (FOIA)

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(d)(1) Correspondance and Communication Information

MAILING INFORMATION

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(d)(3) Description of Applicable Evaporative / Refueling Families

(d)(3) Description of Applicable Evaporative / Refueling Families

This information is not finalized at the time of submission and has been intentionally excluded.

(d)(4) Durability (Procedure) Information

DESCRIPTION OF GENERAL MOTORS
EXHAUST EMISSIONS DURABILITY PROCESS

As required under the provisions of 40 CFR 1823-08, General Motors has provided EPA with detailed information regarding the procedures used by GM for developing aged exhaust emissions components for durability certification. This included a meeting with EPA on July 27, 2006 as well as materials submitted to EPA on December 14, 2006 responsive to EPA follow-up questions provided to GM on November 6, 2006. EPA provided GM with formal approval of these procedures in the document "Durability approval letter_GM_121906.pdf". As approved by EPA, the Alternate Durability Process (ADP) utilizes GM's internal validation programs and processes and is acceptable to CARB (reference CARB approval letter C-90-34). The ADP contains the following parts: 1) deterioration factor (DF) determination, 2) emission component/ system durability demonstration, and 3) in-use emission verification testing. The ADP is based on the assumption that engine-out emissions are stable over the useful life of the vehicle and that loss in exhaust emission performance is primarily due to thermal degradation of the catalytic converter.

EMISSION CONTROL SYSTEM/COMPONENT DURABILITY DEMONSTRATION:

General Motors demonstrates emission control system/component durability using any one or combination of methods: 1) laboratory (bench) testing of components and systems, 2) whole-vehicle road durability testing, 3) field performance data, and/or 4) other GM internal validation processes.

DF DETERMINATION:

The ADP durability vehicle is selected to represent the durability group based on expected worst-case emission deterioration as specified in 40 CFR 86.1822-01. The ADP vehicle accumulates 4,000 equivalent miles following either the appropriate GM durability driving schedule or the AMA driving schedule. The vehicle is emission tested at least three times to establish the low mileage emission performance levels. The vehicle is then operated according to the appropriate GM durability schedule and catalytic converter operating temperature profile data is obtained. The catalyst operating temperature data is used to determine the amount of bench aging (General Motors Aging Cycle (GMAC) or General Motors Burner Cycle (GMBC)) hours needed to age the catalyst to the high mileage point. As an option, catalyst temperature data that was gathered during development testing may be used to determine the amount of GMAC hours needed to age the catalyst to the high mileage point. The catalyst(s) is removed from the vehicle and bench-aged to the appropriate number of GMAC (or GMBC) hours. The bench-aged catalyst is reinstalled on the ADP vehicle. Optionally, catalysts that have been aged to at least 110% of the required GMAC (or GMBC) aging hours may be used for high-mileage testing in place of the original ADP catalysts. The oxygen sensors are removed from the vehicle and vehicle-aged or bench-aged oxygen sensors are installed on the ADP vehicle. The ADP vehicle is emission tested at least three times to establish the high mileage emission performance levels. According to an agreement between GM and CARB, the number of valid emission tests performed at the high mileage point will be the same as the number of valid tests performed at 4K. Additive emission constituent DF's are calculated in accordance with 40 CFR 86.1823-01(a)(3)(i).

EMISSION CONTROL SYSTEM/COMPONENT WHOLE-VEHICLE DURABILITY DEMONSTRATION:

The whole-vehicle durability used currently by General Motors for diesel engine equipped vehicles follows 40 CFR 86.1823-08. The EPA Standard Road Cycle (SRC) described in Appendix V to Part 86 is used for durability mileage accumulation. The durability vehicle is selected to represent the durability group based on expected worst-case emission deterioration as specified in 40 CFR 86.1822-01.

GENERAL MOTORS PROCESS FOR CREATING AND USING AGED COMPONENTS

IN-USE VERIFICATION:

The ADP includes an in-use verification test program. This program involves exhaust emission testing customer-owned vehicles as specified in 40 CFR 86.1845-04. In accordance with 40 CFR 86.1823-01(a)(3)(ii), GM intends to utilize aged components in certain situations to demonstrate compliance with exhaust emission standards.

Component Aging

Catalytic converter temperature data will be collected while a representative vehicle is being driven according to the appropriate GM durability driving schedule or EPA Standard Road Cycle (SRC). This data will be used to determine the minimum amount of General Motors Aging Cycle (GMAC) or General Motors Burner Cycle (GMBC) hours that a converter would have to endure in order for it to be representative of useful life. Converters that have been aged to at least the minimum amount of GMAC (or GMBC) hours will be used in emission data vehicle testing.

GM will also use oxygen sensors that have either been vehicle- or bench-aged to useful life.

Emission Data Vehicle Testing with Aged Components

Emission data vehicles will first be stabilized with the equivalent of 4000 miles of mileage accumulation. Exhaust and evaporative (if necessary) emission tests will be performed at 4K to demonstrate compliance with 4K exhaust emission standards and useful life evaporative standards. Subsequent to 4K testing, catalytic converters and O2 sensors that have been aged to represent useful life will be installed in the vehicle. The vehicle is then emission tested to demonstrate compliance to the intermediate and full useful life standards. If any emission values exceed the intermediate useful life standard, a catalyst that has been aged to the intermediate useful life point would be installed on the vehicle and the vehicle would be retested to demonstrate compliance with the intermediate useful life standards.

Battery electric emissions data vehicles will first be stabilized with 2000 miles of mileage accumulation, using the EPA approved Standard Road Cycle (SRC) or an approved Modified SRC. The vehicle and all range effecting components will be aged as a system. Energy Consumption and Range tests will be performed as per SAEJ1634 revision 2012 or revision 2017 beginning at 2K to demonstrate zero emissions performance.

Fuel Economy Vehicle Testing with Aged Components

GM may or may not use aged components when testing for fuel economy purposes. If it is not feasible to test fuel economy data vehicles with aged components, a deterioration factor (DF) will be calculated in order to determine whether a fuel economy test passes the emission standards. A DF will be created from the 4K and useful life testing performed on the emission data vehicle. This DF will be used for fuel economy purposes only.

DESCRIPTION OF GENERAL MOTORS EVAPORATIVE EMISSIONS, RUNNING LOSS AND ORVR DURABILITY PROCESS

Regulatory Requirement:

Evaporative and Running Loss Durability Process

EPA - Manufacturer develops process using good engineering judgment (40 CFR Subpart S 86.1824). For evaporative emission durability vehicles, all mileage accumulation must use gasoline that contains ethanol in the highest concentration allowed by law (generally 10%).

CARB - "California Evaporative Emission Standards and Test Procedures" (adopted August 5, 1999) requires:

1. a bench test (Part II A. 2.3)
2. evaporative emission testing of exhaust durability vehicles (Part II A. 2.4 (a)) - OR - if the bench test procedure includes on-road useful life deterioration of the evaporative test vehicle, an evaporative emission test only at the end of exhaust emission durability vehicle testing (Part II A. 2.4 (b)).

ORVR Durability Process

EPA and CARB - Manufacturer develops process using good engineering judgment (40 CFR Subpart S 86.1825).

Evaporative and Running Loss Durability Process:

General Motors uses a bench test process approved by CARB to demonstrate durability and establish deterioration factors (DF's) for our evaporative and running loss systems. This bench test procedure is described in Attachment A.

The additional CARB requirement to conduct evaporative DF testing on exhaust durability vehicles is not required since GM's evaporative bench test process includes on-road useful life deterioration of the bench test vehicle. Therefore, per CARB regulations (Part II A. 2.4 (b)), an evaporative test is only conducted at the end of exhaust durability testing. The test sequence is the EPA 2-day test. If the 2-day test result is less than or equal to the 3-day test standard, no further testing is required. If the 2-day result is greater than the 3-day standard but less than the 2-day standard, then a passing 3-day test must also be performed. This evaporative emission data is not used in the DF calculation. CARB has approved this test sequence in the past.

GM uses the CARB 3-day test procedure to generate evaporative and running loss DF data. The 3-day DF data is carried across to the 2-day test, as previously approved by CARB.

Evaporative and Running Loss Durability Process (continued):

GM has run all evaporative emission durability mileage accumulation using E10 fuel. Note the one exception was evaporative emission durability vehicle 48KP3141, which did not run its mileage with E10 fuel. Reference attachment E-1 for what was done to satisfy the ethanol requirement for this vehicle.

The above described evaporative and running loss bench test process has been approved by CARB for the pre-CAP 2000 model years (see the following summary of CARB approvals). The process remains the same for subsequent model years; therefore, a new CARB approval is not required per Part II A. 2.3 of the CARB evaporative emission regulations. EPA has also accepted it in the past by the issuance of a certificate of conformity.

SUMMARY OF CARB APPROVALS

MODEL YEAR	GM LETTER / DATE	CARB APPROVAL
1999	ML-XG005A / 7-31-97	08-04-97 (1)
	MLXG164 / 4-9-98	04-30-98 (1)
1998	ML-WG007A / 7-29-96	47-26-96 CARB ref. #C-96-053 (1)
	ML-WG030 / 12-9-96	12-12-96 CARB ref. #C-96-097 (1)
	ML-GM515 / 4-24-97	05-02-97 CARB ref. #C-97-034 (1)
	ML-WG103 / 5-29-97	06-24-97 CARB ref. #C-97-051 (1)
1997	ML-VG073 / 1-22-96	
	ML-VG135 / 4-9-96	
	ML-VG148 / 5-31-96	06-05-96 CARB ref. #C-96-041 (1)
1996	ML-TG038 / 12-5-94	
	ML-TG043 / 12-16-94	01-11-95 CARB ref. #C-94-058 (CARB letter)
	ML-TG113 / 6-28-95	07-13-95 (1)

(1) GM letter stamped, approved and signed by CARB representative

ORVR Durability Process:

General Motors also uses a bench test process to demonstrate durability and establish DF's for our ORVR systems. It is a manufacturer defined bench test process that is described at the end of Attachment B. This bench test process has been accepted by EPA and CARB since 1998 and remains the same for subsequent model years.

Miscellaneous Information:

GM will modify its durability process based on the results of in-use verification testing if it is deemed appropriate (40 CFR Subpart S 86.1845).

ATTACHMENT E-1

E-Mail Sent to EPA (note CARB also verbally approved during cert preview)

To: hart.frederick@epa.gov, healy.stephen@epa.gov
cc: bontekoe.eldert@epa.gov, Kevin Cullen/US/GM/GMC@GM, Randall C. Harvey/US/GM/GMC@GM
Subject: 2005 Tier2 Evap Durability - E10 Mileage Accumulation Fuel Issue

Thank you for meeting with Kevin Cullen and myself on 9/24/02. This memo documents the issue discussed.

Because of recent product plan changes; GM's 2005 Tier2 Evaporative phase-in has fallen below the 25% requirement. The additional product that needs to be added to cover the shortfall needs an evaporative DF. We recently completed an evap durability vehicle for CARB LEVII on a full size pickup truck. The DF from this vehicle could be used since it is representative but it did not run mileage with E10 fuel as required by Tier2 regulations.

Based on the provisions of 86.1824-01(a)(2)(v), GM proposed running additional mileage on the CARB LEVII durability vehicle with E10 fuel and periodically emission testing until evaporative emissions are stable (we estimate 2-3 months). The new stabilized emission level would be used to adjust the DF as required. It was pointed out that this plan is worst case because:

- the CARB LEVII durability vehicle was aged to 150K and Tier2 only requires 120K
- the 4K data is lower than it would have been if E10 fuel had been used for mileage, resulting in a higher DF

We also noted that this is a one time special case and all future evap durability programs for both EPA and CARB will accumulate mileage with E10 fuel. Based on good engineering judgment GM believes this plan is appropriate and will document the DF process in its application.

It is our understanding that EPA has no issues and agrees with this certification plan. If you have any questions or require additional input please contact me (248-685-6520).

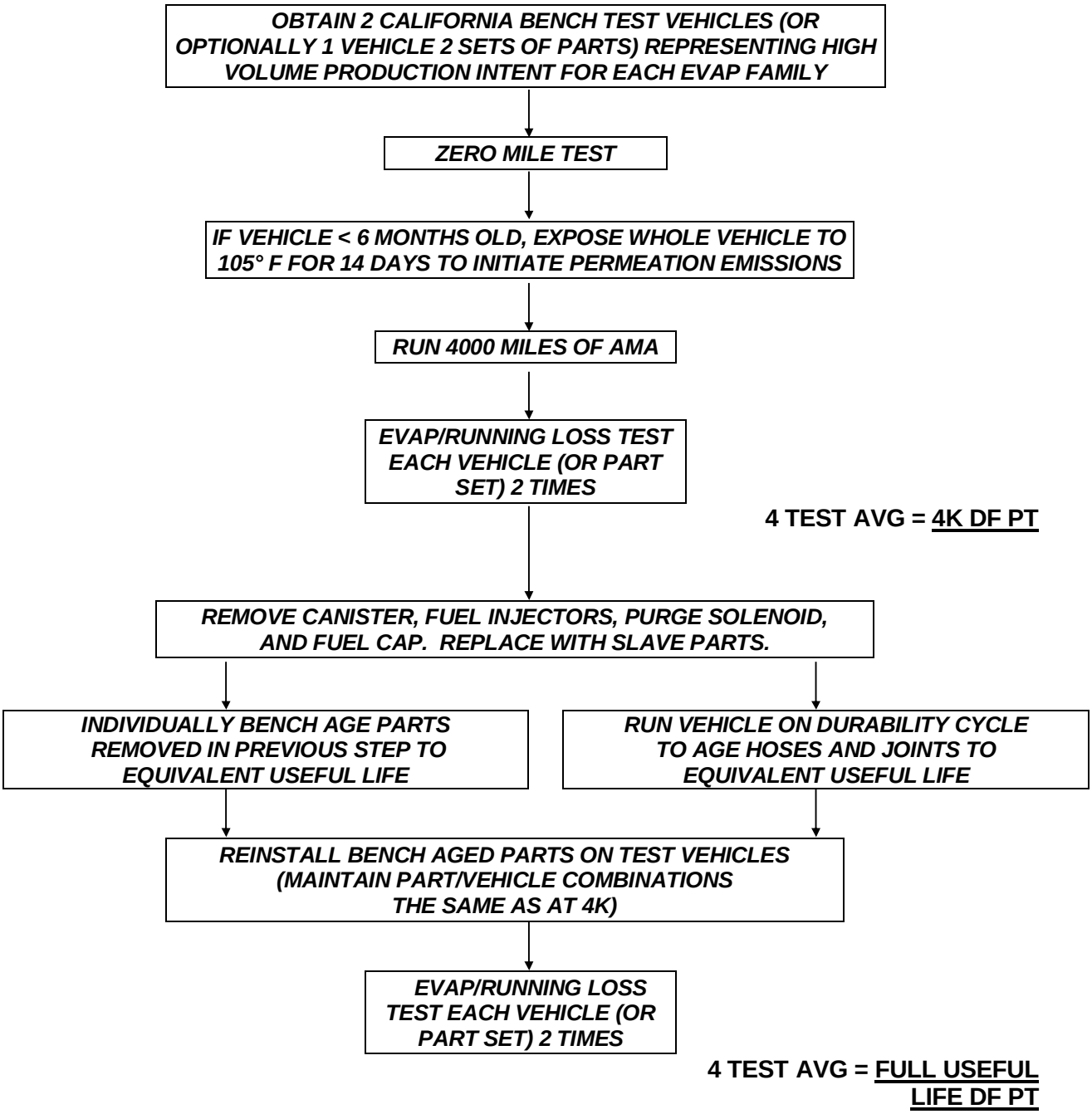
Sincerely,

Michael L Fedewa

ATTACHMENT A

EVAP AND RUNNING LOSS BENCH TEST FLOW CHART

PARTS TESTED: **Canister, Fuel Injectors, Purge Solenoid, Fuel Cap, Hoses & Joints**

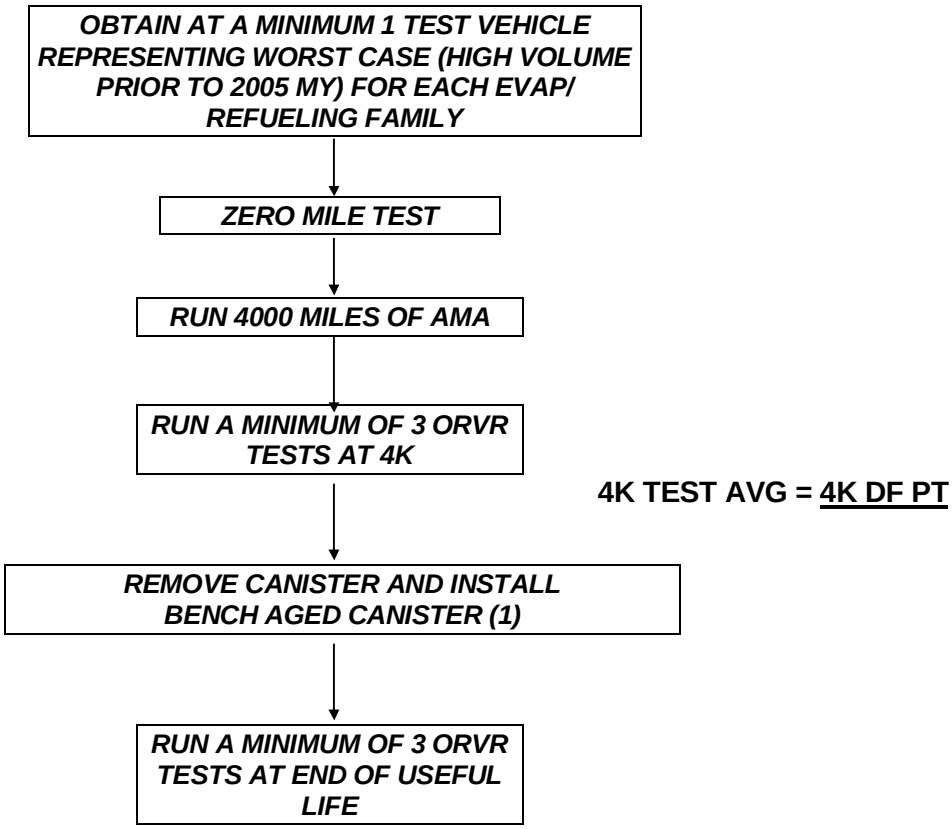


ADDITIVE DF = FULL USEFUL LIFE DF POINT MINUS 4K DF POINT (if <0 then 0)

DURABILITY DEMONSTRATED BY PASSING STANDARDS AT USEFUL LIFE TEST POINT

ATTACHMENT B

ORVR BENCH TEST FLOW CHART



(1) CANISTER IS BENCH AGED BY POURING LIQUID FUEL INTO CARBON BED UNTIL EPA CANISTER WORKING CAPACITY IS REDUCED TO A LEVEL THAT MATCHES THE LATEST IN-USE CANISTER PERFORMANCE.

DURABILITY DEMONSTRATED BY:

- **PASSING STANDARDS AT USEFUL LIFE TEST POINT AND**
- **IN-HOUSE ORVR SYSTEM VALIDATION**

ADDITIVE DF = FULL USEFUL LIFE DF POINT MINUS 4K DF POINT (if <0 then 0)

GENERAL MOTORS ASSIGNED DETERIORATION FACTORS

The General Motors process for generating manufacturer assigned deterioration factors (DF's) was developed under the guidelines of the CAP 2000 regulations. As allowed by 40 CFR 86.1822-01(a) and 86.1834-01(b)(2), manufacturer assigned DF's may be applied to test groups in lieu of exhaust or evaporative durability demonstration. Whole test groups may use the assigned DF provisions if the total aggregate Federal sales are less than 15,000 units. Title 13 of the California Administrative Code, California Exhaust Emission Standards and Test Procedures for 2000 and Subsequent Model Year Light Duty Vehicles, Light Duty Trucks and Medium Duty Vehicles, and the amended provisions G-12.1, which replaces Subpart S, Part 86, Title 40 CFR 86.1834-01, allows manufacturer assigned DF's for test groups which represent less than 4500 unit sales in California. Whole test groups may use the assigned DF provisions if the total aggregate California sales are less than 4500 units. The assigned DF's for a test group will be calculated using all of the DF's generated by vehicles in the same weight class and emission category as the test group the DF's represent. As required by 86.1822-01(b)(2)(i)(A), the DF's shall represent the average OR the 70th percentile (whichever is less), of all the DF's generated. In cases where the 70th percentile cannot be calculated, General Motors will use the average. Refer to the test group Part 1 Application information for the specific deterioration factor calculation.

(d)(8) Statements of Conformity

This information is not finalized at the time of submission and has been intentionally excluded.

(d)(12) Shift Schedule Cross Reference List

GM/EPA Shift Schedule Cross Reference List

GM Sched	EPA Sched	GM Sched	EPA Sched	GM Sched	EPA Sched	GM Sched	EPA Sched	GM Sched	EPA Sched	GM Sched	EPA Sched	GM Sched	EPA Sched	GM Sched	EPA Sched
	HWS	259	49	338	80	388	124	459	171	518	518	569	569	619	619
27	1	265	52	339	81	389	125	460	172	519	519	570	570	620	620
58	4	269	33	340	82	390	126	461	173	520	520	571	571	621	621
59	217	270	41	341	87	391	127	462	174	521	521	572	572	622	622
71	2	271	34	342	88	392	128	463	175	522	522	573	573	623	623
72	5	272	23	343	89	393	129	464	176	523	523	574	574	624	624
83	3	273	53	344	90	394	130	465	177	524	524	575	575	625	625
84	6	274	61	345	91	395	131	466	178	525	526	576	576	626	626
89	7	278	24	346	92	396	132	467	179	525	526	577	577	627	627
90	19	279	13	347	93	397	133	468	180	527	527	578	578	628	628
111	8	280	25	348	94	398	134	469	181	528	528	579	579	629	629
112	20	281	14	349	95	399	136	470	182	529	529	580	580	630	630
121	9	282	26	350	96	400	135	471	183	530	530	581	581	632	632
122	40	289	15	351	39	407	203	472	184	531	531	582	582	634	634
130	206	290	27	352	47	408	200	473	185	532	532	583	583	636	636
155	48	291	35	353	97	410	201	474	186	533	533	584	584	637	637
156	60	297	32	354	98	411	202	475	187	534	534	585	585	900	FT5
157	161	298	45	360	104	412	138	476	188	535	535	586	586	901	HW5
158	162	299	38	361	105	413	139	477	189	536	536	589	589		
177	49	300	46	362	106	414	140	478	190	537	537	590	590		
178	61	301	54	363	107	414 *2	428	479	191	538	538	591	591		
185	10	302	63	364	108	415	141	480	192	539	539	592	592		
187	11	303	55	365	109	417	417	481	193	540	540	593	593		
188	21	304	61	366	110	419	207	482	194	541	541	594	594		
193	12	308	28	367	111	419 1*	219	489	213	542	542	595	595		
194	22	310	60	368	112	420	216	490	214	543	543	596	596		
205	198	311	56	369	113	423	218	491	221	544	544	597	597		
208	199	312	61	370	114	424	220	492	222	545	545	598	598		
209	209	314	195	371	115	426	231	493	223	546	546	599	599		
212	205	317	57	372	116	437	151	494	224	547	547	600	600		
213	204	318	64	373	59	438	147	495	227	548	548	601	601		
214	210	319	58	374	66	439	148	496	228	549	549	602	602		
215	235	320	65	375	16	440	149	497	230	550	550	603	603		
216	208	321	83	376	29	441	150	498	498	551	551	604	604		
218	211	322	84	377	17	443	152	499	499	552	552	605	605		
220	215	323	85	378	30	445	154	502	502	554	554	606	606		
221	225	324	86	379	117	446	153	503	503	555	555	607	607		
222	226	329	69	380	118	447	155	507	507	556	556	608	608		
223	229	330	70	381	119	448	156	508	508	557	557	609	609		
227	50	331	71	382	120	449	157	509	509	558	558	610	610		
228	62	332	72	383	18	450	158	510	510	559	559	611	611		
229	50	333	73	384	31	451	159	511	511	561	561	612	612		
230	61	334	74	385	121	452	160	512	512	562	562	613	613		
241	170	335	75	386	122	453	165	513	513	563	563	614	614		
245	77	336	76	387	123	455	166	514	514	564	564	615	615		
246	78	337	79			456	167	515	515	565	565	616	616		
251	67					457	168	516	516	566	566	617	617		
252	68					458	169	517	517	567	567	618	618		

*1 Resubmitted

*2 This 414 is a US06. The old one is a HWFE.