COGCC PRESENTATION TO GARFIELD COUNTY COMMISSIONERS
108 8TH ST., RM 100, GLENWOOD SPGS, CO 81601
MONDAY, FEBRUARY 10, 2014

David Andrews
COGCC Engineering Supervisor

MAMM CREEK FIELD COGCC POLICY BACKGROUND

1. The Mamm Creek Field is defined in the Mamm Creek Field Notice to Operators as a 10-township area of approximately 360 square miles, located south of the town to Silt.
2. COGCC's drilling and completion requirements in this area are more stringent than COGCC statewide rules.
3. Additional regulations have been in place since 2004 when the first version of the Mamm Creek Field NTO was released.
4. The Mamm Creek NTO was revised in 2007, and in 2011 COGCC retained a consultant to study drilling and completion practices within the East Mamm Creek Area and to identify potential areas for improved standards.
5. The East Mamm Creek Area is located within the Mamm Creek Field, and it is an approximate 4 square mile irregular-shaped area
6. Drilling and completion regulatory requirement are even more stringent in the East Mamm Creek Area.
7. The 2011 study reported that the Mamm Creek Field NTO, along with operators' Standard Operating

Procedures (“SOP”), have resulted in improvements in drilling and cementing practices in the Mamm Creek Field Area.

8. The 2011 study offered recommendations that resulted in following list of COAs, which have since been applied to all permits within the East Mamm Creek.
9. This list of COAs was intended to standardize best management practices, clarify existing standards, and improve agency-operator communication in the East Mamm Creek Area.

EMCA DRILLING PERMIT
CONDITIONS OF APPROVAL

These COAs have been applied to 15 APDs to date, on three separate well pads (the A10E, F12E, and D11E Pads), 13 of the 15 permitted wells have been drilled and the 2 permits for the D11E Pad are still active. I will review COAs as they were applied to the F12E Pad permits.

1. COMPLIANCE WITH THE MOST CURRENT REVISION OF THE NORTHWEST COLORADO NOTIFICATION POLICY IS REQUIRED.
    a. This is a standard COA that is applied to help our field inspection and engineering staff stay aware of ongoing operations in northwest Colorado.

2. GARFIELD COUNTY RULISON FIELD NOTICE TO OPERATORS. **NOTE:** ALL NOTICES SHALL BE GIVEN VIA E-MAIL. SEE ATTACHED NOTICE
    a. This is another standard COA that is applied to all permits in Garfield Co. This policy requires more stringent surface casing setting depths compared to statewide rules to consider well control concerns. This policy also requires additional monitoring and reporting of lost circulation, well control events, water flows, and cement levels, which are not otherwise required by statewide rules.

3. NEW MAMM CREEK FIELD NOTICE TO OPERATORS APPLIES TO THIS WELL. **NOTE:** ALL NOTICES SHALL BE GIVEN VIA E-MAIL. SEE ATTACHED NOTICE
    a. This NTO was originally developed in 2004 after the West Divide Creek gas seep, and it has been applied to all permits to drill in the Mamm Creek Field Area since that time. The NTO was revised in 2007. The most significant requirements of the NTO include increased surface casing requirements (more stringent than COA 2), increased Bradenhead pressure monitoring and reporting, FIT requirements, and the requirement to submit a “request to complete” prior to stimulating a well.

4. THE PROPOSED SURFACE CASING IS MORE THAN 50' BELOW THE DEPTH OF THE DEEPEST WATER WELL WITHIN 1MILE OF THE SURFACE LOCATION WHEN CORRECTED FOR ELEVATION DIFFERENCES. THE DEEPEST WATER WELL WITHIN 1 MILE IS 450 FEET DEEP.
    a. This COA is also standard. It is a statement that COGCC staff has verified that all existing water wells are adequately protected by the approved surface casing setting depth.

5. SUBMIT PASON OR EQUIVALENT MUD LOG DATA FROM SURFACE TO TOTAL WELL DEPTH WITH THE REQUEST TO COMPLETE.
    a. Statewide, collection of mud log data by operators is common in production holes, but not surface holes. Mud logs provide information related to geologic layers and the amount of gas that enters the wellbore during drilling operations.

6. SUBMIT ALL ELECTRONIC DRILLING RECORDER DATA IN ADDITION TO A MUD/DRILLING LOG FROM SURFACE TO TOTAL DEPTH DRILLED FOR THE FIRST WELL DRILLED ON THIS PAD WITH THE FOLLOWING CURVATURE DATA: RATE OF PENETRATION (ROP), GAS, MUD VOLUME, TORQUE, DIFFERENTIAL PRESSURE AND WEIGHT ON BIT (WOB).
    a. This COA requires more specific and more in depth details on the mud log information for the first well drilled on the pad.

7. SUBMIT THE FOLLOWING OPEN-HOLE LOGS ON THE SURFACE HOLE FOR THE FIRST WELL DRILLED ON THIS PAD, VIA EMAIL TO COGCC WESTERN COLORADO ENGINEERING SUPERVISOR, WITHIN 24HS OF RUNNING AND WITH FORM 5: SPONTANEOUS POTENTIAL, GAMMA RAY, FORMATION DENSITY, COMPENSATED NEUTRON, AND RESISTIVITY (TRIPLE COMBO).
    a. Statewide, open-hole logs are common in production holes, but not surface holes. This requirement will provide information on the naturally occurring shallow gas bearing sand zones in the Mamm Creek Field. Many of these

zones exist at the same depths or shallower than water wells in the area.

8. SUBMIT THE FOLLOWING OPEN-HOLE LOGS ON THE PRODUCTION HOLE, FOR AT LEAST ONE WELL PER PAD (ON THE F12E, PREFERABLY ONE OF THE WELLS BEING DRILLED TO THE NORTHWEST OF THE PAD), FROM TOTAL WELL DEPTH TO SURFACE CASING SHOE WITH FORM 5: SPONTANEOUS POTENTIAL, GAMMA RAY, FORMATION DENSITY, COMPENSATED NEUTRON, AND RESISTIVITY (TRIPLE COMBO).
    a. Resistivity logs are required statewide by Rule 317.o. Operators in the Piceance Basin commonly run a standard triple combo open-hole logs or RST cased-hole logs to satisfy this rule requirement. These logs provide detailed information regarding geology and gas shows, and they allow an operator to make well design changes to the rest of the wells on the pad, if needed. This COA requires an open-hole log on the first well on a pad to adjust the cement program, if necessary on the first well, based on gas shows on the log.

9. 80% EXCESS CEMENT, OVER THE CALCULATED VOLUME REQUIRED TO FILL THE ENTIRE ANNULUS, IS REQUIRED TO BE PUMPED ON THE SURFACE CASING CEMENT JOB. SUBMIT CEMENT TICKETS AS AN ATTACHMENT TO THE REQUEST TO COMPLETE, FOR VERIFICATION OF CEMENT VOLUMES.
    a. Pumping excess cement in order to achieve the designed cement top is a common practice, but it is not required by rule statewide. Pumping 80% excess cement increases the chance of circulating cement to surface (100% success rate on A10E and F12E Pads), thereby reducing the potential for a top-out cement requirement. Rule 317.h. requires fully cemented surface casing strings statewide.

10. IF LOST CIRCULATION OF 20 BBL/HR OR MORE IS EXPERIENCED AT ANY TIME DURING THE DRILLING OF THIS WELL, OPERATOR SHALL STOP DRILLING, PUMP LOST CIRCULATION MATERIAL AS NEEDED.
    a. Minor lost circulation events (that can still be greater than 20bbl/hr) can often be overcome by pumping lost circulation material (LCM) while drilling ahead. Requiring the rig to stop drilling and pump LCM is a more conservative approach

because it eliminates the risk of opening up new lost circulation zones or gas zones before full circulation is regained. This requirement costs the operator rig time, and it is not required statewide.

11. IF LOST CIRCULATION OF 100+ BBLS WITHIN 24 HR OR MAJOR GAS (GAS OVER 1800 UNITS WHILE DRILLING) OCCURS AT A TRUE VERTICAL DEPTH LESS THAN 4200', OPERATOR SHALL NOTIFY COGCC'S WESTERN COLORADO ENGINEERING SUPERVISOR WITHIN 24 HOURS, AND PRIOR TO RUNNING CASING, TO DISCUSS THE OPTIONS FOR UTILIZING A DV TOOL ON PRODUCTION OR INTERMEDIATE CASING.
    a. This requires communication between COGCC engineering staff and the operator's engineering staff after a significant lost circulation zone or gas zone is encountered to ensure an appropriate casing/cementing design is used to address specific drilling challenges that were encountered in the well.

12. PRODUCTION CASING CEMENT TOP MUST BE 500’ ABOVE THE SHALLOWEST GAS SIGNATURE OBSERVED ON MUD LOGS OR OPEN-HOLE LOGS. THE SHALLOWEST GAS SIGNATURE, AS DEFINED BY 2500 UNITS, DEPTH SHALL BE REPORTED ON THE REQUEST TO COMPLETE.
    a. This COA provides a more conservative definition on the “shallowest gas signature” compared to COGCC’s policy requirements for this area. Top of Gas (TOG) is normally defined as the uppermost commercial gas-bearing zone. This COA requires cement coverage of gas zones that can contain less gas than is economic to produce.

13. SURFACE CASING SHALL BE SET A MINIMUM OF 50’ BELOW THE MOLINA MEMBER OF THE WASATCH FORMATION. THE MOLINA AND ATWELL GULCH MEMBERS OF THE WASATCH FORMATION TOPS SHALL BE REPORTED ON THE REQUEST TO COMPLETE.
    a. The fracture system within the Molina Member of the Wasatch Formation has been identified as the possible conduit that allowed gas to reach West Divide Creek in 2004, resulting in the West Divide Creek gas seep. Covering this formation

with the surface casing string and cement is intended to mitigate potential releases.

14. SUBMIT 48 HOUR NOTICES, VIA EMAIL, FOR RUNNING AND CEMENTING ALL CASING STRINGS AND PERFORMING A WELL CONTROL DRILL TO COGCC'S GARFIELD COUNTY FIELD INSPECTOR, COGCC'S NORTHWEST AREA FIELD INSPECTION SUPERVISOR, AND COGCC'S WESTERN COLORADO ENGINEERING SUPERVISOR. CONTACT INFORMATION FOR NOTICES CAN BE FOUND ON COGCC'S CURRENT NOTIFICATION POLICY.
    a. Receiving notice of drilling, casing, and cementing operations 48 hours in advance (more notice than is regularly required) gives COGCC staff more opportunity to perform inspections of the well site during key stages of the operations. COGCC staff used this advanced notice to witness many of the casing, cementing, and pressure testing activities on the A10E and F12E Pads.

15. FRESH WATER DRILLING MUD MUST BE UTILIZED DURING THE DRILLING OF THE SURFACE CASING INTERVAL, AS OPPOSED TO WATER ONLY. MUD THAT HAS BEEN USED TO DRILL A PRODUCTION INTERVAL MAY NOT BE REUSED TO DRILL ANOTHER SURFACE INTERVAL.

    a. This COA requires the operator to use only fresh water to make up the mud for drilling the surface interval (not produced water or re-used mud from a production hole). The COA also requires that the operator make up a true drilling mud (mud that is designed for hole cleaning, well control, and proper filter cake properties), rather than using only water for the surface intervals, which is common practice in some areas of the state.

16. CENTRALIZER SYSTEMS MUST BE DESIGNED TO ACHIEVE A MINIMUM OF 50% STANDOFF ON ALL CASING STRINGS. REPORT CENTRALIZER PLACEMENT AND CALCULATED STANDOFF ON THE REQUEST TO COMPLETE.

    a. Centralizers are used to hold the steel casing string in the center of a wellbore so a cement sheath can be formed 360 degrees around the casing string for proper isolation. Without sufficient centralization, especially in deviated

wellbores, casing can press right up against the formation, which allows the potential for cement gaps and channels in the annulus between the casing and the wellbore.

17. RUN A CEMENT EVALUATION TOOL ON ALL CASING STRINGS, BEFORE DRILL OUT OF EACH SHOE, FROM FLOAT COLLAR TO SURFACE. TIMING OF THE LOGS SHALL BE BASED ON COMPRESSIVE STRENGTH TESTS OF SLURRIES PROVIDED BY CEMENT SERVICE PROVIDER. ALL LOGS SHALL BE PROVIDED WITH THE REQUEST TO COMPLETE
    a. A Cement Bond Log (CBL) is a tool used to evaluate the placement of cement, as well as the casing to cement bond quality and the cement to formation bond quality. CBL's are required on all production casing stings state wide (Rule 317.o.). This COA also requires a CBL to be run on surface casings and intermediate casings, if used. Surface casing CBL's are not required by rule and are not a common practice statewide.

18. UTILIZE INTERMEDIATE CASING IF THE FORMATION INTEGRITY TEST FAILS OR IF THE SURFACE CASING REQUIRES PERFORATION AND CEMENT SQUEEZING.
    a. This is a further specification to an existing requirement in the Mamm Creek Field Notice to Operators (COA 3). This requirement is more stringent by requiring intermediate casing in the event that remedial cement work is needed on the surface casing in order to achieve a full column of cement.

19. SUBMIT DAILY DRILLING REPORTS TO COGCC WITH THE REQUEST TO COMPLETE.
    a. This is not common reporting practice, and it is not required by rule or policy. It gives COGCC Engineering Staff the opportunity to review the rig notes of all drilling operations on the well prior to giving the operator authorization to stimulate the well.

20. SUBMIT DAILY WELL STIMULATION REPORTS TO COGCC WITH THE FORM 5 DRILLING COMPLETION REPORT.
    a. This is not common reporting practice, and it is not required by rule or policy. This gives COGCC Staff the opportunity to review the rig notes of all

stimulation operations when they have been completed.

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David Andrews
COGCC Engineering Supervisor

Conditions of Approval
F12E PAD, Mamm Creek Field

Well	Spud	#1 NW Notification	#2 GARCO Rulison Notice	#3 Mamm Creek Notice	#4 Surf Csg > 50'	#5 Pason Surf-TD
Twin Creek 12-5A1 (R12E) RTC (045-20390)	01/27/2012	Verbal, HF	N/A	Yes - RTC	1149	Yes
Twin Creek 12-3D1 (F12E) RTC (045-20386)	01/20/2012	Verbal, HF	N/A	Yes - RTC	1149	Yes
Twin Creek 12-5D1 (F12E) RTC (045-20388)	01/29/2012	Verbal, HF	N/A	Yes - RTC	1149	Yes
Twin Creek 12-6D1 (F12E) RTC (045-20393)	01/15/2012	Verbal, HF	N/A	Yes - RTC	1148	Yes
Twin Creek 12-6C1 (F12E) RTC (045-20391)	01/22/2012	Verbal, HF	N/A	Yes - RTC	1149	Yes
Twin Creek 12-4D1 (F12E) RTC (045-20387)	01/25/2012	Verbal, HF	N/A	Yes - RTC	1149	Yes
Twin Creek 12-3D2 (F12E) RTC (045-20392)	01/21/2012	Verbal, HF	N/A	Yes - RTC	1149	Yes
Twin Creek 12-4A1 (F12E) RTC (045-20389)	01/24/2012	Verbal, HF	N/A	Yes - RTC	1149	Yes
Twin Creek 12-6A1 (F12E) RTC (045-20394)	01/18/2012	Verbal, HF	N/A	Yes - RTC	1148	Yes
Twin Creek 12-5A2 (F12E) RTC (045-20385)	01/26/2012	Verbal, HF	N/A	Yes - RTC	1170	Yes
COMMENTS/RANGE OF VALUES =>	Jan 2012	Verbal, HF	N/A	Yes - RTC	1148' - 1170'	Yes

Notes: HF = Hydraulic Fracture Treatment, N/A = does not apply, Yes = received by COGCC, RTC = Request to Complete, OH = open-hole, RST = reservoir saturation tool, bbl circ = barrels of cement circulated to surface, DOR = included on operator Daily Operations Report, MD = measured depth, TVD = total vertical depth, gu = gas units, TOG = top of gas, TOC = top of cement, FIT = formation integrity test

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Well	Spud	#6 Mud Log Surf-TD	#7 Surf Hole Logs	#8 Prod OH Logs	#9 Surf Csg Cmt 80% excess	#10 20 bbls lost
Twin Creek 12-5A1 (R12E) RTC (045-20390)	01/27/2012	Yes	CBL	RST	Yes, 30 bbl circ	DOR
Twin Creek 12-3D1 (F12E) RTC (045-20386)	01/20/2012		CBL	RST	Yes, 30 bbl circ	DOR
Twin Creek 12-5D1 (F12E) RTC (045-20388)	01/29/2012	Yes	CBL	OH and RST	Yes, 40 bbl circ	DOR
Twin Creek 12-6D1 (F12E) RTC (045-20393)	01/15/2012		OH, CBL	RST	Yes, 20 bbl circ	DOR
Twin Creek 12-6C1 (F12E) RTC (045-20391)	01/22/2012		CBL	RST	Yes, 39 bbl circ	DOR
Twin Creek 12-4D1 (F12E) RTC (045-20387)	01/25/2012		CBL	RST	Yes, 35 bbl circ	DOR
Twin Creek 12-3D2 (F12E) RTC (045-20392)	01/21/2012		CBL	RST	Yes, 31 bbl circ	DOR
Twin Creek 12-4A1 (F12E) RTC (045-20389)	01/24/2012		CBL	RST	Yes, 25 bbl circ	DOR
Twin Creek 12-6A1 (F12E) RTC (045-20394)	01/18/2012		CBL	RST	Yes, 35 bbl circ	DOR
Twin Creek 12-5A2 (F12E) RTC (045-20385)	01/26/2012		CBL	RST	Yes, 35 bbl circ	DOR
COMMENTS/RANGE OF VALUES =>	Jan 2012	12-5D1	12-6D1	12-5D1	20-40 bbls cmt circ	DOR

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F12E PAD, Mamm Creek Field

Well	Spud	#11 Intm Csg 100 bbls lost 1800 units
Twin Creek 12-5A1 (R12E) RTC (045-20390)	01/27/2012	
Twin Creek 12-3D1 (F12E) RTC (045-20386)	01/20/2012	DV tool added
Twin Creek 12-5D1 (F12E) RTC (045-20388)	01/29/2012	
Twin Creek 12-6D1 (F12E) RTC (045-20393)	01/15/2012	7" Int added (4365' MD) for well control
Twin Creek 12-6C1 (F12E) RTC (045-20391)	01/22/2012	7" Int added (4537' MD) for well control
Twin Creek 12-4D1 (F12E) RTC (045-20387)	01/25/2012	DV tool added
Twin Creek 12-3D2 (F12E) RTC (045-20392)	01/21/2012	
Twin Creek 12-4A1 (F12E) RTC (045-20389)	01/24/2012	
Twin Creek 12-6A1 (F12E) RTC (045-20394)	01/18/2012	7" Int added (4420' MD) for well control
Twin Creek 12-5A2 (F12E) RTC (045-20385)	01/26/2012	
COMMENTS/RANGE OF VALUES =>	Jan 2012	Changes b/c of losses below 4200'

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Well	Spud	#12 T/Cmt 500' above 2500 U gas
Twin Creek 12-5A1 (R12E) RTC (045-20390)	01/27/2012	N/A (2500 gu)/ 3965' TOG, (3) Well Control 3899' TVD and below, 2405' MVRD, 1400' TOC
Twin Creek 12-3D1 (F12E) RTC (045-20386)	01/20/2012	5523' (2500 gu)/4265' TOG, 3007' DV (100 sx sqz), 2749' MVRD, 3976'/1200' TOC
Twin Creek 12-5D1 (F12E) RTC (045-20388)	01/29/2012	N/A (2500 gu)/3758' TOG, 2355' MVRD, 750' TOC
Twin Creek 12-6D1 (F12E) RTC (045-20393)	01/15/2012	N/A (2500 gu)/ 3795' TOG, 2309' MVRD, 3080' PC/1150' IC TOC
Twin Creek 12-6C1 (F12E) RTC (045-20391)	01/22/2012	N/A (2500 gu)/3690' TOG, (4) Well Control 3271' TVD and below, 2262' MVRD, 2720' PC/2190' IC TOC
Twin Creek 12-4D1 (F12E) RTC (045-20387)	01/25/2012	4133' (2500 gu)/4208' TOG, 2977' DV, 2754' MVRD, 3310'/1180' TOC
Twin Creek 12-3D2 (F12E) RTC (045-20392)	01/21/2012	3984' (2500 gu)/4088' TOG, 2630' MVRD, 2160' TOC
Twin Creek 12-4A1 (F12E) RTC (045-20389)	01/24/2012	N/A (2500 gu)/4601' TOG, 4180' TOC, 3194' MVRD
Twin Creek 12-6A1 (F12E) RTC (045-20394)	01/18/2012	3866' (2500 gu)/3881' TOG, (1) Well Control at 3686' TVD, 2557' MVRD, 4120' PC/1370' IC TOC
Twin Creek 12-5A2 (F12E) RTC (045-20385)	01/26/2012	3940' (2500 gu)/3946' TOG, 2501' MVRD, 2180' TOC
COMMENTS/RANGE OF VALUES =>	Jan 2012	5/10 above 2500 gu (all WMFK), (3) wells with Form 23s, 9/10 Cmt above MVRD top

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Well	Spud	#13 50' Molina/Atwell Gulch	#14 48 hr Notice Csg/Cmt	#15 Fresh Wtr Mud	#16 50 % Standoff	#17 CBL All Csgs
Twin Creek 12-5A1 (R12E) RTC (045-20390)	01/27/2012	Compliant - 546' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-3D1 (F12E) RTC (045-20386)	01/20/2012	Compliant - 601' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-5D1 (F12E) RTC (045-20388)	01/29/2012	Compliant - 514' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-6D1 (F12E) RTC (045-20393)	01/15/2012	Compliant - 527' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-6C1 (F12E) RTC (045-20391)	01/22/2012	Compliant - 464' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-4D1 (F12E) RTC (045-20387)	01/25/2012	Compliant - 601' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-3D2 (F12E) RTC (045-20392)	01/21/2012	Compliant - 601' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-4A1 (F12E) RTC (045-20389)	01/24/2012	Compliant - 684' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-6A1 (F12E) RTC (045-20394)	01/18/2012	Compliant - 557' AG	Verbal	DOR	Yes	Yes
Twin Creek 12-5A2 (F12E) RTC (045-20385)	01/26/2012	Compliant - 590' AG	Verbal	DOR	Yes	Yes
COMMENTS/RANGE OF VALUES =>	Jan 2012	AG top 514' to 684'	Verbal	DOR	Yes	Yes

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Well	Spud	#18 Intm Csg FIT Surf Perf Sqz	#19 Drill Rpts	#20 Da Compl Rpts Form 5
Twin Creek 12-5A1 (R12E) RTC (045-20390)	01/27/2012	FIT passed	Yes	5A
Twin Creek 12-3D1 (F12E) RTC (045-20386)	01/20/2012	FIT passed	Yes	5A
Twin Creek 12-5D1 (F12E) RTC (045-20388)	01/29/2012	FIT passed	Yes	5A
Twin Creek 12-6D1 (F12E) RTC (045-20393)	01/15/2012	FIT passed	Yes	5A
Twin Creek 12-6C1 (F12E) RTC (045-20391)	01/22/2012	FIT passed	Yes	5A
Twin Creek 12-4D1 (F12E) RTC (045-20387)	01/25/2012	FIT passed	Yes	5A
Twin Creek 12-3D2 (F12E) RTC (045-20392)	01/21/2012	FIT passed	Yes	5A
Twin Creek 12-4A1 (F12E) RTC (045-20389)	01/24/2012	FIT passed	Yes	5A
Twin Creek 12-6A1 (F12E) RTC (045-20394)	01/18/2012	FIT passed	Yes	5A
Twin Creek 12-5A2 (F12E) RTC (045-20385)	01/26/2012	FIT passed	Yes	5A
COMMENTS/RANGE OF VALUES =>	Jan 2012	FIT passed all	Yes	5A

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