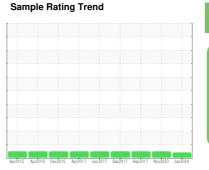


## **OIL ANALYSIS REPORT**





VISCOSITY

Component Diesel Engine Fluid

DE Samples - CAT LAB

TULCO LUBSOIL DT CI-4 15W40 (--- GAL)

CATERPILLAR 990 LOADER G 6427 (S/N BCR00127)

Sample Number     Client Info     TO10003073     TO10002879     Z01002203     28 Sep 201       Machine Age     hrs     Client Info     48390     48135     37588     0       Dil Changed     Client Info     255     586     0     NoRMAL     NORMAL	I-4 15W40 ( G	AL)	AprZ015 Ap	2016 Dec2016 Apr2017	Jun2017 Sep2017 Sep2017 Nov20	123 Jan2024	
Sample Date     Client Into     06 Jan 2024     13 Nov 2023     29 Sep 201       Machine Age     hrs     Client Info     48390     48135     37588       Dil Age     hrs     Client Info     255     586     0       Oli Changed     Client Info     Not Changed     Changed     Changed     Changed     NoRMAL       CONTAMINATION     method     imit/base     current     history1     history1       Water     WC Method     >0.2     NEG     NEG     NEG       WEAR METALS     method     limit/base     current     history1     history1       ron     ppm     ASTM05185m     >20     0     <1     <1       Silver     ppm     ASTM05185m     >2     0     0     0       Silver     ppm     ASTM05185m     >2     0     0     0     0       Silver     ppm     ASTM05185m     >2     0     0     0     0     0     0     0     0     0     0     0	SAMPLE INFORM	IATION	method	limit/base	current	history1	history2
Machine Age     hrs     Client Info     48390     48135     37588       Dil Age     hrs     Client Info     255     556     0       Dil Age     hrs     Client Info     Not Changed     Changed     Changed       Sample Status     Imit/base     current     History1     History1     History1       Water     WC Method     >0.2     NEG     NEG     NEG       Wear     WC Method     >0.2     NEG     NEG     NEG       Wear     WC Method     >0.2     NEG     NEG     NEG       Wear     ppm     ASTM 05165m     >20     0     0     0       Vickel     ppm     ASTM 05165m     >2     0     0     0       Silver     ppm     ASTM 05165m     >2     0     0     0       Copper     ppm     ASTM 05165m     >2     0     0     0       Adminum     ppm     ASTM 05165m     2     0     0     0       Vanadium     ppm	Sample Number		Client Info		TO10003073	TO10002879	TO1006276
Dil Age hrs Client Info 255 586 0   Dil Changed Client Info Not Changed	Sample Date		Client Info		08 Jan 2024	13 Nov 2023	29 Sep 2017
Dil Changed Client Info Not Changed ATTENTION Changed NORMAL Changed NORMAL   CONTAMINATION method limit/base current history1 history1   Water WC Method >0.2 NEG NEG NEG   Silycol WC Method >0.2 NEG NEG NEG   WEAR METALS method limit/base current history1 history1   ron ppm ASTM 05185m >20 0 <1	Machine Age	hrs	Client Info		48390	48135	
Dil Changed Client Info Not Changed ATTENTION Changed NORMAL Changed NORMAL   CONTAMINATION method limit/base current history1 history1   Water WC Method >0.2 NEG NEG NEG   Silycol WC Method >0.2 NEG NEG NEG   WEAR METALS method limit/base current history1 history1   ron ppm ASTM 05185m >20 0 <1	Oil Age	hrs	Client Info		255	586	0
CONTAMINATION     method     limit/base     current     history1     history2       Water     WC Method     >0.2     NEG     NEG     NEG       Silycol     WC Method     >0.2     NEG     NEG     NEG       WCAR METALS     method     limit/base     current     history1     history1       ron     ppm     ASTM D5185m     >20     0     <1	Oil Changed				Not Changd	Changed	Changed
Water     WC Method     >0.2     NEG     NEG     NEG       Silycol     WC Method     NEG     NEG     NEG     NEG       WEAR METALS     method     limit/base     current     historyt     historyt       ron     ppm     ASTM D5185m     >100     15     58     8       Chromium     ppm     ASTM D5185m     >20     0     <1	Sample Status				-	NORMAL	NORMAL
Salycol     WC Method     NEG     NEG     NEG       WEAR METALS     method     limit/base     current     history1     history1       ron     ppm     ASTM D5185m     >20     0     <1	CONTAMINATION	N	method	limit/base	current	history1	history2
WEAR METALS     method     limit/base     current     history1     history2       ron     ppm     ASTM D5185m     >20     0     <1	Water		WC Method	>0.2	NEG	NEG	NEG
ron     ppm     ASTM D5185m     >100     15     58     8       Chromium     ppm     ASTM D5185m     >20     0     <1	Glycol		WC Method		NEG	NEG	NEG
Dromium     ppm     ASTM D5185m     >20     0     <1     <1       Nickel     ppm     ASTM D5185m     >2     0     0     0       Silver     ppm     ASTM D5185m     >2     0     0     0       Aluminum     ppm     ASTM D5185m     >2     0     0     0       Aluminum     ppm     ASTM D5185m     >2     0     0     0       Lead     ppm     ASTM D5185m     >2     0     0     0       Copper     ppm     ASTM D5185m     >330     2     1     <1	WEAR METALS		method	limit/base	current	history1	history2
Nickel     ppm     ASTM D5185m     >2     0     0     0       Titanium     ppm     ASTM D5185m     >2     0     0     0       Silver     ppm     ASTM D5185m     >2     0     0     0       Aluminum     ppm     ASTM D5185m     >25     1     1     <1	Iron	ppm	ASTM D5185m	>100	15	58	8
Titanium     ppm     ASTM D5185m     >2     0     0     0       Silver     ppm     ASTM D5185m     >2     0     0     0       Aluminum     ppm     ASTM D5185m     >25     1     1     <1	Chromium	ppm	ASTM D5185m	>20	0	<1	<1
Silver     ppm     ASTM D5185m     >2     0     0     0       Aluminum     ppm     ASTM D5185m     >25     1     1     <1	Nickel	ppm	ASTM D5185m	>2	0	0	0
Aluminum     ppm     ASTM D5185m     >25     1     1     <1     <1       Lead     ppm     ASTM D5185m     >40     0     0     0       Copper     ppm     ASTM D5185m     >330     2     1     <1	Titanium	ppm	ASTM D5185m	>2	0	0	0
Lead     ppm     ASTM D5185m     >40     0     0     0       Copper     ppm     ASTM D5185m     >330     2     1     <1	Silver	ppm	ASTM D5185m	>2	0	0	0
Copper     ppm     ASTM D5185m     >330     2     1     <1       Tin     ppm     ASTM D5185m     >15     0     0     7       Antimony     ppm     ASTM D5185m       0     0       Vanadium     ppm     ASTM D5185m     0     0     0     0       Cadmium     ppm     ASTM D5185m     0     0     0     0       ADDITIVES     method     limit/base     current     history1     history1       Boron     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     65     63     64       Maganese     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     1133     1158     1073       Phosphorus     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     22     3     2     2       Sodium     ppm	Aluminum	ppm	ASTM D5185m	>25	1	1	<1
Tin     ppm     ASTM D5185m     >15     0     0     7       Antimony     ppm     ASTM D5185m       0       Vanadium     ppm     ASTM D5185m     0     0     0     0       Cadmium     ppm     ASTM D5185m     0     0     0     0       ADDITIVES     method     limit/base     current     history1     history1       Boron     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     9     0     0     0       Manganese     ppm     ASTM D5185m     967     935     939     1007       Zinc     ppm     ASTM D5185m     1113     1079     1007       Zinc     ppm     ASTM D5185m     1132     1294     1203       Sulfur     ppm     ASTM D5185m     25     2     3     2       Solicon     ppm	Lead	ppm	ASTM D5185m	>40	0	0	0
Tin     ppm     ASTM D5185m     >15     0     0     7       Antimony     ppm     ASTM D5185m       0       Vanadium     ppm     ASTM D5185m     0     0     0     0       Cadmium     ppm     ASTM D5185m     0     0     0     0       ADDITIVES     method     limit/base     current     history1     history1       Boron     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     9     0     0     0       Manganese     ppm     ASTM D5185m     967     935     939     1007       Zinc     ppm     ASTM D5185m     1113     1079     1007       Zinc     ppm     ASTM D5185m     1132     1294     1203       Sulfur     ppm     ASTM D5185m     25     2     3     2       Solicon     ppm	Copper	ppm	ASTM D5185m	>330	2	1	<1
Antimony     ppm     ASTM D5185m       0       Vanadium     ppm     ASTM D5185m     0     0     0     0       Cadmium     ppm     ASTM D5185m     0     0     0     0       ADDITIVES     method     limit/base     current     history1     history1       Boron     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     0     0     0       Manganese     ppm     ASTM D5185m     65     63     64       Magnesium     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     11133     1158     1073       Phosphorus     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     22     3     2       Sodium     ppm     ASTM D5185m     22     3     2       Sodium     ppm     ASTM D5185m     20     0	Tin				0	0	7
Vanadium     ppm     ASTM D5185m     0     0     0       Cadmium     ppm     ASTM D5185m     0     0     0       ADDITIVES     method     limit/base     current     history1     history2       Boron     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     0     0     0       Manganese     ppm     ASTM D5185m     655     633     64       Magnesium     ppm     ASTM D5185m     967     9355     939       Calcium     ppm     ASTM D5185m     91133     1158     1073       Phosphorus     ppm     ASTM D5185m     1133     1079     1007       Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history2       Solicon     ppm     ASTM D5185m     >20     0	Antimony		ASTM D5185m				0
Cadmium     ppm     ASTM D5185m     0     0     0       ADDITIVES     method     limit/base     current     history1     history2       Boron     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     0     0     0       Maganese     ppm     ASTM D5185m     655     63     64       Magnesium     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     11133     1178     1073       Phosphorus     ppm     ASTM D5185m     1113     1079     1007       Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     25     2     3     2       Solicon     ppm     ASTM D5185m     >20     0     0     <1       Solicon     ppm     ASTM D5185m     20     0.1 </td <td>Vanadium</td> <td></td> <td></td> <td></td> <td>0</td> <td>0</td> <td>0</td>	Vanadium				0	0	0
Boron     ppm     ASTM D5185m     4     14     15       Barium     ppm     ASTM D5185m     0     0     0     0       Molybdenum     ppm     ASTM D5185m     65     63     64       Manganese     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     9133     1158     1073       Phosphorus     ppm     ASTM D5185m     1133     1079     1007       Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history2       Silicon     ppm     ASTM D5185m     >25     2     3     2     2       Sodium     ppm     ASTM D5185m     >20     0     0     <1	Cadmium				0	0	0
Barium     ppm     ASTM D5185m     0     0     0       Molybdenum     ppm     ASTM D5185m     65     63     64       Manganese     ppm     ASTM D5185m     c1     <1	ADDITIVES		method	limit/base	current	history1	history2
Molybdenum     ppm     ASTM D5185m     65     63     64       Manganese     ppm     ASTM D5185m     <1	Boron	ppm	ASTM D5185m		4	14	15
Maganese     ppm     ASTM D5185m     <1     <1     <1     <1       Magnesium     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     1133     1158     1073       Phosphorus     ppm     ASTM D5185m     1113     1079     1007       Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history2       Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >20     0     0     <1	Barium	ppm	ASTM D5185m		0	0	0
Manganese     ppm     ASTM D5185m     <1     <1     <1     <1       Magnesium     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     1133     1158     1073       Phosphorus     ppm     ASTM D5185m     1113     1079     1007       Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history2       Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >20     0     0     <11	Molybdenum	ppm	ASTM D5185m		65	63	64
Magnesium     ppm     ASTM D5185m     967     935     939       Calcium     ppm     ASTM D5185m     11133     1158     1073       Phosphorus     ppm     ASTM D5185m     11133     1079     1007       Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history2       Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >20     0     0     <10	Manganese	ppm	ASTM D5185m		<1	<1	<1
Phosphorus     ppm     ASTM D5185m     1113     1079     1007       Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history2       Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >20     0     2     2       Potassium     ppm     ASTM D5185m     >20     0     0     <10     <10       Fuel     %     ASTM D5185m     >20     0     0     <10       INFRA-RED     method     limit/base     current     history1     history2       Soot %     %     *ASTM D7844     >3     0.3     0.9     0.3       Sulfation     Abs/cm     *ASTM D7624     >20     6.3     8.0	Magnesium		ASTM D5185m		967	935	939
Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history1       Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >20     0     2     2       Potassium     ppm     ASTM D5185m     >20     0     0     <11	Calcium	ppm	ASTM D5185m		1133	1158	1073
Zinc     ppm     ASTM D5185m     1322     1294     1203       Sulfur     ppm     ASTM D5185m     3405     3170     3160       CONTAMINANTS     method     limit/base     current     history1     history2       Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >20     0     2     2       Potassium     ppm     ASTM D5185m     >20     0     0     <1	Phosphorus	ppm	ASTM D5185m		1113	1079	1007
CONTAMINANTS     method     limit/base     current     history1     history2       Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     >20     0     2     2       Potassium     ppm     ASTM D5185m     >20     0     0     <1	Zinc	ppm	ASTM D5185m		1322	1294	1203
Silicon     ppm     ASTM D5185m     >25     2     3     2       Sodium     ppm     ASTM D5185m     0     2     2       Potassium     ppm     ASTM D5185m     >20     0     0     <1	Sulfur	ppm	ASTM D5185m		3405	3170	3160
Sodium     ppm     ASTM D5185m     0     2     2       Potassium     ppm     ASTM D5185m     >20     0     0     <1	CONTAMINANTS		method	limit/base	current	history1	history2
Potassium     ppm     ASTM D5185m     >20     0     0     <1       Fuel     %     ASTM D3524     >5     0.1     <1.0     <1.0       INFRA-RED     method     limit/base     current     history1     history2       Soot %     %     *ASTM D7844     >3     0.3     0.9     0.3       Nitration     Abs/cm     *ASTM D7844     >20     6.3     8.0     5.       Sulfation     Abs/.1mm     *ASTM D7415     >30     19.1     21.3     17.       FLUID DEGRADATION     method     limit/base     current     history1     history2       Oxidation     Abs/.1mm     *ASTM D7414     >25     14.2     15.6     11.	Silicon	ppm	ASTM D5185m	>25	2	3	2
Fuel     %     ASTM D3524     >5     0.1     <1.0     <1.0       INFRA-RED     method     limit/base     current     history1     history1       Soot %     %     *ASTM D7844     >3     0.3     0.9     0.3       Nitration     Abs/cm     *ASTM D7624     >20     6.3     8.0     5.       Sulfation     Abs/.1mm     *ASTM D7415     >30     19.1     21.3     17.       FLUID DEGRADATION     method     limit/base     current     history1     history2       Oxidation     Abs/.1mm     *ASTM D7414     >25     14.2     15.6     11.	Sodium	ppm	ASTM D5185m		0	2	2
INFRA-RED     method     limit/base     current     history1     history2       Soot %     %     *ASTM D7844     >3     0.3     0.9     0.3       Nitration     Abs/cm     *ASTM D7624     >20     6.3     8.0     5.       Soulfation     Abs/lmm     *ASTM D7615     >30     19.1     21.3     17.       FLUID DEGRADATION     method     limit/base     current     history1     history2       Oxidation     Abs/lmm     *ASTM D7414     >25     14.2     15.6     11.	Potassium	ppm	ASTM D5185m	>20	0	0	<1
Soot %     %     *ASTM D7844     >3     0.3     0.9     0.3       Nitration     Abs/cm     *ASTM D7624     >20     6.3     8.0     5.       Sulfation     Abs/.1mm     *ASTM D7415     >30     19.1     21.3     17.       FLUID DEGRADATION     method     limit/base     current     history1     history1       Oxidation     Abs/.1mm     *ASTM D7414     >25     14.2     15.6     11.	Fuel	%	ASTM D3524	>5	0.1	<1.0	<1.0
Nitration     Abs/cm     *ASTM D7624     >20     6.3     8.0     5.       Sulfation     Abs/.1mm     *ASTM D7415     >30     19.1     21.3     17.       FLUID DEGRADATION     method     limit/base     current     history1     history2       Oxidation     Abs/.1mm     *ASTM D7414     >25     14.2     15.6     11.	INFRA-RED		method	limit/base	current	history1	history2
Sulfation     Abs/.1mm     *ASTM D7415     >30     19.1     21.3     17.       FLUID DEGRADATION     method     limit/base     current     history1     history2       Oxidation     Abs/.1mm     *ASTM D7414     >25     14.2     15.6     11.	Soot %	%	*ASTM D7844	>3	0.3	0.9	0.3
Sulfation     Abs/.1mm     *ASTM D7415     >30     19.1     21.3     17.       FLUID DEGRADATION     method     limit/base     current     history1     history2       Oxidation     Abs/.1mm     *ASTM D7414     >25     14.2     15.6     11.	Nitration	Abs/cm	*ASTM D7624	>20	6.3	8.0	
Dxidation     Abs/.1mm     *ASTM D7414     >25     14.2     15.6     11.	Initiation						
	Sulfation	Abs/.1mm	*ASTM D7415	>30	19.1	21.3	17.
	Sulfation						history2
	Sulfation	TION	method	limit/base	current	history1	history2

### DIAGNOSIS

### Recommendation

No corrective action is recommended at this time. Resample at the next service interval to monitor.

#### Wear

All component wear rates are normal.

#### Contamination

Fuel content negligible. There is no indication of any contamination in the oil.

#### Fluid Condition

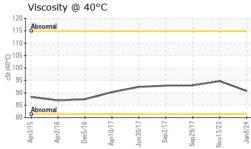
The oil viscosity is lower than normal. The BN result indicates that there is suitable alkalinity remaining in the oil. Confirm oil type.

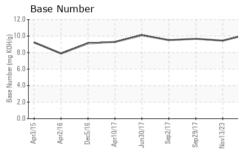
Submitted By: SKIP SAENGERHAUSEN

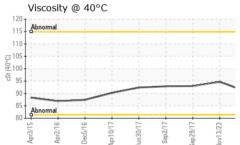


# **OIL ANALYSIS REPORT**









						VISUAL			method	limit/ba	ase	CL	urrent		histo	ry1	ł	nistory	/2
					_	White Metal		scalar	*Visual	NONE		NO	NE	I	NONE		N	ONE	
						Yellow Metal		scalar	*Visual	NONE		NO	NE		NONE		N	ONE	
						Precipitate		scalar	*Visual	NONE		NO	NE	I	NONE		N	ONE	
						Silt		scalar	*Visual	NONE		NO	NE		NONE			ONE	
						Debris		scalar	*Visual	NONE		NO			NONE			ONE	
					4	Sand/Dirt		scalar	*Visual	NONE		NO			NONE			ONE	
					Jan 8/24	Appearance		scalar	*Visual	NORM		-	RML		NORM				
					,	Odor		scalar	*Visual	NORML	L	-	RML		NORM	L			
С						Emulsified Wa Free Water	iter	scalar	*Visual *Visual	>0.2		NEC			NEG NEG			EG EG	
	1			1		FLUID PRC		scalar		limit/b	000					a.1			رم ب
						Visc @ 40°C	PERI	cSt	method ASTM D445	limit/ba	ase	90.7	urrent		histoi 94.7	гут		nistory 2.96	12
						Visc @ 100°C		cSt	ASTM D445			12.2			12.6			2.91	
					-	Viscosity Inde		Scale	ASTM D2270			128			128		13		
						GRAPHS	( )					-						-	
- 11/0	- 11/0	- 11/2	- 11/e	3/23 -	8/24	Iron (ppm)						Load	(ppm)						
Apr10/17	Jun30/17	Sep2/17	Sep29/17	Nov13/23	Jan8/24	250 T					<sup>100</sup> T	r:	(hhu)	, ; ;					
						200 - Severe		1			80	Severe			1				
					bbm	150 100 - Abnormal					E 60	Abnorm	al						
	-	-				50-					20								
						0					0								-
			Apr3/15 - Apr2/16 - Dec5/16 -	Apr10/17	Jun30/17	Sep22/17 Sep29/17 Nov13/23	Jan 8/24		Apr3/15	Apr2/16 Der5/16	Apr10/17	Jun30/17	Sep2/17	Sep29/17	Nov13/23	Jan 8/24			
					ηn	No Sei S	7				~		0	Se	No	, C			
			Aluminum (	ppm)				- 50 T Chromiu	mium	(ppm)									
- 11	11	11	17	23		40 - Severe					40	Severe							
Apr10/17	Jun30/17	Sep2/17	Sep29/17	Nov13/23	8	20 Abnormal					팀 <sup>30</sup> -	Abnorm							
	,			~		and the second sec					I	Abnorm							
С						10					10								
						Apr3/15 Apr2/16 Dec5/16	Apr10/17	Jun30/17	Sep2/17 Sep29/17 Nov13/23	Jan 8/24		Apr3/15	Apr2/16 Der5/16	Apr10/17	Jun30/17	Sep2/17	Sep29/17	Nov13/23	Jan 8/24
								Jun	Sep Sep	Ja				~	Jun	Se	Sep	Nov	Ja
						Copper (ppr	n)				<sup>80</sup> T		n (ppr	n)					
-						300					60-								
	-		7-	~		200 -					튼 40 -	Abnorm	al						
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Submitted By: SKIP SAENGERHAUSEN