WEC INSTRUMENT USER MANUAL

CHAPTER 4

ENVIRONMENT

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Acronyms

See Chapter 1.

4.1 THERMAL (EID-B SECTIONS 4.1,TO 4.2)

4.1.1 Conditions

A nominal functioning of the whole WEC experiment is guaranteed as long as the Temperature Reference Point (TRP) is inside the temperature range specified in Table 4.1.1 below (EID-B section 4.2, table 4.2/1.2):

Unit	Operating limits (°C)		Non operating limits (°C)		Switch ON limits	
WEC.1..4	-20	+40	-30	+50	-20	+40
WEC.5	-10	+40	-20	+50	-10	+40
WEC.6			-100	+60		
WEC.7	-10	+40	-20	+50	-10	+40
WEC.8	-10	+40	-20	+50	-10	+40
WEC.9	-10	+40	-20	+50	-10	+40
WEC.10	-10	+40	-20	+50	-10	+40
WEC.11	-10	+40	-20	+50	-10	+40

Table 4.1.1-Temperature range of the TRP in flight operations

It is assumed that the temperature of the TRP of each unit will be known at system level (directly measured or related to the nearest temperature probe) and recorded in Housekeeping parameters.

The main WEC requirement (condition) is to keep the TRP in the temperature range specified above.

There are also temperature probes in some of the WEC units (WEC.7, 8, 9, 10) but they are only used for off line monitoring, not for control of operations.

4.1.2 Monitoring

During flight operations, only the temperature of the TRP must be verified at regular intervals and used for action. According to the temperature inertia of the units, one measurement every ten minutes is enough to keep a reasonable control of the temperature. As the monitoring cycle is 61.8 s (cf.: EID_C part 7 /2.3.3), the "cycle counter" can be set to 10 consecutive events before the action is triggered. The parameters to be verified are the following:

Temperature Sensor	AIT ID	ESOC ID	Non-operating limits	
			Low limit	High limit
WEC 1	T_MEPU2X	xT_317	-30	+50
WEC 2	T_MEPU1X	xT_316	-30	+50
WEC 3	T_MEPU3X	xT_318	-30	+50
WEC 4	T_MEPU6X	xT_321	-30	+50
WEC 5 and 10	T_MEPU4X	xT_319	-20	+50
WEC 7,8,9 and 11	T_MEPU5X	xT_320	-20	+50

4.1.3 Control

On board monitoring: If the temperature measured by one of the parameters T_316 to T_321 in the above table is out of the "non operating" limits more than 10 consecutive times, WEC must be switched OFF until further evaluation by the Experimenters. The commands and verification are the following:

Command	Verification		
WEC Power OFF	PLWECA_S	==	"OFF"
	and PLWECB_S	==	"OFF"

Table 4.1.3.1

4.1.4 Procedures

Ground monitoring: If the temperature measured by T_316 to T_321 is out of the non-operating limits for 120 or more formats (about 10 minutes), then enter contingency procedure CRP_WEC_M501 at entry condition 1 to switch off WEC.

If WEC is switched OFF then:

1/ The WEC OPERATIONS GROUP,
2/ The WEC CHAIR,
3/ The APPROPRIATE PIs

must all be informed in parallel.

WEC will ensure that the relevant contact information is always available to ESOC.

The situation will be evaluated and further action recommended to ESOC as soon as possible.

4.2 POWER (EID-B SECTION 3.1)

4.2.1 Profiles

The total Power consumed by WEC is relatively stable in a specified mode but, of course, can depend on the WEC mode: number of units being powered, WHISP/transmitter rate, speed of the DWP transputers, etc. Then, it is only possible to give the main limits of the WEC consumption in normal operations. The following table is based on tests at Velizy using the FM7 and FM9 models, with WBD powered on, and with the minimum number of DWP transputers (2 or 3) required to support the mode.

JSOC mode name	**WEC mode name**	**Power** (W)
NMBA	NBR basic	14.3
NMCO	NBR continuous	15.1
NMLR	NBR low recurrence	14.3
NMSY	NBR synchronised	14.5
NMLA	NBR langmuir (a)	15.3
NMLC	NBR langmuir (c)	15.0
BMLR	HBR low recurrence	14.4
BMEA	HBR EFW (a)	14.3
BMAN	HBR angle	14.3
BMEB	HBR EFW (b)	13.8
BMWH	HBR Whisper	14.3
BMBA	HBR basic	15.0
BMCO	HBR continuous	15.3
BMLA	HBR langmuir (a)	15.3
BMSY	HBR gliding	14.7
BMCL	HBR correlator	15.0
	Minimum	13.8
	Average	14.7
	Maximum	15.3

4.2.2 High Voltages

Not applicable to WEC.

4.2.3 Conditions

A power condition can only be defined when WEC is turned ON and is operating (in any mode).

During operation, the parameters which must be verified (possible dangerous situation for WEC) is the level of the input current (power consumption) and the secondary voltage supplied to DWP (new for Cluster 2).

The input current may be measured at the WEC LCL. The tripping limit of the LCL (0.9 A) is too large to protect the experiment in case of a problem. As it would be too difficult to define a general power matrix for each possible situation, only a maximum limit covering the worst case will be specified. The input current can be tested at every basic cycle of 61.8s (this duration is long but acceptable). If its value is above the limit, WEC must be switched OFF until further evaluation by the Experimenters.

The same sort of control of the input current is already made by DWP by checking the WEC Current Sense. If it jumps above a limit (which can be modified by telecommand) all the WEC instruments are turned OFF. However, DWP cannot switch OFF itself. The test at the spacecraft level is a redundancy and a good complement of the internal WEC control.

The secondary voltage is measured by the WEC parameter EW5VMON (D_072). The upper limit is 5.5V (raw value 229), and the lower limit 4.5V (raw value 187). Note that these are wider limits than those specified for ground verification. WEC should be turned OFF if the parameter is out of limits three times. A faster response would be better, but the validity of the parameter cannot be defined with certainty.

The monitoring should be performed when either WEC LCL A or WEC LCL B is ON. It must be possible to modify the limits and/or to inhibit the control with appropriate commands.

4.2.4 Monitoring

WEC LCL Input Current (s/c parameters J_253, or J254).

DWP voltage monitor (EW5VMON, D_072).

4.2.5 Control

On board monitoring: If WEC LCL current > 610mA, or EW5VMON > 229 three times, or EW5VMON < 187 three times, then WEC Power OFF;

Verification: PLWECA_S == "OFF"

and PLWECB_S == "OFF"

The default value of the current limit must correspond to 610 mA at the input of WEC (calibration to be identified to specify the raw value).

4.2.6 Procedures

Ground monitoring: If the WEC current measured by parameters J_253 or J_254 is greater than 610 mA, 3 or more times, then enter contingency procedure CRP_WEC_M501 at entry condition 1. If the DWP voltage measured by parameter D_072 is is greater than 5.5V, 3 or more times, then enter contingency procedure CRP_WEC_M501 at entry condition 1 to switch off WEC.

If an experiment is switched OFF then:

1/ The WEC OPERATING GROUP,
2/ The WEC CHAIR,
3/ The APPROPRIATE PIs

must all be informed in parallel.

WEC will ensure that the relevant contact information is always available to ESOC.

The situation will be evaluated and further action recommended to ESOC as soon as possible.

4.3 COMMUNICATION (EID-B SECTION 3.3.4)

4.3.1 Failure to produce telemetry

A sustained failure to produce HK telemetry when WEC is powered on, is a potentially dangerous condition, and if this occurs WEC should be powered OFF. The automatic on board control of the DWP voltage requested in section 4.2.5 also covers this situation - the EW5VMON, D_072 parameter will certainly be OOL (0 or 255) if WEC is not producing HK.

4.3.2 CDMU communication channel

Two units of the WEC: DWP and WBD are connected to the CDMU by two separate channels each: channel A (main) and channel B (redundant).

In DWP, the interface circuits are designed to work with the communication signals on any of the two channels. This is not the case for WBD which expects, by default, the telemetry clock on the line A. In case the line B is in use, special commands are needed by WBD to get the clock on that channel.

4.3.3 Monitoring

The WBD /CTU interface on "B" output is tested by DINTFACW == "B"

4.3.4 Control

WBD is turned ON by the command ZEWMS2FS, 0x44
and is switched to the B CTU line by the 2 commands ZEWDS1FS, 0xF0
ZEWDS8FS, 0x9F

4.3.5 Procedure

To have a good adaptation of WBD to the CDMU, two operations must be made under control:

i) each time WBD is turned ON, the CDMU channel must be tested. If "B", the relevant commands must be sent to WBD.

ii) each time the CDMU is switched to the "B" output, the relevant commands must be sent to WBD (this is only applicable if the CDMU channel can be modified when the experiments are ON).

It must be noted that an automatic on-board process is not needed for this control, and is not recommended because on board generated commands could become interleaved with ground commands, and possibly be received when WEC was not able to process them correctly. This control should be made from the ground by adequate procedures to define or to modify the command schedule. The procedure CRP_WEC_M502 is available for use if necessary during commissioning.

4.3.6 Bit rates associated to each TM and Experiment's Mode

The bit rate associated to each TM mode is fully described in Table 4.3.1 below (EID-B section 3.3.4, table 3.3/2):

TM Mode	Allocation	Block size	exact bit rate
NM1	5.2 kb/s	336 bytes	5217.17 b/s
NM2	5.2	336	5217.17
NM3	5.2	336	5217.17
BM1	43.8	456	43898.73
BM2	91.5	950	91455.69
BM3	29.5	306	29458.36
WBD	220.0	n/a	220752.00
HK	250 b/s	192	298.12

Table 4.3.1- Bit rate requirements

In the different TM modes, various experiment modes can be run involving different distributions of the TM allocation within the WEC instruments. This is an internal WEC problem which is not controlled at system level.

WEC can work in many configurations but the internal DWP Telemetry Mode must be adapted to the OBDH mode. This is not done automatically and appropriate MLCs must be sent to DWP each time the TM mode is modified. It is expected that this will be included in the command sequences defined for flight operations. It must be noted that any s/c TM mode change made which is not associated with the correct WEC command sequence will produce useless WEC telemetry.

4.3.7 Monitoring

The WEC H/K EW5ACQMD : OBDH Acquisition Mode, indicates in which mode DWP is working. The normal correspondence within the TM mode and the WEC H/K must be as follows:

TM Mode	EW5ACQMD
NM1	0x96
NM2	0x97
NM3	0x98
BM1	0x99
BM2	0x9A
BM3	0x9B

} Note that, for WEC, the 3 Normal Modes are identical

Table 4.3.2

4.3.8 Control

A conflict between the TM and DWP modes would cause the loss of the WEC science telemetry but is not a dangerous situation for the experiment. A conflict will not exist within the 3 Normal Modes because they are identical for DWP.

Control of this situation for nominal operations is currently implemented at JSOC level, as this is the only way to give the WEC operations group adequate visibility of when commands to change the WEC TM mode will be sent.

It must be noted that an automatic on-board process is not needed for this control, and is not recommended because on board generated commands could become interleaved with ground commands, and possibly be received when WEC was not able to process them correctly. This control should be made from the ground by adequate procedures to define or to modify the command schedule.

4.3.9 Procedures

Ground monitoring: If the DWP model tag MSB (parameter D_T47) is not equal to 205, 3 or more times, then enter contingency procedure CRP_WEC_M501 at entry condition 1 to power off WEC.

If WEC is powered off, or a telemetry mode conflict occurs then as soon as possible inform:

1/ The WEC OPERATIONS GROUP,
2/ The WEC CHAIR,
3/ The APPROPRIATE PIs

The situation will be evaluated and any further action recommended to ESOC as soon as possible.

4.4 TIMING (EID-B SECTION 3.3.3)

4.4.1 Conditions

As long as the specifications of the EID-A, section 3.3.1.4, are respected, there is no special requirement from WEC concerning the on board control of the timing. All the internal synchronisations are controlled by DWP taking the "Reset Pulse" (RES) as a timing reference. It is expected that the absolute time of the RES will be reconstituted on the ground with an accuracy better than 2 ms. A strong request from WEC, raised at the beginning of the Project and repeated at several occasions, is to obtain a timing accuracy of the order of 30 µs between the four spacecraft.

Timing accuracy is particularly important for EFW and STAFF to allow phase comparison of waveform data recorded on different spacecraft. A description of how greater accuracy than the 1.11 ms of the DWP master clock is achieved is given in chapter1 section 1.4.5.15 Time Tagging of WEC Data.

4.4.2 Monitoring

Not applicable.

4.4.3 Control

Not applicable.

4.4.4 Procedures

Not applicable.

4.5 INTERFACE TO OTHER EXPERIMENTS (EID-B SECTION 3.4)

4.5.1 Conditions

WEC is interfaced with most of the other experiments, as specified in EID-B section 3.4.

Some DC Magnetic data are received from FGM	**in DWP**	
Some Electron data are received from PEACE	**in DWP**	
The WHISPER Blanking Pulse is sent	**to EDI**	**by DWP**
WHISPER mode information sent	**to PEACE**	**by DWP**
The Spacecraft Potential and WHISPER mode is sent	**to ASPOC**	**by DWP**
The Spacecraft Potential and WHISPER mode is sent	**to CIS**	**by DWP**
The AC Magnetic Data are sent	**to EDI**	**by STAFF**

Of course, some of the WEC modes can need other experiments in a specified mode to take advantage of the IEL but there is no requirement from WEC to have an on-board control of the compatibility within the Cluster experiments. This must be implemented and verified in the ground when the Scientific Programmes are elaborated.

4.5.2 Monitoring

Not applicable.

4.5.3 Control

Not applicable.

4.5.4 Procedures

If the PEACE or FGM experiments are not able to send correct IEL data to WEC as scheduled then the WEC operations group should be informed. Any change required to operational modes will be handled through normal operations planning procedures (for example by submitting a fine tuning request).

4.6 OFF LINE MONITORING

4.6.1 Conditions

If it can be accepted to reduce drastically the number and the complexity of on-board monitoring and control, there is no reason not to analyse rapidly and systematically the story of the experiment's status in the ground, at the end of each orbit to identify as soon as possible any sort of misfunctioning.

Then it is requested from ESOC a routine analysis of the H/K listed below as soon as they are available and a fast report to the relevant office (JSOC, Experimenter ?).

It is assumed that for ground operations the full definition of the AIT Data Base will be available (i.e. conditioning and calibration of the parameters allowed).

4.6.2 Monitoring

4.6.2.1 Power verifications

par. Name	Short description	Condition/Action	
EW5WECCS	WEC Current Sense		(0)
EW5VMON	DWP voltage monitor (5V)		(0)
EW0RLCYC	EFW relay cycles		(1)
EW0PWRST	EFW power status		(1)+(*)
EW2RLCYC	Staff MWF relay cycles		(1)
EW2PWRST	Staff MWF power status		(1)+(*)
EW2VMON0	Staff MWF voltage monitor 0 (-9.00V)		(0)
EW2VMON1	Staff MWF voltage monitor 1 (-5.75V)		(0)
EW2VMON2	Staff MWF voltage monitor 2 (+9.00V)		(0)
EW2VMON3	Staff MWF voltage monitor 3 (+5.75V)		(0)
EW1RLCYC	Staff SA relay cycles		(1)
EW1PWRST	Staff SA power status		(1)+(*)
EW1VMON0	Staff SA voltage monitor 0 (+6.00V)		(0)
EW1VMON1	Staff SA voltage monitor 1 (-6.00V)		(0)
EW1VMON2	Staff SA voltage monitor 2 (+5.40V)		(0)
EW4RLCYC	Wideband relay cycles		(1)
EW4PWRST	Wideband power status		(1)+(*)
EW4VMON0	WBD voltage monitoring (6.00V)		(0)
EW3PWRST	Whisper power status		(1)+(*)
EW3TXPST	Whisper TX power status		(1)
EW3RLCYC	Whisper relay cycles		(1)
EW3TRCYC	Whisper TX relay cycles		(1)

Table 4.6.1- Power verifications

4.6.2.2 Temperature verifications:

par. Name	Short description	Condition/Action	
EW5TMON	DWP temperature monitor		(0)
EW1TMON	Staff SA temperature monitor - WEC.8		(0)
EW2TMON0	Staff MWF temperature monitor - WEC.7		(0)
EW3TMON	Whisper temperature monitor		(0)
EW4TMON	Wideband temperature monitor		(0)

Table 4.6.2- Temperature verifications

4.6.2.3 DWP and i/f verifications:

par. name	Short description	Condition/Action	
EW5EMCST	DWP master clock status		(2)
EW5EAPOV	DWP application buffer overflow		(2)
EW5ELINT	DWP lost events		(2)
EW5ATSNP	DWP no processor for application. task		(2)
EW5ETMOV	DWP telemetry buffer overflow		(2)
EW5ESTMR	OBDH TLM request not expected		(2)
EW5EITCM	Telecommand Invalid		(2)
EW5NFAIL	OBDH nominal channel failure		(2)
EW5NRFAI	OBDH nominal reset channel failure		(2)
EW5RFAIL	OBDH redundant channel failure		(2)
EW5RRFAI	OBDH redundant reset channel failure		(2)
EW5DMAFL	DWP DMA channel fault		(2)
EW5EITEW	Telecommand extension invalid		(2)
EW5ENRDY	Telecommand when instrument not ready		(2)
EW5TIWME	Telecommand illegal whilst macro executing		(2)

Table 4.6.3- DWP and i/f verifications

4.6.2.4 EFW verifications:

par. name	Short description	Condition/Action	
EW0BADHD	EFW data with bad header		(2)
EW0NOTLM	EFW no telemetry received		(2)
EW0BDTMC	EFW bad tape mode command		(2)
EW0UXTLM	EFW unexpected telemetry		(2)
EW0MOT1S	EFW status motor 1		(2)
EW0MOT2S	EFW status motor 2		(2)
EW0MOT3S	EFW status motor 3		(2)
EW0MOT4S	EFW status motor 4		(2)

Table 4.6.4- EFW verifications

Get the following H/K to build derived parameters:

EW0SLWB0	EFW sliding window byte 0
EW0SLWB1	EFW sliding window byte 1
EW0SLWB2	EFW sliding window byte 2
EW0SLWB3	EFW sliding window byte 3
EW0SLWB4	EFW sliding window byte 4
EW0SLWB5	EFW sliding window byte 5
EW0SLWB6	EFW sliding window byte 6
EW0SLWB7	EFW sliding window byte 7

Table 4.6.5

Calculate:

sample0 by putting EW0SLWB1 in the MSB and EW0SLWB0 in the LSB of a 16- bit signed integer

sample1 by putting EW0SLWB3 in the MSB and EW0SLWB2 in the LSB of a 16- bit signed integer

sample2 by putting EW0SLWB5 in the MSB and EW0SLWB4 in the LSB of a 16- bit signed integer

sample3 by putting EW0SLWB7 in the MSB and EW0SLWB6 in the LSB of a 16- bit signed integer

par.name	Short description	Condition/Action
sample0	**EFW word 0**	**(3)**
sample1	**EFW word 1**	**(3)**
sample2	**EFW word 2**	**(3)**
sample3	**EFW word 3**	**(3)**

Table 4.6.6

4.6.2.5 STAFF verifications:

par. name	Short description	Condition/Action	
EW2EWORD	Staff MWF error word		(2)
EW2ENWRK	Staff MWF not working		(2)
EW2CALMD	Staff MWF Calibration Mode		(1)+(*)
EW1EWORD	Staff SA error word		(2)
EW1ENWRK	Staff SA not working		(2)
EW1ZCNTR	Staff SA number of zeros		(4)
EW1AMODE	Staff SA analysis mode		(5)

Table 4.6.7- STAFF verifications

4.6.2.6 WHISPER verifications

WHISPER has defined two levels of verification. The first one is compliant with the rest of the section 4.6: this is only an analysis of the H/K to check any obvious malfunctionning of the instrument. The second level is a verification of the WHISPER modes according to the command schedule. It's a more complicated processing which is more compliant with the following section 4.7.

par. name	Short description	Condition/Action		
EW3CREG0	Whisper command register 0 (within DWP)		(*)	
EW3CREG1	Whisper command register 1 (within DWP)		(*)	
EW3CREG2	Whisper command register 2 (within DWP)		(*)	
EW3CREG3	Whisper command register 3 (within DWP)		(*)	
EW3WPW	Whisper data processing control within DWP		(*)	
EW3ENWRK	Whisper not working		(2)	
EW3LUDET	Whisper latchup detection		(2)	
EW3WAMW4	Whisper actual mode word 4		(*)	
EW3WAMW5	Whisper actual mode word 5		(*)	
EW3EWCMW	Whisper command word error		(2)	
EW3MODE	Whisper command mode (defined in DWP)		(*)	
EW3PMODE	Whisper primary mode		(7)	
EW3WAMW1	Whisper actual mode word 1		(*)	
EW3WAMW2	Whisper actual mode word 2		(*)	
EW3WAMW3	Whisper actual mode word 3		(*)	
EW3WDTST	Whisper watch dog test result		(1)	
EW3DATPR	Whisper data processing		(*)	
EW3ERATE	Whisper E/R rate		(*)	
EW3PULSE	Whisper TX pulse duration		(*)	
EW3TXLVL	Whisper emission level		(*)	
EW3RPTLR	Whisper repetition + line row		(*)	
EW3CALRL	Whisper calibration result		(1)	

Table 4.6.8- WHISPER verifications

4.6.2.7 WBD verifications:

par. name	Short description	Condition/Action
EW4VCXOL	Wideband VCXO lock status	(2)
EW4BANDW	Wideband bandwidth	(*)
EW4CONFQ	Wideband converter frequency	(*)
EW4WBDHK	Wideband data via DWP	(*)
EW4GNSEL	Wideband gain select	(*)
EW4OBDHI	Wideband OBDH interface	(*)
EW4ANTNA	Wideband selected antenna	(*)

Table 4.6.9- Wideband verfications

4.6.2.8 Conditions /Actions description:

Condition: (0): Conditions those of the ESOC Data Base.

These parameters are defined with limits or imposed value in the Data Base.

Wrong if not compliant.

Report:- (i) number of wrong situation

(ii) date/time of the first and last one

Condition: (1): See condition 8 **(WEC)**

Condition: (2): ***Wrong if*** not always ZERO (digital value)

Report: (i) number of wrong situation

(ii) date/time of the first and last one

Condition: (3): ***Wrong if*** the parameter gives the same value during 4 consecutive HK frames (sampling circuitry has stopped working).

Report: (i) number of wrong situation

(ii) date/time of the first and last one

Condition: (4): ***Wrong if*** > 0x14 (TBC)

Report:- (i) number of wrong situations.

(ii) date/time of the first and last one

Condition: (5): ***Wrong if*** the parameter takes the value "ILLEGAL"

Report:- (i) number of wrong situation

(ii) date/time of the first and last one

Condition: (7): ***Wrong if*** not equal to the parameter EW3MODE

Report:- (i) number of wrong situation

(ii) date/time of the first and last one

Condition: (8): **Report:**- (i) number of transition (change of value)

(ii) date/time of the first and last one

Condition: (*): Parameters to be compared with the command schedule. **(WEC)**

This is another part of the operation verification which is more complicated and not so urgent.

It can be treated separately.

Conditions tested by ESOC except where noted **(WEC).**

4.7 PROCESSING OF THE HOUSEKEEPING DATA

If most of the H/K have been defined to check the status and the main functioning of the experiments, some of them can be considered as reduced Science Data and could be used to improve the verification of the experiments or to produce a summary of the scientific events detected by the instruments. This involves a more sophisticated processing of the H/K and is, for this reason, not included in the previous section.

According to this idea:

4.7.1 STAFF CAL HK processing

An organigram and a table of limit values (extracted from AIT Data Base) are given.

Once the STAFF CAL Mode is recognised (EW2CALMD), search for CAL STEP 2. Compare successively Bxmax-Bxmin, Bymax-Bymin to limit values. Then search for CAL STEP 6 and compare successively the 9 AGC (AGC1 to AGC9) to the limits. If the respective values are in the limit, then set a bit to 0, if not to 1. In normal conditions there will be a 12 bit word equal to 0. The word should be in the report, in the form of a 12 bit word allowing us to know where is the problem. In case its value is not equal to 0, a WARNING should be established.

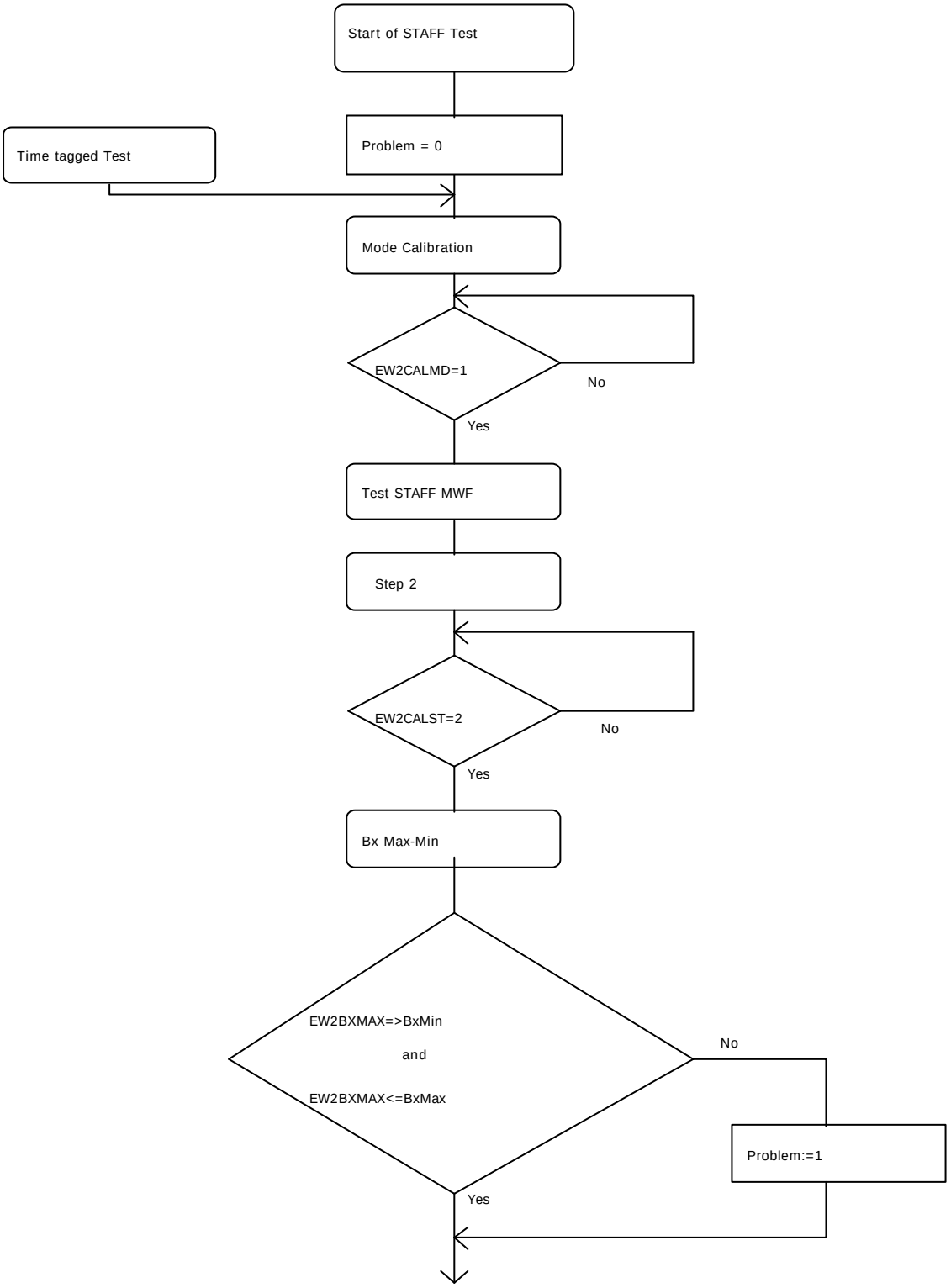
STAFF mwf limits in Cal step 2 :

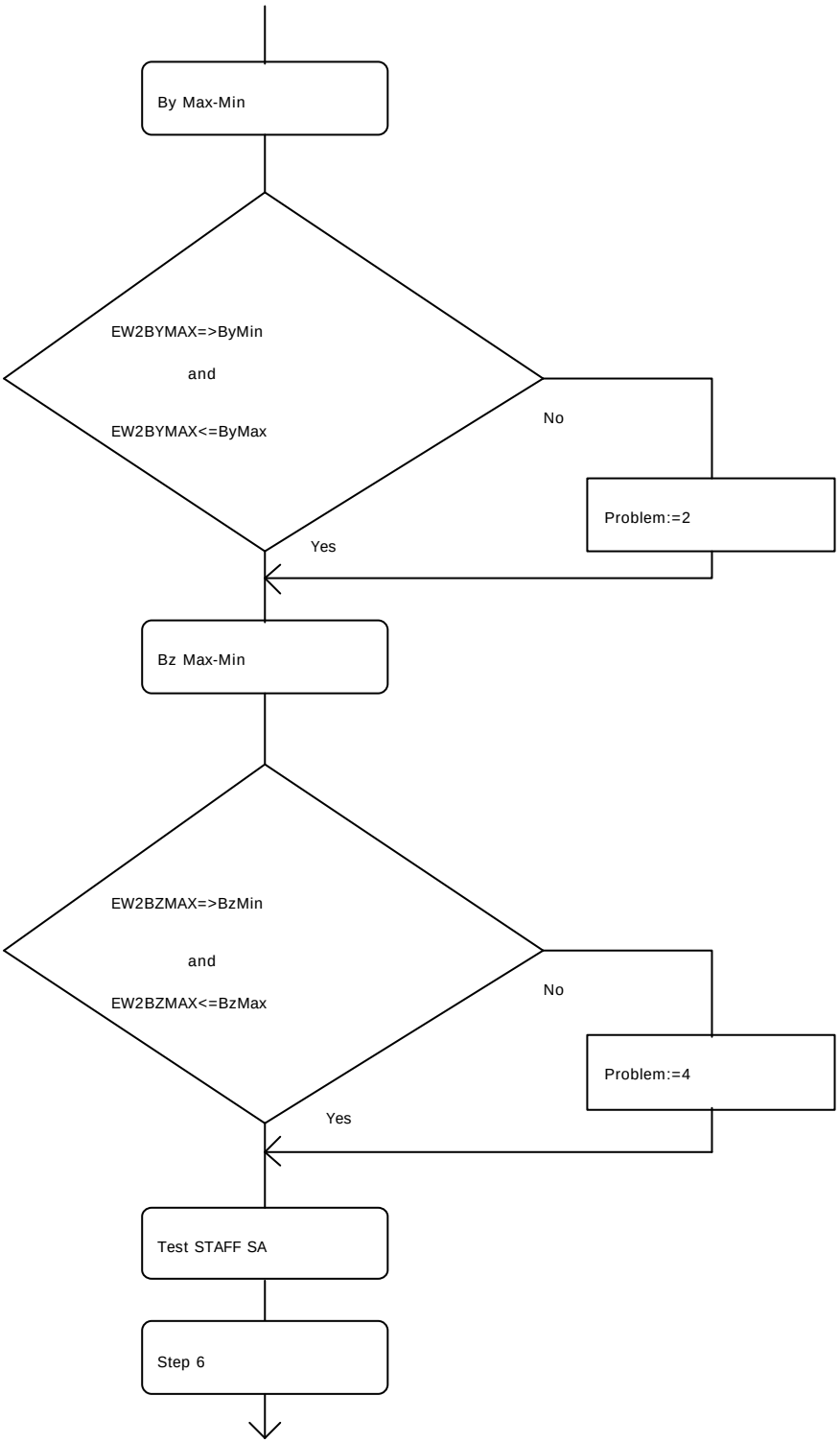
BxMin	ox0100
BxMax	0x0500
ByMin	0x0100
ByMax	0x0500
BzMin	0x0100
BzMax	0x0500

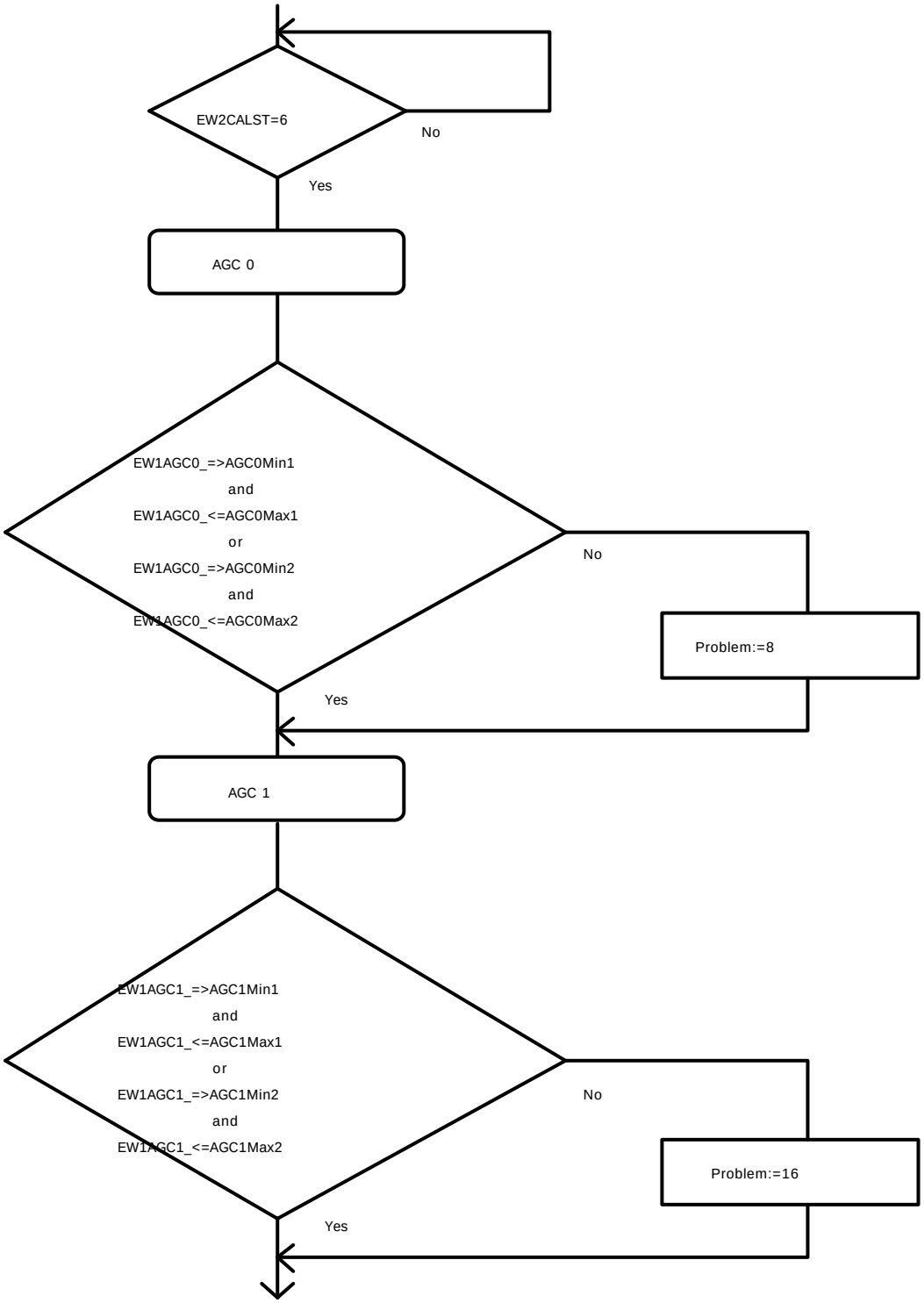
STAFF SA limits in Cal step 6 :

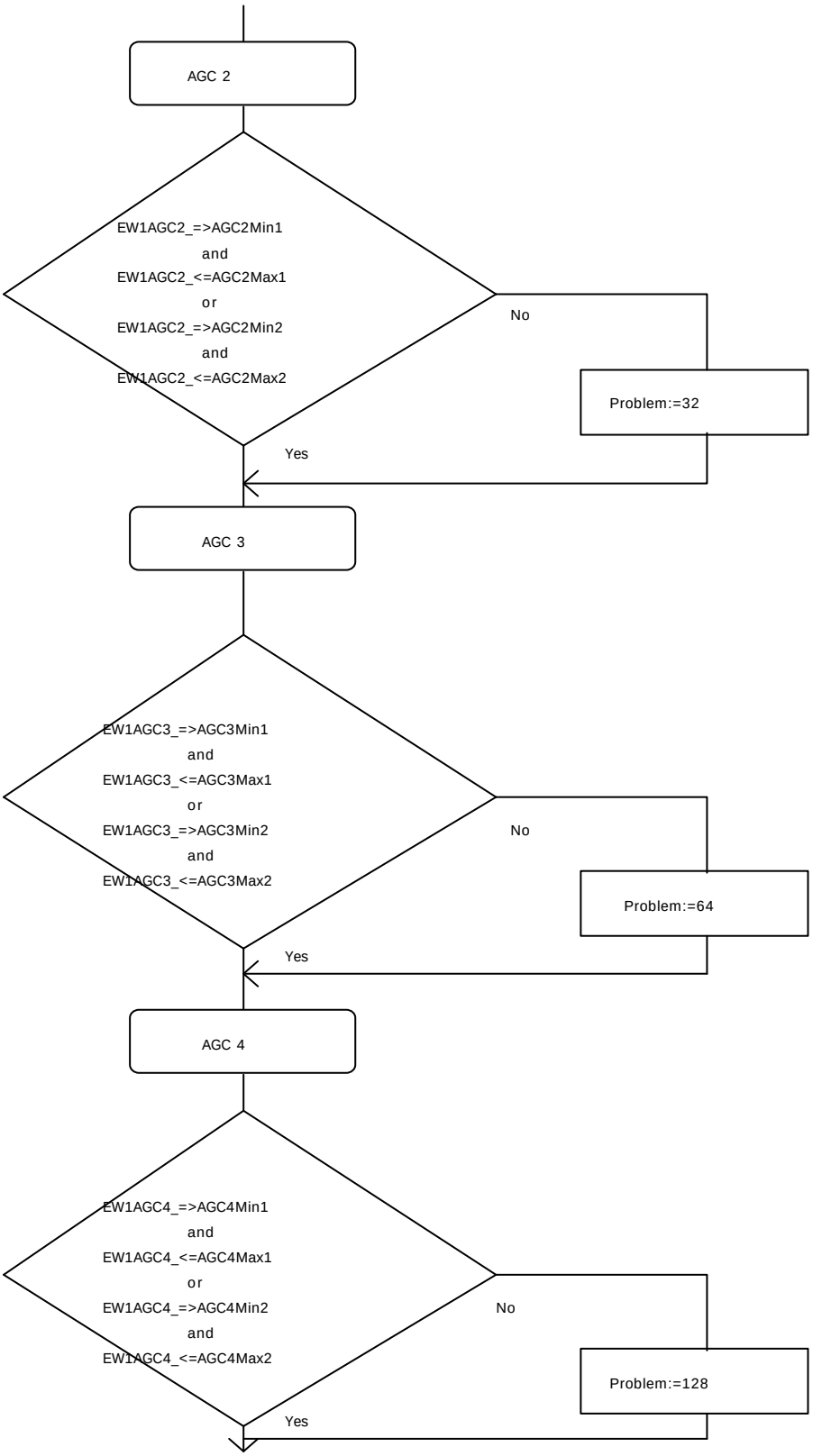
AGC0Min1	**0x8B**	**AGC0Max1**	**0x9B**
AGC0Min2	**0x6D**	**AGC0Max2**	**0x7D**
AGC1Min1	**0x8A**	**AGC1Max1**	**0x99**
AGC1Min2	**0x6C**	**AGC1Max2**	**0x7C**
AGC2Min1	**0x77**	**AGC2Max1**	**0x89**
AGC2Min2	**0x5A**	**AGC2Max2**	**0x72**
AGC3Min1	**0x8B**	**AGC3Max1**	**0x9B**
AGC3Min2	**0x6E**	**AGC3Max2**	**0x7E**
AGC4Min1	**0x7A**	**AGC4Max1**	**0x89**
AGC4Min2	**0x5D**	**AGC4Max2**	**0x6C**
AGC5Min1	**0x78**	**AGC5Max1**	**0x88**
AGC5Min2	**0x5C**	**AGC5Max2**	**0x6B**
AGC6Min1	**0x63**	**AGC6Max1**	**0x72**
AGC6Min2	**0x45**	**AGC6Max2**	**0x55**
AGC7Min1	**0x62**	**AGC7Max1**	**0x71**
AGC7Min2	**0x45**	**AGC7Max2**	**0x54**
AGC9Min1	**0x63**	**AGC9Max1**	**0x72**
AGC9Min2	**0x46**	**AGC9Max2**	**0x55**

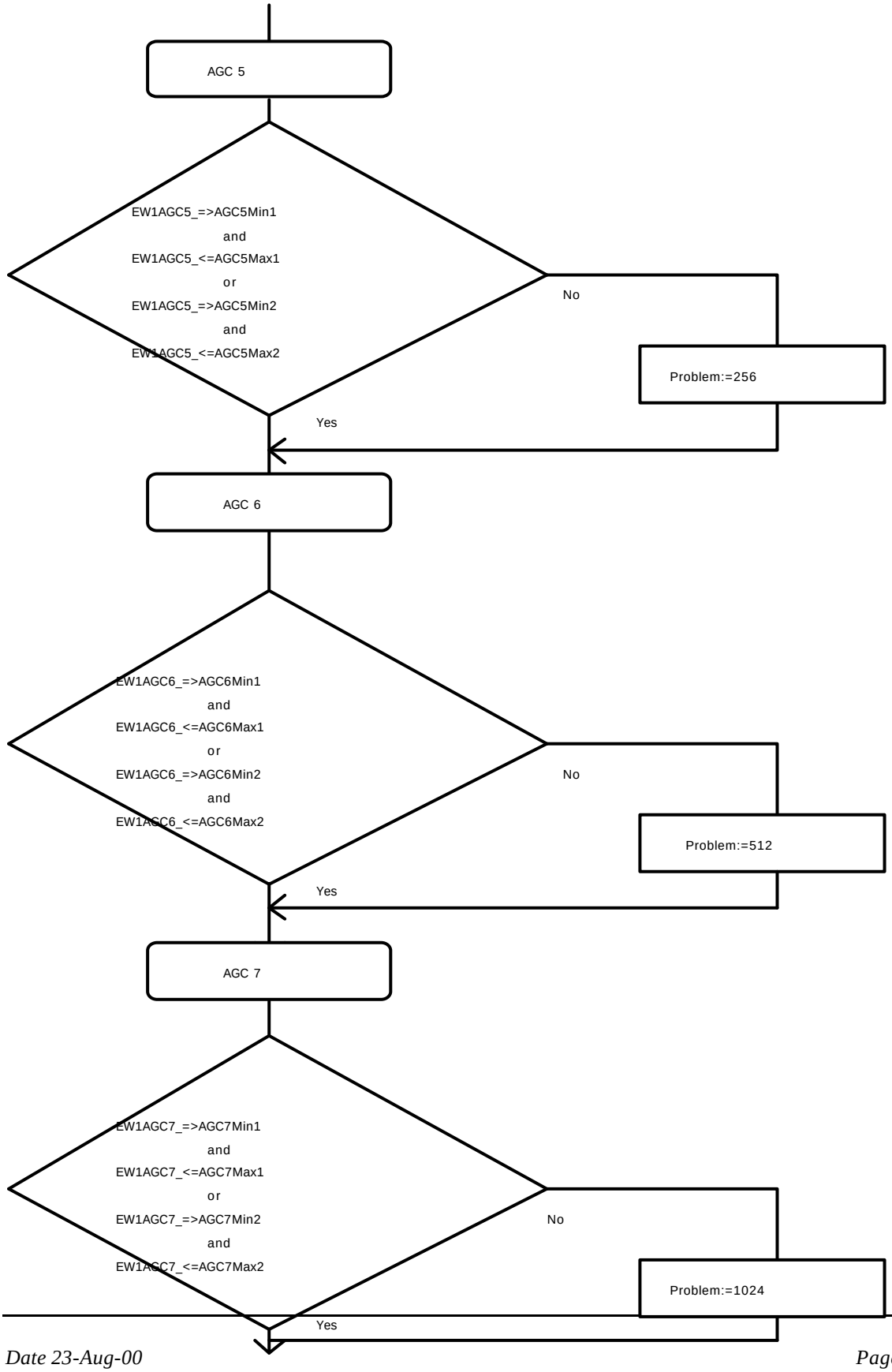
STAFF NBR Calibration Test Flow Chart.(Organigram)

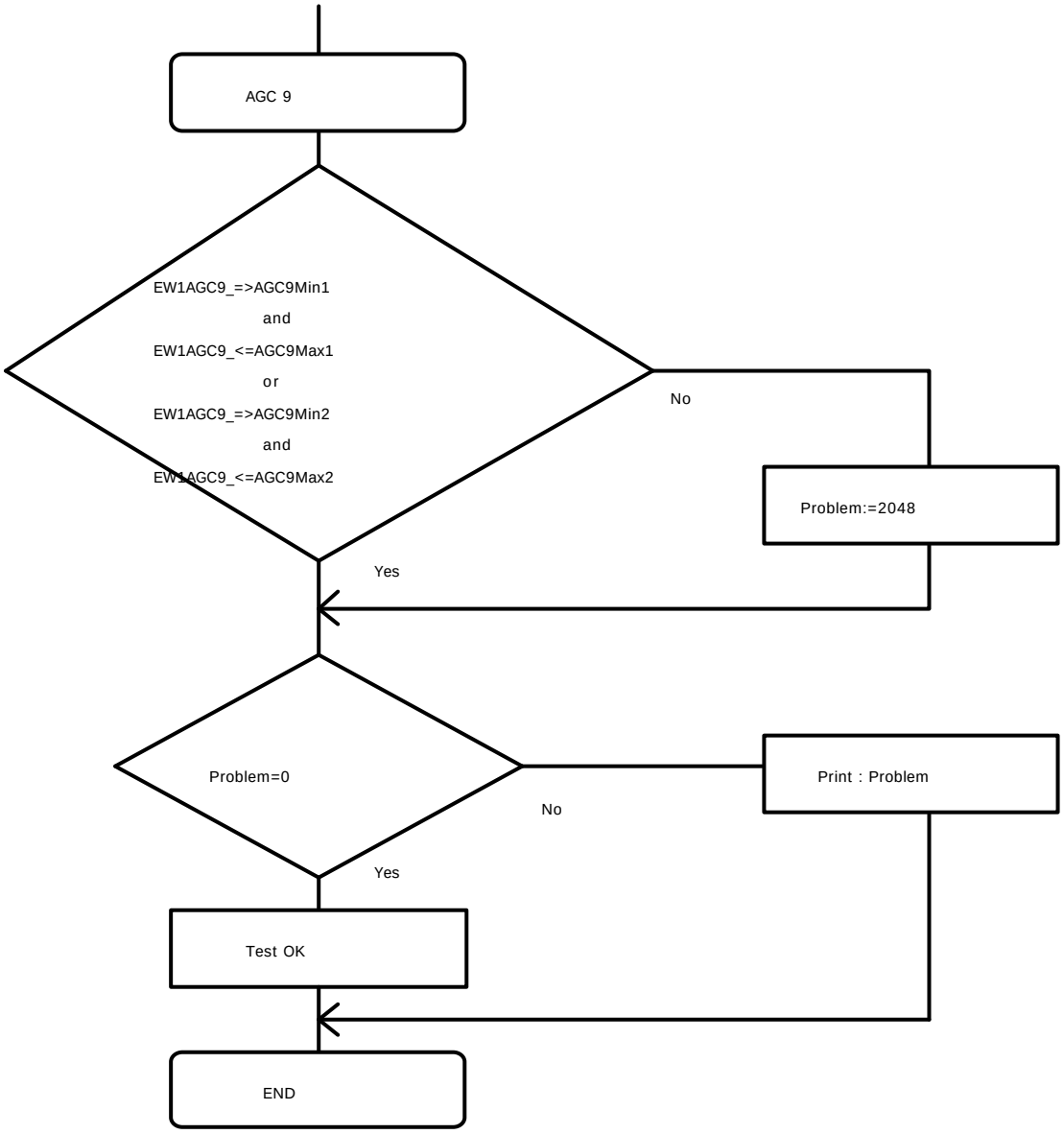



By Max-Min
EW2BYMAX=>ByMin
and
EW2BYMAX<=ByMax
No
Problem:=2
Yes
Bz Max-Min
EW2BZMAX=>BzMin
and
EW2BZMAX<=BzMax
No
Problem:=4
Yes
Test STAFF SA
Step 6


EW2CALST=6
No
Yes
AGC 0
EW1AGC0_=>AGC0Min1
and
EW1AGC0_<=AGC0Max1
or
EW1AGC0_=>AGC0Min2
and
EW1AGC0_<=AGC0Max2
No
Problem:=8
Yes
AGC 1
EW1AGC1_=>AGC1Min1
and
EW1AGC1_<=AGC1Max1
or
EW1AGC1_=>AGC1Min2
and
EW1AGC1_<=AGC1Max2
No
Problem:=16
Yes


AGC 2
EW1AGC2_=>AGC2Min1
and
EW1AGC2_<=AGC2Max1
or
EW1AGC2_=>AGC2Min2
and
EW1AGC2_<=AGC2Max2
No
Problem:=32
Yes
AGC 3
EW1AGC3_=>AGC3Min1
and
EW1AGC3_<=AGC3Max1
or
EW1AGC3_=>AGC3Min2
and
EW1AGC3_<=AGC3Max2
No
Problem:=64
Yes
AGC 4
EW1AGC4_=>AGC4Min1
and
EW1AGC4_<=AGC4Max1
or
EW1AGC4_=>AGC4Min2
and
EW1AGC4_<=AGC4Max2
No
Problem:=128
Yes


AGC 5
EW1AGC5_=>AGC5Min1
and
EW1AGC5_<=AGC5Max1
or
EW1AGC5_=>AGC5Min2
and
EW1AGC5_<=AGC5Max2
No
Problem:=256
Yes
AGC 6
EW1AGC6_=>AGC6Min1
and
EW1AGC6_<=AGC6Max1
or
EW1AGC6_=>AGC6Min2
and
EW1AGC6_<=AGC6Max2
No
Problem:=512
Yes
AGC 7
EW1AGC7_=>AGC7Min1
and
EW1AGC7_<=AGC7Max1
or
EW1AGC7_=>AGC7Min2
and
EW1AGC7_<=AGC7Max2
No
Problem:=1024
Yes


AGC 9
EW1AGC9_=>AGC9Min1
and
EW1AGC9_<=AGC9Max1
or
EW1AGC9_=>AGC9Min2
and
EW1AGC9_<=AGC9Max2
No
Problem:=2048
Yes
Problem=0
No
Print : Problem
Yes
Test OK
END

4.7.2 WHISPER processing

(1) Extract, from HK TM file, start and stop times of time slices. The start time of slice 1 is the date of the first HK block encountered which satisfies NCRITERIA = TRUE.

NCRITERIA is TRUE if:

- Whisper is ON (from byte 26 of WEC HK block)
- Whisper is NOT DISABLED (from byte 52)
- Whisper HK flag is ON (from byte 132)
- Whisper running mode is NATURAL (from byte 139)

Once the start time slice 1 STT(1) is encounted , successive start times are defined as STT(M+1) = STT(M) + 600 (time in seconds) until the end of file is encountered.

A stop time, STO(M) = STT(M) + 600, is associated to each time slice.

For the last slice, STO(MAX) is defined as the last block date where NCRITERIA is TRUE. It may coincide with STT(MAX).

(2) Calculate the value of several parameters for each time slice.

Let IT be the number of HK blocks where NCRITERIA is TRUE for a time slice. IT can vary from 0 to 117.

For each successive block in a time slice:

- extract:
  - Gcu and Gcl, upper and lower commanded gain values (byte 144),
  - Ga, Whisper actual gain (byte 139),
  - Ovf, Overflow number (byte 138),
  - En, the 32 bits value of Whisper quadratic sum (EW3QSUM),
- increment an index , NG (initialised to 0) if Ga differs from Gcu,
- calculate the factor BSR:
  BSR = 4 if Ga = Gcu and Gcu differs from Gcl, else BSR = 1,
- calculate the equivalent amplitude Ae (in Volts):
  Ae = Ca * SQRT (En) * BSR / ga,
  Ca = 0.00345 (TBC),
  ga is Ga expressed as a scalar (i.e. Ga = 9 dB means ga = 2.83),
- calculate the equivalent noise B (in V^2 /Hz) and its square root, SQB, according to:
  B = Ae * Ae/7800,

For each time slice, if IT > 0:

- raise a flag 'Commanded gain change' if Gcu and Gcl are not constant,

- calculate the percentage of gain changes PNG:
  PNG = 100 * NG/IT,

- calculate the averages of Ae, B, SQB and Ovf as MAe, MB, MSQB and MOvf,

- calculate the variance of B:
  Var = MB - MSQB*MSQB,

In case IT = 0 for a time slice, set to 0:

Gcu, Gcl, PNG, MOvf, MAe, MB, Var,

(3) Issue a report with 3 lines per time slice:

- STT(M) = , STO(M) = , ALARM ON GAIN (if MOvf>16, TBC)
- Gcu = , Gcl = , or 'Commanded gain change', PNG = , MOvf = ,
MAe = , MB = , Var = ,
- a blank line,

(4) This report is to be forwarded or put on FTP server and a message of availability to be forwarded as soon as possible after it is ready.

Several experimenters are also interested by the production of a "Data Summary" using the housekeeping only but this would involve more than WEC and is not well defined for the moment.

It is also necessary to discuss who, within ESOC and JSOC, can take in charge this sort of task.