07-210-91

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION UNIT 2

OPERATING PROCEDURE

N2-OP-73B

REVISION 02

24 VOLT D.C. DISTRIBUTION

Approved By:
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L B Abbott FOR STATION ONLY
Vice President - Nuclear Generation

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Date

THIS REVISION IS A GENERAL REWRITE

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NOT TO BE USED AFTER August 1992
SUBJECT TO PERIODIC REVIEW

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A. REFERENCES

1.0 Technical Specifications

None

2.0 Licensee Documentation

Updated Safety Analysis Report, USAR

Vol. 16, Section 8.1

Vol. 16, Section 8.1.5

3.0 Standards, Regulations, and Codes

4.0 Policies, Programs, and Procedures

5.0 Technical Information

5.1 Flow Diagrams

None

5.2 Electrical Diagrams

ESK-10IHA511, D.C. Elem. Annun. Syst.

ESK-10IHA403, D.C. Elem. Annun. Syst.

ESK-10IHA490, D.C. Elem. Annun. Syst.

EE-1BA, One Line Diagram Normal Bus

EE-1X, One Line Diagram Normal Bus 2NJS-US5

EE-1Y, One Line Diagram Normal Bus 2NJS-US6

EE-11BL, 600VAC Wiring Diagram DPNL 2NJS-PNL 500 and 600

EE-11Z, Ext. Conn. Diagram Distrib. Transformer

EE-10AK, Ext. Conn. Diagram Distrib. 24/48 VDC *

EE-10K, 24/48 VDC Wiring Diagram Dist. PNL 2BWS-PNL300A and B

EE-10AJ, Batt. Ext. Conn. Diagram Dist. 24/48 VDC

EE-1CT, 24/48 VDC One Line Diagram Normal PNL 2BWS-PNL300 A and B

A. REFERENCES (Cont)

5.3 Vendor Manuals

GB 3384B IOM. P.O.1.540-219 Spec. E033A, Gould Battery Installation and Operation Instructions

14476-6. P.O. 1.540-219 Spec. E034A, Power Conversion Products Instruction Manual for FD-24-25CE

IDF-943 S&W File Number 1.540-219-006, Power Conversion Products Drawing

IDF-943-1 S&W File Number 1.540-219-003, Power Conversion Products Drawing

5.4 System Instruction Manuals

None

6.0 Supplemental References

None

7.0 Commitments

Sequence Number	NCTS Number	Description

None

B. SYSTEM DESCRIPTION

1.0 The 24V DC system provides a reliable source of continuous power for the source and intermediate range neutron monitoring systems. All associated equipment is located in the control building on El. 214'.

2.0 The ± 24V DC power distribution system consists of two pairs of separate three wire distribution buses (positive/common/negative) with the common pole grounded to the station grounding grid, two 12 cell 24V DC lead acid batteries, distribution panels, and four battery chargers (two per battery).

2.1 The equipment associated with the two distribution buses are designated as follows:

Batteries	Battery Chargers	Distribution Panels
2BWS-BAT3A	2BWS-CHGR3A1	2BWS-PNL300A
2BWS-BAT3C	2BYS-CHGR3C1	2BWS-PNL300A
2BWS-BAT3B	2BWS-CHGR3B1	2BWS-PNL300B
2BWS-BAT3D	2BWS-CHGR3D1	2BWS-PNL300B

B. SYSTEM DESCRIPTION (Cont)

2.2 The supply to each bus is provided by two 24V twelve cell lead calcium batteries, one connected between the positive (+24V) and common wires, the other connected between the common and negative (-24V) wires. A 24 volt static battery charger is provided for each 12 cell, 24V battery. The ± 24V chargers are supplied by a 600-240/120V transformer which receives power from its associated load center. During normal operation, each 24V DC distribution panel is fed from its two associated battery chargers which work as a unit to separately supply the positive and negative buses of the system simultaneously, since the load is normally unequal on the two buses. The battery chargers supply power for the system loads while maintaining a full charge on their associated batteries. Upon loss of AC power to the chargers or failure of a charger, the DC load is supplied from the associated battery. The battery is designed to supply all connected loads for a minimum of two hours without the chargers.

3.0 The batteries are made up of 12 Lead Calcium type cells which are in a 3 cell per jar configuration. The jars are constructed of clear styrene acrylonitrile plastic and are mounted on two tier racks with 6 cells per tier. Each battery is rated at 100 ampere-hours based on a constant discharge rate for eight hours with a minimum voltage of 1.75 volts per cell at the end of the eight-hour period. The two 24V batteries are used as a unit (in series) along with their respective battery chargers and a distribution panel.

4.0 The battery chargers are convection air cooled, wall mounted, single phase controlled ferroresonant. They each have a rating of 25 amperes.

4.1 The battery chargers are protected from high voltage by an overvoltage relay, set at 30.0 volts, which will trip chargers output breaker and sound an alarm in the Control Room. Low voltage is also alarmed by a low voltage relay set at 22.5 volts.

4.2 Each battery charger is equipped with a DC voltmeter, ammeter, and a 120-hour timer to control the duration of equalizing charge cycles. The normal float voltage is 27.0 volts and the normal equalizing voltage is 28.0 volts. This corresponds to 2.25 volts/cell in Float and 2.33 volts/cell in Equalize mode. |TCN-3 |TCN-3

C. OPERATING REQUIREMENTS

1.0 The following systems must be in operation to support the 24/48 VDC Distribution System:

1.1 Standby Switchgear/Battery Room Ventilation N2-OP-53E

1.2 Station Electrical Feed and 115 KV Switchyard N2-OP-70

C. OPERATING REQUIREMENTS (Cont)

1.3 13.8KV/4160V/600V AC Distribution	N2-OP-71
1.4 Normal DC Distribution	N2-OP-73A

D. PRECAUTIONS AND LIMITATIONS

1.0 Battery rooms shall be ventilated at all times to prevent hydrogen gas build-up.

2.0 The following safety equipment shall be worn when working with electrolyte:

Rubber gloves

Rubber apron

Face Shield

3.0 The following is forbidden in the battery rooms:

Open flames

Smoking

Use of spark producing devices or tools

4.0 Tools capable of causing a short between battery cell terminals shall be taped with insulating tape.

5.0 Electrolyte spills shall be cleaned up immediately using a baking soda water solution to neutralize the spill. Use care to prevent introducing baking soda into a battery cell.

6.0 Battery rooms will normally be locked and only authorized persons will be allowed entry.

7.0 Loss of 24 VDC may result in a reactor trip depending on plant conditions.

8.0 The Battery Charger AC supply breaker must be open before closing the DC POWER breaker or severe charger damage may result.

9.0 Actions in this procedure are performed locally unless otherwise specified.

E. STARTUP

1.0 Placing A Battery, 2BWS-3A1 and 2BWS-3C1 Battery Chargers in Service

1.1 Verify open all load switches in panel 2BWS-PNL300A.

1.2 Verify Fuses for connected circuits are installed at panel 2BWS-PNL300A.

1.3 Verify AC POWER breakers are placed in OFF position for the following Battery Chargers:

1.3.1 2BWS-CHGR3A1

1.3.2 2BWS-CHGR3C1

1.4 Verify DC POWER breakers are placed in OFF position for the following Battery Chargers:

1.4.1 2BWS-CHGR3A1

1.4.2 2BWS-CHGR3C1

1.5 Close MAIN FEED, Battery switch at panel 2BWS-PNL300A.

1.6 Verify the equalizer interval timer is in OFF position.

1.7 Verify the FLOAT/EQUALIZE toggle selector switch is in the FLOAT position.

1.8 Place DC POWER breakers in ON position for the following Battery Chargers:

1.8.1 2BWS-CHGR3A1

1.8.2 2BWS-CHGR3C1

1.9 Observe battery voltage indication at the Battery Chargers.

1.10 Energize transformer 2BWS-XD003A by closing breaker 14 at 2NJS-PNL500.

1.11 Close breaker 2BWS-BKR3A, A.C. feed to both 2BWS-3A1 and 2BWS-3C1 Battery Chargers.

NOTE: The charger may go to the load limit if the battery is not fully charged.

1.12 Place AC POWER breakers in ON position for the following Battery Chargers:

1.12.1 2BWS-CHGR3A1

1.12.2 2BWS-CHGR3C1

E. STARTUP (Cont)

NOTE: The following actions are performed locally for the charger being placed in service unless otherwise specified.

1.13 Verify the equalizer interval timer is in OFF.

1.14 Verify the FLOAT/EQUALIZE toggle selector switch is in the FLOAT position.

1.15 Adjust the float potentiometer until the charger DC VOLTS meter indicates 27.0 VDC. |TCN-3

1.16 Maintain setting and tighten lock nut on the float potentiometer.

1.17 Place the FLOAT/EQUALIZE toggle selector switch in the EQUALIZE position.

1.18 Adjust the equalize potentiometer until the charger DC VOLTS meter indicates 28 VDC.

1.19 Maintain setting and tighten lock nut on the equalize potentiometer.

1.20 Place the FLOAT/EQUALIZE toggle selector switch in the FLOAT position.

2.0 Placing B Battery, 2BWS-3B1 and 2BWS-3D1 Battery Chargers in Service

2.1 Verify open all load switches in panel 2BWS-PNL300B.

2.2 Verify fuses for connected circuits are installed at panel 2BWS-PNL300B.

2.3 Verify AC POWER breakers are placed in OFF position for the following Battery Chargers:

2.3.1 2BWS-CHGR3B1

2.3.2 2BWS-CHGR3D1

2.4 Verify DC POWER breakers are placed in OFF position for the following Battery Chargers:

2.4.1 2BWS-CHGR3B1

2.4.2 2BWS-CHGR3D1

2.5 Close MAIN FEED, Battery switch at panel 2BWS-PNL300B.

2.6 Verify the equalizer interval timer is in OFF position.

E. STARTUP (Cont)

2.7 Verify the FLOAT/EQUALIZE toggle selector switch is in the FLOAT position.

NOTE: The charger may go to the load limit if the battery is not fully charged.

2.8 Place DC POWER breakers in ON position for the following Battery Chargers:

2.8.1 2BWS-CHGR3B1

2.8.2 2BWS-CHGR3D1

2.9 Observe battery voltage indication at the Battery Chargers.

2.10 Energize transformer 2BWS-XD003B by closing breaker 14 at 2NJS-PNL600.

2.11 Close breaker 2BWS-BKR3B, A.C. feed to both 2BWS-3B1 and 2BWS-3D1 Battery Chargers.

2.12 Place AC POWER breakers in ON position for the following Battery Chargers:

2.12.1 2BWS-CHGR3B1

2.12.2 2BWS-CHGR3D1

NOTE: The following actions are performed locally for the charger being placed in service unless otherwise specified.

2.13 Verify the equalizer interval timer is in OFF position.

2.14 Verify the FLOAT/EQUALIZE toggle selector switch is in the FLOAT position.

2.15 Adjust the float potentiometer until the charger DC VOLTS meter indicates 27.0 VDC. TCN-3

2.16 Maintain setting and tighten lock nut on the float potentiometer.

2.17 Place the FLOAT/EQUALIZE toggle selector switch in the EQUALIZE position.

2.18 Adjust the equalize potentiometer until the charger DC VOLTS meter indicates 28 VDC.

2.19 Maintain setting and tighten lock nut on the equalize potentiometer.

E. STARTUP (Cont)

2.20 Place the FLOAT/EQUALIZE toggle selector switch in the FLOAT position.

3.0 Energize loads by performing Attachment 2, Electrical Lineup.

F. NORMAL OPERATIONS

N/A

This is a passive system requiring no Operator Actions other than inspections as conducted in Operator Rounds.

G. SHUTDOWN

N/A

This system is normally in operation with components out of service for short periods of time for maintenance.

H. OFF-NORMAL OPERATIONS

1.0 Removing Battery Chargers from Service

* *

CAUTION

Performing this section may result in a half Reactor Protection System trip if operating Mode is other than Mode 1.

* *

1.1 Verify there are no other activities in progress which could initiate a reactor trip.

1.2 Place breaker 2BWS-BKR3A(B), A.C. Feed to 2BWS-CHGR3A1(B1) and 2BWS-CHGR3C1(D1) Battery Chargers in OFF.

1.3 Place switch 2BWS-CHGR3A1(B1) Charger Feed to Bus in the OPEN position at panel 2BWS-PNL300A(B), 24/48 VDC.

1.4 Open DC POWER breaker at the Battery Charger.

1.5 Open 2BWS-XD003A(B), 2BWS-BATT Chgr 3A/3C(3B/3D) Transformer Supply at panel 2NJS-PNL500(PNL600) el. 237' Normal Switchgear Bldg.

1.6 Obtain battery voltage readings hourly.

1.7 IF voltage drops to 21 VDC or any cell drops 1 VDC THEN open MAIN FEED switch at panel 2BWS-PNL300A(B), 24/48 VDC.

H. OFF-NORMAL OPERATIONS (Cont)

2.0 Removing a Battery from Service

2.1 Open MAIN FEED switch in panel 2BWS-PNL300A(B).

2.2 Verify FLOAT/EQUALIZE toggle selector switch is in the FLOAT position.

3.0 Returning Battery Chargers to Service

3.1 Verify the following breakers/switches are open at the locations designated:

3.1.1 2BWS-CHGR3A1(B1) Charger Feed to Bus at panel 2BWS-PNL300A(B)

3.1.2 AC POWER at Battery Charger

3.1.3 DC POWER at Battery Charger

3.2 Verify the equalizer interval timer is in OFF.

3.3 Verify the FLOAT/EQUALIZE toggle selector switch is in the FLOAT position.

3.4 Close breaker 2BWS-XD003A(B), 2BWS-BATT Chgr. 3A/3C(3B/3D) Transformer Supply at panel 2NJS-PNL500(PNL600) el. 237' Normal Switchgear Bldg.

3.5 Place breaker 2BWS-BKR3A(B), A.C. Feed to 3A(B) and 3C(D) Battery Chargers in ON.

3.6 Close switch 2BWS-CHGR3A1(B1), Charger Feed to Bus at panel 2BWS-PNL300A(B), 24/48 VDC.

3.7 Place the following DC POWER breakers in ON at the Battery Chargers:

3.7.1 2BWS-CHGR3A1(B1)

3.7.2 2BWS-CHGR3C1(D1)

3.8 Determine if a battery equalize charge is required from the following:

3.8.1 The battery has not been on charge such that there is a discharge measurable by regularly taken plant data.

3.8.2 Notification of unacceptable surveillance test data.

3.9 Notify Electrical Maintenance to initiate battery equalizing charge procedure for the battery requiring equalize charge.

H. OFF-NORMAL OPERATIONS (Cont)

3.10 Place the following AC POWER breakers in ON at the Battery Chargers:

3.10.1 2BWS-CHGR3A1(B1)

3.10.2 2BWS-CHGR3C1(D1)

4.0 Returning a Battery to Service

4.1 Close MAIN FEED switch at panel BWS-PNL300A(B).

4.2 Determine if a battery equalize charge is required from the following:

4.2.1 The battery has not been on charge such that there is a discharge measurable by regularly taken plant data.

4.2.2 Notification of unacceptable surveillance test data.

4.3 Notify Electrical Maintenance to initiate battery equalizing charge procedure for the battery requiring equalize charge.

5.0 Loss of Power to PNL300A/B

5.1 In order to lose 2BWS-PNL300A/B both the battery and the charger must be lost. The plant effect from the loss(es) of the panel(s) is/are as listed below:

Panel Lost	Mode Switch Position	Plant Effect	Appl. Procedure For Correcting Problem
2BWS-PNL300A	Run	Loss of A,C, SRMs A,C,E,G, IRMs	OP-73B sect. I.1.0
2BWS-PNL300A	Not in Run	Loss of A,C, SRMs Loss of A,C,E,G, IRMs Trip of "A" RPS	OP-73B sect. I.1.0
2BWS-PNL300B	Run	Loss of B & D SRMs Loss of B,D,F,H, IRMs	OP-73B sect. I.2.0
2BWS-PNL300B	Not in Run	Loss of B & D SRMs Loss of B,D,F,H, IRMs Trip of "B" RPS	OP-73B sect. I.2.0

H. OFF-NORMAL OPERATIONS (Cont)

5.1 (Cont)

Panel Lost	Mode Switch Position	Plant Effect	Appl. Procedure For Correcting Problem
2BWS-PNL300A & 2BWS-PNL300B	Run	Loss of all IRM & SRMs	OP-73B sect. I.1.0 & sect. I.2.0
2BWS-PNL300A & 2BWS-PNL300B	Not in Run	Loss of all IRM & SRMs Reactor Scram	OP-73B sect. I.1.0 & sect. I.2.0 OP-101C
2BWS-PNL300A or 2BWS-PNL300B	Shorting Links removed	Loss of effect side IRM & SRMs Reactor Scram	OP-73B sect. I.1.0 or sect. I.2.0 OP-101C

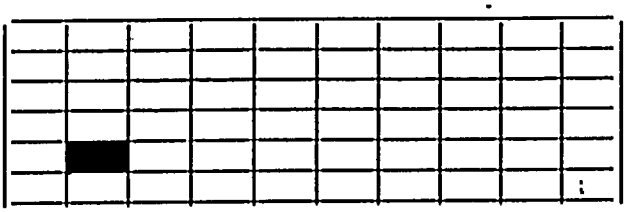
I. PROCEDURES FOR CORRECTING ALARM CONDITIONS

Reflash: Yes

852542

24/48VDC
DISTRIBUTION
PANEL 300A
UNDERVOLTAGE

542



Computer Point	Printout	Source	Setpoint	
BWSEC03	2BWS-CHGR3A1 DC VOLT	K1-1 K2-1	High 30.0 VDC Low 22.5 VDC	*
BWSEC01	2BWS-CHGR3C1 DC VOLT	K2-1 K1-1	High 30.0 VDC Low 22.5 VDC	*

Automatic Response

DC POWER breaker trip at chargers

Possible trip of R.P.S. Channel A on undervoltage to SRMSs and IRMs if the Reactor Mode switch is out of RUN position

Operator Actions

* *

CAUTION

The Battery Charger AC supply breaker must be open before closing the DC POWER breaker or severe charger damage may result.

* *

a. Cease all activities which could result in a R.P.S. trip.

b. Dispatch an Operator to verify alarm condition.

c. IF a half Scram occurred THEN ensure blue scram indicating lights on Full Core Display are extinguished.

d. IF AC ON indicating light is illuminated THEN perform the following:

1. Verify the FLOAT/EQUALIZE toggle selector switch is in FLOAT position.

2. Open breaker 2BWS-BKR3A, AC Supply to CHGRs 3A1 and 3C1 located above chargers.

Operator Actions (Cont)

3. Close DC POWER breakers at charger.

4. Close breaker 2BWS-BKR3A, AC Supply to CHGRs 3A1 and 3C1 located above chargers.

5. Notify the SSS of conditions.

e. IF AC ON indicating light is extinguished THEN perform the following:

1. Verify the DC POWER breakers are closed.

2. Verify AC supply breakers upstream of the chargers are closed.

3. Notify the SSS of conditions.

f. IF chargers fail to start THEN perform the following:

1. Open breaker 2BWS-BKR3A, AC Supply to CHGRs 3A1 and 3C1 located above chargers.

2. Remove the chargers from service in accordance with N2-OP-73B, 24 VOLT D.C. DISTRIBUTION.

3. Notify the SSS of conditions.

g. When conditions have been corrected, reset R.P.S. Channel A if necessary.

Possible Causes

Loss of AC supply
Electrical bus fault
Charger fault
Incorrect operating sequence
Incorrect potentiometer adjustment

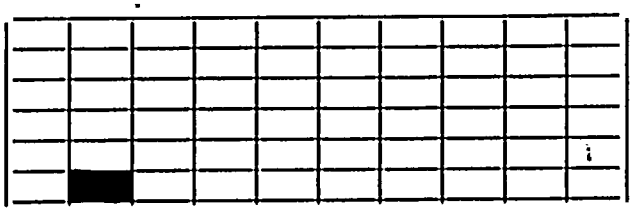
References

N2-OP-73B, 24 VOLT D.C. DISTRIBUTION

I. PROCEDURES FOR CORRECTING ALARM CONDITIONS (Cont)

Reflash: Yes 852552

24/48VDC
DISTRIBUTION
PANEL 300B
UNDERVOLTAGE
552



Computer Point	Printout	Source	Setpoint	
BWSEC04	2BWS-CHGR3B1 DC VOLT	K1-1 K2-1	High 30.0 VDC Low 22.5 VDC	*
BWSEC02	2BWS-CHGR3D1 DC VOLT	K2-1 K1-1	High 30.0 VDC Low 22.5 VDC	*

Automatic Response

DC POWER breaker trip at chargers

Possible trip of R.P.S. Channel B on undervoltage to SRMs and IRMs if the Reactor Mode switch is out of RUN position

Operator Actions

* *

CAUTION

The Battery Charger AC supply breaker must be open before closing the DC POWER breaker or severe charger damage may result.

* *

a. Cease all activities which could result in a R.P.S. trip.

b. Dispatch an Operator to verify alarm condition.

c. IF a half Scram occurred THEN ensure blue scram indicating lights on Full Core Display are extinguished.

d. IF AC ON indicating light is illuminated THEN perform the following:

1. Verify the FLOAT/EQUALIZE toggle selector switch is in FLOAT position.

2. Open breaker 2BWS-BKR3B, AC Supply to CHGRs 3B1 and 3D1 located above chargers.

Operator Actions (Cont)

3. Close DC POWER breakers at charger.

4. Close breaker 2BWS-BKR3B, AC Supply to CHGRs 3B1 and 3D1 located above chargers.

5. Notify the SSS of conditions.

e. IF AC ON indicating light is extinguished THEN perform the following:

1. Verify the DC POWER breakers are closed.

2. Verify AC supply breakers upstream of the chargers are closed.

3. Notify the SSS of conditions.

f. IF chargers fail to start THEN perform the following:

1. Open breaker 2BWS-BKR3B, AC Supply to CHGRs 3B1 and 3D1 located above chargers.

2. Remove the chargers from service in accordance with N2-OP-73B, 24 VOLT D.C. DISTRIBUTION.

3. Notify the SSS of conditions.

g. When conditions have been corrected, reset R.P.S. Channel B if necessary.

Possible Causes

Loss of AC supply
Electrical bus fault
Charger fault
Incorrect operating sequence
Incorrect potentiometer adjustment

References

N2-OP-73B, 24 VOLT D.C. DISTRIBUTION

ATTACHMENT 1

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ATTACHMENT 2
ELECTRICAL LINEUP SHEET

Component Number	Component Description	Power Supply Bus Number	- Cubicle Breaker	Required Position	Initials/ Date	Remarks
2BWS-BAT3A/3C	24V Batteries 3A and 3C (Output)	2BWS-PNL300A	MAIN FEED	ON		
Test Load	Test Load	2BWS-PNL300A	TEST LOAD	OFF		
2BWS-CHGR3A1/3C1	2BWS-Charger 3A1/3C1 D.C. Output	2BWS-PNL300A	Switch 1-3	ON		
2NMS-ANC602	24V D.C. Power to CEC-PNL709 (Nuc. Instr.)	2BWS-PNL300A	Switch 5-7	ON		
2BWS-XD003A	2BWS-Batt. Chgr. 3A1/3C1 Transformer Supply	2NJS-PNL500	Breaker 14	ON		
2BWS-BKR3A	2BWS-Chgr. 3A1/3C1 A.C. Supply from 2BWS-XD003A	2BWS-XD003A	2BWS-BKR3A	ON		
2BWS-BAT3B/3D	24 Volt Batteries 3B and 3D (output)	2BWS-PNL300B	Main Feed	ON		
Test Load	Test Load	2BWS-PNL300B	TEST LOAD	OFF		
2BWS-CHGR3B/3D	2BWS-Charger 3B1/3D1 D.C. Output	2BWS-PNL300B	Switch 1-3	ON		
2NMS-ANC602	24VDC Power to CEC-PNL708 (Nuc. Instr.)	2BWS-PNL300B	Switch 5-7	ON		
2BWS-XD003B	2BWS-Batt. Chgr. 3B1/3D1 Transformer Supply	2NJS-PNL600	Breaker 14	ON		
2BWS-BKR3B	2BWS-Chgr. 3B1/3D1 A.C. Supply from 2BWS-XD003A	2BWS-XD003B	2BWS-BKR3B	ON		