

# Maintenance Section

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## V Range Suction Sweepers Incorporating

**VT501 • 651 • 801**

Twin engine machines

**&**

**VS501 • 651 • 801**

Single engine, Hydrostatic machines

(MKII Systems Wafer)

Part No 7037358

Revision Level B

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**VT - Twin Engine**

Specific to Twin engine sweepers.

***VS - Single Engine***

*Specific to Single engine sweepers.*

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## CHAPTER

## 1

**Scheduled Maintenance****Table of Contents**

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## INTRODUCTION

### Regular Maintenance

It is impossible to over emphasise the importance of regular maintenance, inspection and running adjustments to maintain efficiency and obtain trouble free service from the machine.

Attention is drawn to the recommendation in the Auxiliary Engine Handbook relating to the post delivery check over.

The maintenance schedule specified are for average operating conditions. Under particularly dry and dusty conditions, it is essential that more frequent attention is given to:

- 1 Air cleaner servicing
- 2 Engine oil changes
- 3 Fluid oil changes
- 4 Gearbox oil changes
- 5 Hydraulic oil changes

Attention to the servicing of air cleaners fitted to both auxiliary and vehicle engines is of vital importance as clean air is essential for the proper functioning and ultimate life of an engine. Badly serviced air cleaners can allow dust particles to be directly induced into the internal working surfaces with a resulting rapid increase in engine wear and eventually complete failure. This also applies to any air leaks occurring between the air cleaner and the engine inlet manifold. See separate instructions for Air Cleaner Servicing.

It is important that the following Safety Precautions are observed when working on the machine.



## Safety Precautions



- Ensure the machine is standing on firm, level ground and there are no obstructions above or to the rear before raising the body and that the vehicle's parking brake is applied.
- Ensure the safety prop is used at all times when working under the body.
- Ensure operators are fully conversant with the controls and operation.
- Isolate the air in the systems locker before working on any pneumatically operated or controlled equipment.
- Disconnect or isolate the vehicle battery when working on the electrical system.
- Ensure the engine is switched off once the channel brush has been lowered for adjustment.
- Be aware of the safety instructions relative to the suction fan given in the equipment maintenance notes.
- Keep hands, loose clothing, hair etc. well clear of moving parts.
- Do not climb on the walkways unnecessarily or approach the fan inlet whilst the engine is running.
- Do not grasp any part of the engine or exhaust system without first ascertaining whether it has cooled sufficiently to avoid scalding.
- Do not use ill-fitting tools such as spanners that may slip and cause injury.
- Use approved safety platforms/gantries when working above ground level. Get a second person to check periodically when only one person is working on access equipment or inside the body.
- The use of 'needle stick gloves' is recommended when changing brushes, using the Wanderhose/Littasnatch and when cleaning out the machine.

## Security of Equipment

As part of the maintenance programme it is recommended to check the security of various components (see 'B' Service in Operators Guide).

### FA-0051 Tightening Torque

Zinc Plated or Dacromet Bolts/setscrews & Nuts (Friction coefficient 0.12 assembled dry) or **Stainless Steel** (Friction coefficient 0.1 assembled lubricated with Molycote grease)

Generally bolts and nuts of the same grade material are used together.

**Bolts with metric coarse thread**

Thread	Property Class			
	4.8/5.6 Steel	8.8 Steel	10.9 Steel	12.9 Steel
	-	A1- 50 S/S	A2-70 S/S	A4- 80 S/S
M 2	0.13 Nm	0.35 Nm	0.5 Nm	0.6 Nm
	-	0.1 Nm	0.23 Nm	0.3 Nm
M 3	0.60 Nm	1.3 Nm	1.8 Nm	2.1 Nm
	-	0.4 Nm	0.8 Nm	1.1 Nm
M 4	1.4 Nm	3.0 Nm	4.5 Nm	5.0 Nm
	-	0.86 Nm	1.85 Nm	4.0 Nm
M 5	2.8 Nm	6 Nm	8.5 Nm	10 Nm
	-	1.6 Nm	3.6 Nm	4.8 Nm
M 6	4.3 Nm	10 Nm	16 Nm	20 Nm
	-	2.9 Nm	6.3 Nm	8.5 Nm
M 8	11.5 Nm	25 Nm	35 Nm	40 Nm
	-	7.1 Nm	15 Nm	20 Nm
M 10	23 Nm	48 Nm	70 Nm	80 Nm
	-	14 Nm	30 Nm	40 Nm
M 12	40 Nm	84 Nm	120 Nm	140 Nm
	-	24 Nm	50 Nm	70 Nm
M 14	60 Nm	135 Nm	195 Nm	230 Nm
	-	38 Nm	82 Nm	110 Nm
M 16	95 Nm	205 Nm	300 Nm	355 Nm
	-	58 Nm	125 Nm	165 Nm
M 18	130 Nm	290 Nm	420 Nm	485 Nm
	-	82 Nm	175 Nm	235 Nm
M 20	185 Nm	410 Nm	580 Nm	680 Nm
	-	115 Nm	245 Nm	375 Nm
M 22	250 Nm	560 Nm	800 Nm	940 Nm
	-	157 Nm	337 Nm	450 Nm
M 24	320 Nm	710 Nm	1000 Nm	1180 Nm
	-	-	-	-
M 27	-	1050 Nm	1480 Nm	1750 Nm
	-	-	-	-
M 30	-	1420 Nm	2030 Nm	2380 Nm
	-	-	-	-

**Bolts with metric fine thread**

Thread	Property Class		
	8.8 Steel	10.9 Steel	12.9 Steel
M 8 x 1	25 Nm	35 Nm	45 Nm
M 10 x 1,25	50 Nm	75 Nm	85 Nm
M 12 x 1,25	90 Nm	135 Nm	155 Nm
M 12 x 1,5	90 Nm	125 Nm	150 Nm
M 14 x 1,5	140 Nm	205 Nm	245 Nm
M 16 x 1,5	215 Nm	320 Nm	370 Nm
M 18 x 1,5	325 Nm	460 Nm	545 Nm
M 20 x 1,5	450 Nm	645 Nm	755 Nm
M 22 x 1,5	610 Nm	870 Nm	1020 Nm
M 24 x 2	765 Nm	1095 Nm	1280 Nm
M 27 x 2	1150 Nm	1600 Nm	1950 Nm
M 30 x 2	1600 Nm	2250 Nm	2700 Nm

These torques apply unless specified on the drawing.

For steel bolts used in conjunction with aluminium parts the following rule applies:

Use the next lower value from the column for property class 10.9.

This directive is valid for all thread diameters and grades.



(e.g. M10 grade 10.9 bolt clamping aluminium parts should be torque to 35 Nm not 70 Nm)

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## STANDARD REPAIR TIMES (SRT)

This Guide Detail the time taken to remove, refit and validate the item listed. Where the task is listed as 2 person the total time taken is shown in the table however certain aspects of the tasks may require 2 persons for the safe completion of the task.


	<b>Used oils and filters should be disposed of in accordance with the local waste disposal regulations.</b>
	<b>These procedures should be carried out by qualified service personnel.</b>

Area	Remove / Refit	Time Taken (Mins)	Special Tools Required	1 or 2 Persons
Hopper	Side Locker Door	10	none	1
Hopper	Side Locker Gas strut	10	none	1
Hopper	Side Locker door catch mechanism	10	none	1
Hopper	Side Door (each)	10	none	1
Hopper	Side Door Seal (each)	25	none	1
Hopper	Side Door lock and catch (each)	15	none	1
Hopper	Mesh Screen (each)	10	none	1
Hopper	Body Tip Cylinder	60	none	1
Hopper	Body tip Hinges	120	none	1
Hopper	Door Lock Hydraulic cylinder	25	none	1
Hopper	Door Lock Proximity switch (each)	10	none	1
Hopper	Rear Door Chute plate	30	none	1
Hopper	Wear Plate (each).	30	none	1
Hopper	Intake Duct	45	none	1
Hopper	Centre Baffle (Dual machines only).	15	none	1
Hopper	Rear Door	70	none	1
Hopper	Rear Door Cylinder	35	none	1
Hopper	Rear Door Seal	30	none	1
Hopper	Fan Case Seal	20	none	1
Hopper	Cowl Seal	45	none	1
Hopper	Cowl NAF	90	none	1
Hopper	Intake duct flap air cylinder	15	80 bar Pressure	1
Hopper	Intake duct flap Actuator	10	none	1
Hopper	Intake duct flap	10	TB1556	1
Hopper	Intake duct flap Shaft	60	none	1
Hopper	Flap shaft bush (inside body)	30	none	1
Hopper	Flap shaft bearing (outside body)	15	none	1
Subframe	Body tip mount.	40	none	1
Subframe	Water filter assembly	30	none	1
Subframe	Body prop	15	Workshop body prop PN:7030765	1
Subframe	Body prop release assembly	25	none	1

This Guide Detail the time taken to remove, refit and validate the item listed. Where the task is listed as 2 person the total time taken is shown in the table however certain aspects of the tasks may require 2 persons for the safe completion of the task.



**Used oils and filters should be disposed of in accordance with the local waste disposal regulations.**



**These procedures should be carried out by qualified service personnel.**

Area	Remove / Refit	Time Taken (Mins)	Special Tools Required	1 or 2 Persons
Sweepgear	Channel Brush position ram (Includes check and top up hydraulic oil)	30	None	1
Sweepgear	Channel brush curtain (each)	10	None	1
Sweepgear	Channel brush kick back fork (Includes replacement of spring)	20	None	1
Sweepgear	Channel brush lift ram	15	None	1
Sweepgear	Channel brush motor (with brush and brush plate removed). Includes check and top up of hydraulic oil	25	None	1
Sweepgear	Channel brush motor mounting (with motor, brush and brush plate removed)	10	None	1
Sweepgear	Brush plate (with brush removed)	10	None	1
Sweepgear	Brush head	10	None	1
Sweepgear	Nozzle assembly	30	None	1
Sweepgear	Nozzle carriage (Nozzle assembly removed)	15	None	1
Sweepgear	Nozzle rubbers	30	None	1
Sweepgear	Nozzle water jets (low pressure)	15	None	1
Sweepgear	Nozzle tow bar (With tow eye removed)	25	None	1
Sweepgear	Nozzle tow eye	10	None	1
Sweepgear	Nozzle box lift cylinder (each)	15	None	1
Sweepgear	Maxi gap cylinder	15	None	1
Sweepgear	Carriage wheel (Includes remove and refit auto lube pipe)	10	None	1
Sweepgear	Nozzle box bumper	10	None	1
Sweepgear	Trunking	10	None	1
Wide Sweep Brush	WSB Assembly (Dual and single machines )	90	None	1
Wide Sweep Brush	Brushes (Replace)	30	None	1
Wide Sweep Brush	Tow bar (Includes removal and refitting of WSB and brushes)	40	None	1
Wide Sweep Brush	Tow bar compensator (Includes removal and refitting of WSB, brushes and tow bar)	45	None	1
Wide Sweep Brush	Brush motor (Includes removal and refitting of brushes)	75	None	1

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**Used oils and filters should be disposed of in accordance with the local waste disposal regulations.**

**These procedures should be carried out by qualified service personnel.**

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Area	Remove / Refit	Time Taken (Mins)	Special Tools Required	1 or 2 Persons
Wide Sweep Brush	Brush motor adapter (Includes removal and refitting of brushes)	60	None	1
Wide Sweep Brush	Motor plate (Includes removal and refitting of brushes)	75	None	1
Wide Sweep Brush	WSB bearing	45	None	1
Wide Sweep Brush	Bearing plate (Includes swap bearing over)	45	None	1
Wide Sweep Brush	Slew ram (Includes removal and refitting of WSB, brushes and tow bar)	120	None	1
Wide Sweep Brush	WSB curtain (Replace)	25	None	1
Wide Sweep Brush	WSB low press spray bar (located under front bumper)	30	None	1
Wide Sweep Brush	WSB lift cylinder (each)	15	None	1
Wide Sweep Brush	Suspension regulator (Includes set up - each)	25	None	1
Wander Hose	Trunking	15	None	1
Wander Hose	Boom	240	None	1
Wander Hose	Turret (Boom removed)	15	None	1
Wander Hose	Turret bearing (Boom and turret removed)	15	None	1
Wander Hose	Boom gaiter (Boom removed)	15	None	1
Mesh Shaker	Shaker cylinder (each)	25	None	1
Mesh Shaker	Push button	10	None	1
Hydraulics	Hydraulic valve bank (Includes check and top up hydraulic oil level)	70	None	1
Hydraulics	Rear door lock valve block (Includes check and top up hydraulic oil level)	30	None	1
Hydraulics	Supa-wash valve block (Includes check and top up hydraulic oil level)	45	None	1
Pneumatic	Vitalizer	20	None	1
Pneumatic	Low pressure air switch	15	None	1
Pneumatic	Recirc. Valve (each)	30	None	1
Pneumatic	Pneumatic valve (PV) (each)	15	None	1
Pneumatic	WSB regulator (Suspension regulator - each)	25	None	1
Pneumatic	Powa-save control regulator	35	None	1

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**Used oils and filters should be disposed of in accordance with the local waste disposal regulations.**





**These procedures should be carried out by qualified service personnel.**

Area	Remove / Refit	Time Taken (Mins)	Special Tools Required	1 or 2 Persons
Water System	Hose reel	60	None	1
Water System	Low pressure spray bar (Located under front spray bar)	30	None	1
Water System	Low pressure nozzle (Includes cleaning nozzle (All nozzles)	10	None	1
Water System	Low pressure gutter spray (Includes cleaning nozzles)	20	None	1
Water System	High pressure spray bar (Located under front bumper)	30	None	1
Water System	High pressure spray bar mounting (Spray bar removed)	15	None	1
Water System	Suction box low pressure nozzles	15	None	1
Water System	Suction box high pressure spray bar	10	None	1
Water System	Nozzles (Includes cleaning)	15	None	1
Water System	Wander hose low pressure nozzle (Includes cleaning)	10	None	1
Water System	Wander hose low pressure water tap	15	None	1
Water System	Supa-wash pump (Includes check and top up hydraulic oil level)	60	None	1
Water System	Water solenoids (Includes cleaning seal and valve - each)	15	None	1
Water System	High pressure water tap (Front high pressure spray bar and suction box high pressure spray bar - each)	20	None	1
Water System	Water filler neck filter (hydrant filler)	10	None	1
Water System	Water tank suction filter	15	None	1
Water System	Water tank breather	25	None	1
Water System	Water filter assembly (R/H rear)	30	None	1
Electrical System	Centre Console (Including software update and test)	20	TB1570	1
Electrical System	JVM Screen (Including software update and test)	30	TB1555 & TB1570	1
Electrical System	Keypad Node (Including software update and test)	20	None	1
Electrical System	Pendant (Including software update and test)	15	None	1

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	<b>Used oils and filters should be disposed of in accordance with the local waste disposal regulations.</b>
	<b>These procedures should be carried out by qualified service personnel.</b>

Area	Remove / Refit	Time Taken (Mins)	Special Tools Required	1 or 2 Persons
Electrical System	Multi-camera Module (Including software update and test)	20	None	1
Electrical System	Systems Locker Node (Including software update and test)	15	None	1
Electrical System	Powapack Node (Including software update and test)	15	None	1
Electrical System	Subframe Node (Including software update and test)	25	None	1
Electrical System	High Current Node (Including software update and test - each)	25	None	1
Electrical System	Pneumatic Valve Island (Including software update and test - each)	30	None	1
Electrical System	Emergency hydraulic pump (Including test)	45	None	1
Electrical System	Rear beacon (each)	15	None	1
Engine Skid Unit	Engine tub assembly	480	None	1
Maintenance	50 Hour Service	90	None	1
Maintenance	'A' Service	180	None	1
Maintenance	'B' Service	300	None	1
Maintenance	'C' Service	420	None	1
Maintenance	'D' Service	500	None	1

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**VT - Twin Engine**

**AUXILIARY ENGINE**

**Throttle Settings**

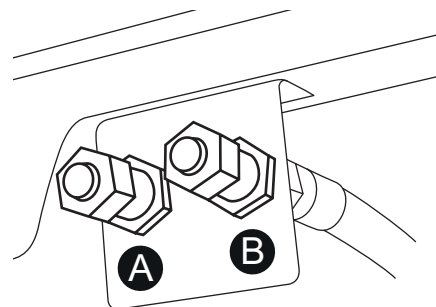
These engines have their own ECU and the speeds are preset and can only be checked. (Except for Dieselmax Stage 3a).

- 1 Raise the body.
- 2 With the fan safety flap closed and a plate (suitably secured with clamps) completely blanking the fan inlet.
- 3 Start the engine and allow to warm up.
- 4 Check the tickover speed and the maximum flight speeds. If these are incorrect, they must be reset by an authorised distributor.
- 5 **NOTE** : Stop the engine before removing the fan inlet blanking plate and lowering the body.

ENGINE TYPE	JOHNSTON PART NO.	IDLE SPEED Rev./Min.	(Max Off Load) Rev./Min.
JCB Ecomax 444 Standard Power Engine 24V (55kW - S3b)	7017176	850	2000
JCB Ecomax 444 Standard Power Engine 12V (55kW - S3b)	7028433	850	2000
JCB Ecomax 444 High Power Engine 24V (93kW - S3b)	7017181	850	2000
JCB Ecomax 444 High Power Engine 12V (93kW - S3b)	7025710	850	2000
John Deere 4045HF285 High Power Engine 12V only (86kW - Tier 3)	283791-12	850	2000
JCB Dieselmax 444 Standard Power Engine 24V (85kW - S3a)	7028407	900	2200
JCB Ecomax 444 High Power Engine 24V (93kW - Tier 4)	7039194	850	2000
JCB Ecomax 444 High Power Engine 12V (93kW - Tier 4)	7039193	850	2000

**Auxiliary Engine and Gearbox Drain Plugs**

The drain plugs for the auxiliary engine (B) and gearbox (A) are located on a bracket near to the Powapack access ladder.



M02MA-058

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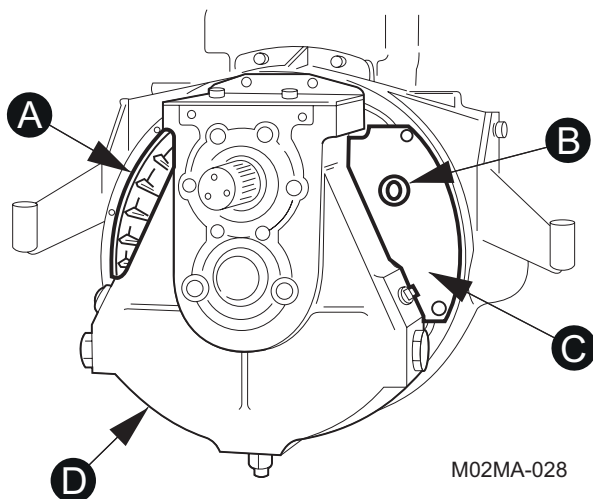
## VT - Twin Engine

### FLUID FLYWHEEL

The fluid flywheel transmits power from the engine to the gearbox. Its design allows for the minimum of maintenance, minimal mechanical wear and superior longevity to the remainder of the transmission system. With the correct attention it should last the life of the sweeper.

#### Fluid Flywheel Filling Ports

(Viewed with fan case and fan not shown for clarity)



- (A) Flywheel with side cover (C) removed.
- (B) Flywheel filler/inspection port visible through side cover sight hole.
- (C) Flywheel side cover.
- (D) Step-up gearbox.

#### Maintenance

After the first 50 hours operation check the fluid level; this operation must be carried out with the unit cold. Repeat this check every 500 hours. The fluid flywheel is fitted with a fusible plug which melts at 198°C (recognised by four equally spaced indentations round the hexagonal socket). Oil should be replaced after 4,000 hours operation.

#### Draining Instructions

- Ensure the flywheel is cool before removing the level filler plug
- Using a propriety vacuum pump or oil extractor/syringe, drain the oil from the flywheel.

#### Filling Instructions

Ensure the flywheel's filler port aligns with sight hole (B) in either of the two flywheel side covers (C), approximately 2 o'clock and 10 o'clock.

Remove the side cover and spacers. Remove filler plug using a 5/16 AF allen key and fill with the correct oil until it reaches the level of the port. (See Operators Guide page OG6:17 for oil specification)

During filling, carefully rock the flywheel to ensure that no air pockets form below the oil level.

**DO NOT OVERFILL AS THIS WILL CAUSE THE UNIT TO OVERHEAT AND RAPID SEAL DETERIORATION WILL OCCUR**

Replace the filler plug using thread sealant to ensure a good seal. Visually check for oil leaks and replace the flywheel cover.

**VT - Twin Engine**
**HYDRAULICS**

**Safety Notice**

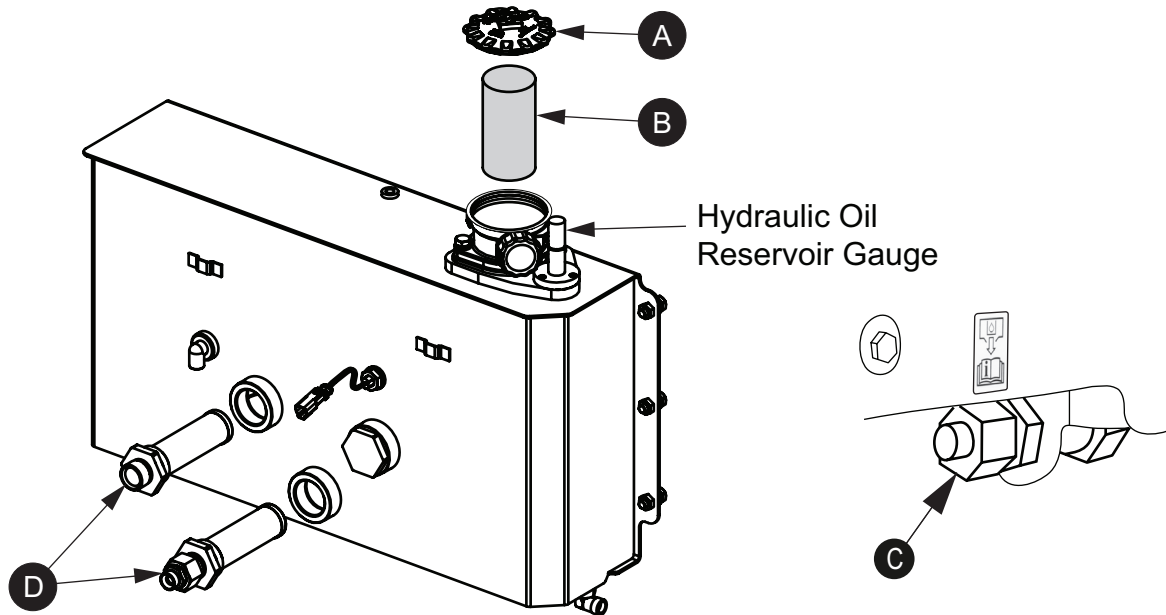

**Before changing the filter ensure the oil is cold.  
Before removing the return filter. Ensure no pressure is present by allowing the system to rest for a short time after turning off the equipment.**

**Hydraulic Oil Reservoir**
**Return Filter**

The filter should be changed every 1000 hours, however there is an integral filter indicator on the side of the filter head and, should this indicate red whilst the suction fan is operating, i.e. body raised, then the filter is contaminated and requires changing at an earlier interval.

**Renewing the Return Filter**

Unscrew cover (A) and lift out the cartridge element (B). Fit new cartridge and screw on the cover



M02MA-055

**Renewing the Suction Filters**
**Note: Drain Oil Before Removing Suction Filters.**

The oil can be drained by removing the drain plug (C) located under the systems locker or by using a propriety vacuum pump or oil extractor/syringe.

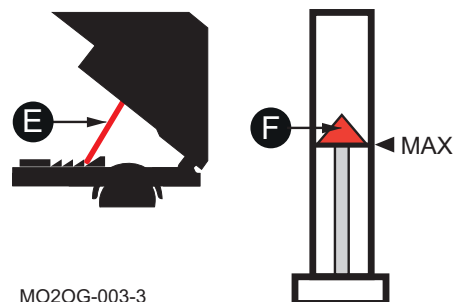
The filters (D) should be changed whilst the system is empty.

**System Refilling**

The system capacity dry is 61 litres.

Raise the body and engage the body prop (E) in its highest position. The bottom of the level indicator (F) should not be higher than the Maximum line as shown on the gauge.

It is important that the correct level is maintained as under filling can adversely affect the heat dissipation rate of the oil, whilst over filling can cause oil to overflow when the body is lowered.



M02OG-003-3



**VS - Twin Engine**

**HYDRAULICS**



**Safety Notice**



**Before changing the filter ensure the oil is cold.  
Before removing the return filter. Ensure no pressure is present by allowing the system to rest for a short time after turning off the equipment.**

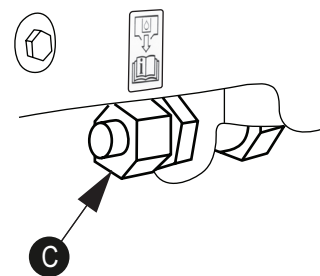
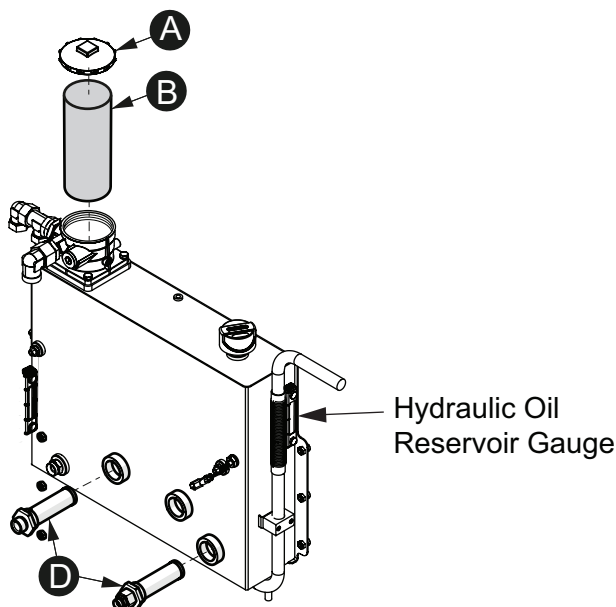
**Hydraulic Oil Reservoir**

**Return Filter**

The filter should be changed every 1000 hours, however there is an integral filter indicator on the side of the filter head and, should this indicate red whilst the suction fan is operating, i.e. body raised, then the filter is contaminated and requires changing at an earlier interval.

**Renewing the Return Filter**

Unscrew cover (A) and lift out the cartridge element (B). Fit new cartridge and screw on the cover



M02MA-056

**Renewing the Suction Filters**

**Note: Drain Oil Before Removing Suction Filters.**

The oil can be drained by removing the drain plug (C) located under the systems locker or by using a propriety vacuum pump or oil extractor/syringe.

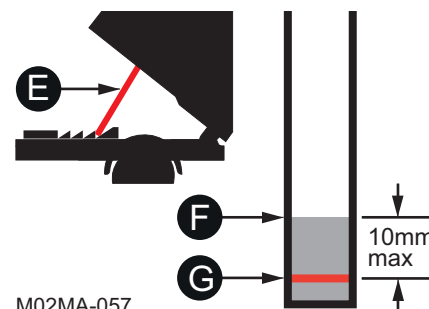
The filters (D) should be changed whilst the system is empty.

**System Refilling**

The system capacity dry is 61 litres.

Raise the body and engage the body prop (E) in its highest position. The level (F) should be 10mm above the lower red line (G) on the gauge.

It is important that the correct level is maintained as under filling can adversely affect the heat dissipation rate of the oil, whilst over filling can cause oil to overflow when the body is lowered.



M02MA-057

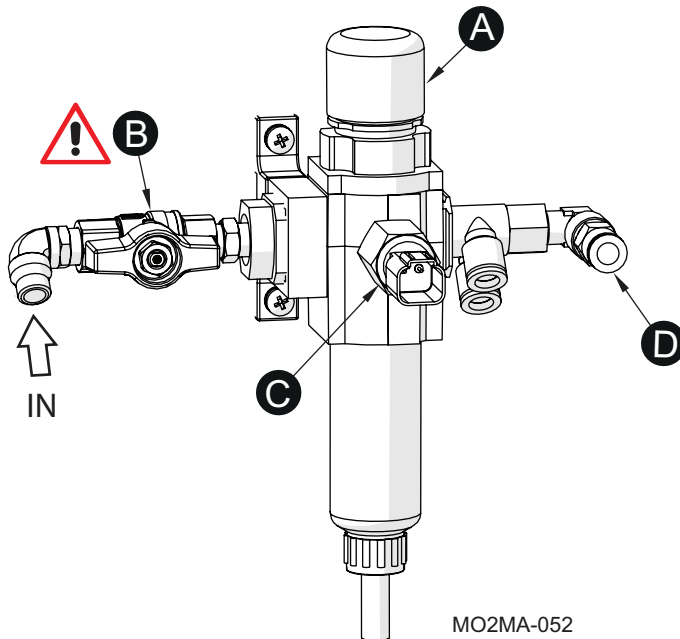
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**PNEUMATICS****Safety Notice**

The shut off valve must be used when servicing any item on the air system

**Filter Regulator Unit**

Comprises of a combined air filter/pressure regulator. It is mounted in the systems locker.



MO2MA-052

**The Air Filter Regulator Unit incorporates The following features;-**

- (A) Pressure regulator ensures the equipment is not over pressurised. It is factory set and sealed at 7.5 bar (108 psi).
- (B) Isolation/drain valve, automatically dumps accumulated water when the machine is shut down or when the air supply is isolated by the shut off valve
- (C) Pressure switch is fitted to illuminate the low air pressure warning lamp on the JVM.
- (D) Service connection enabling the system to be charged using a workshop air supply.

**Pneumatic Cylinder Maintenance**

Periodically inspect the cylinder rods for damage, blemishes or build up of material such as tar, cement, paint etc. The rods can be cleaned with fine wire wool and/or spirit and should be kept clean to ensure long seal life.

**Hydraulic Cylinder Maintenance**

Observe the notes on damage etc. described under pneumatic cylinders.  
Avoid playing the water washdown hose or high pressure hand lance over the body tip cylinder when in the fully raised condition.

## CLEANING THE VEHICLE



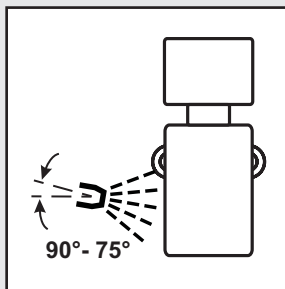
## Safety Precautions



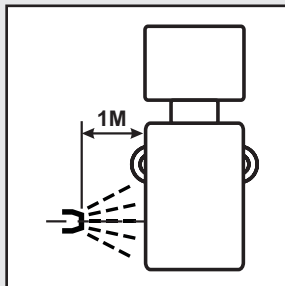
- Care **MUST** be taken not to damage sign written areas when cleaning. See special notes for cleaning vehicles with vinyl livery below.
- **ALWAYS** keep pressure equipment in good condition and regularly maintained, particularly at joints and unions.
- The use of safety goggles is recommended in case of deflected spray/debris.
- **NEVER** direct a high pressure nozzle at the skin as the fluid may penetrate the underlying tissue etc. and cause serious injury.

## Special notes for cleaning vehicles with vinyl livery or reflective markings

The Supawash hand lance or similar can be used for cleaning areas of the vehicle with vinyl or reflective markings subject to the following precautions being taken



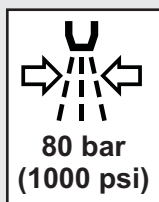
- The spray angle should be maintained between 90 and 75 degrees to the panel ✓



- The nozzle distance should be greater than 1 metre minimum from the panel ✓



- The spray pattern should be a wide fan pattern ✓



- The nozzle pressure should be 80 bar (1000PSI) max ✓
- The water temperature should not exceed 60 °C ✓
- Do not use acid or solvent cleaning solutions ✗

## Alternative Methods

- Do Clean with a sponge or soft cloth using cold or warm water with a soap or detergent, followed by a cold water rinse ✓

**VS - Twin Engine****ADDITIONAL INFORMATION - VS****Safety Notice**

**Important ensure that the Safety Precautions shown at the front of this chapter are observed when working on the equipment**

**Regular Maintenance**

It is impossible to over emphasise the importance of regular maintenance, inspection and running adjustments to maintain efficiency and obtain trouble free service from the machine.

Attention is drawn to the recommendation in the Chassis Handbook relating to the post delivery check over.

**Engine Management ECU**

Please note that the chassis manufacturers Engine Management System has been set in accordance with our requirements. If a malfunction of the ECU occurs and the component replaced then the parameters would require downloading and reset in the new component.

Failure to do this will cause the machine to malfunction.

**VS - Single Engine**

**Transmission Pump Oil Filter Replacement**

This filter should be changed every 500 hours.

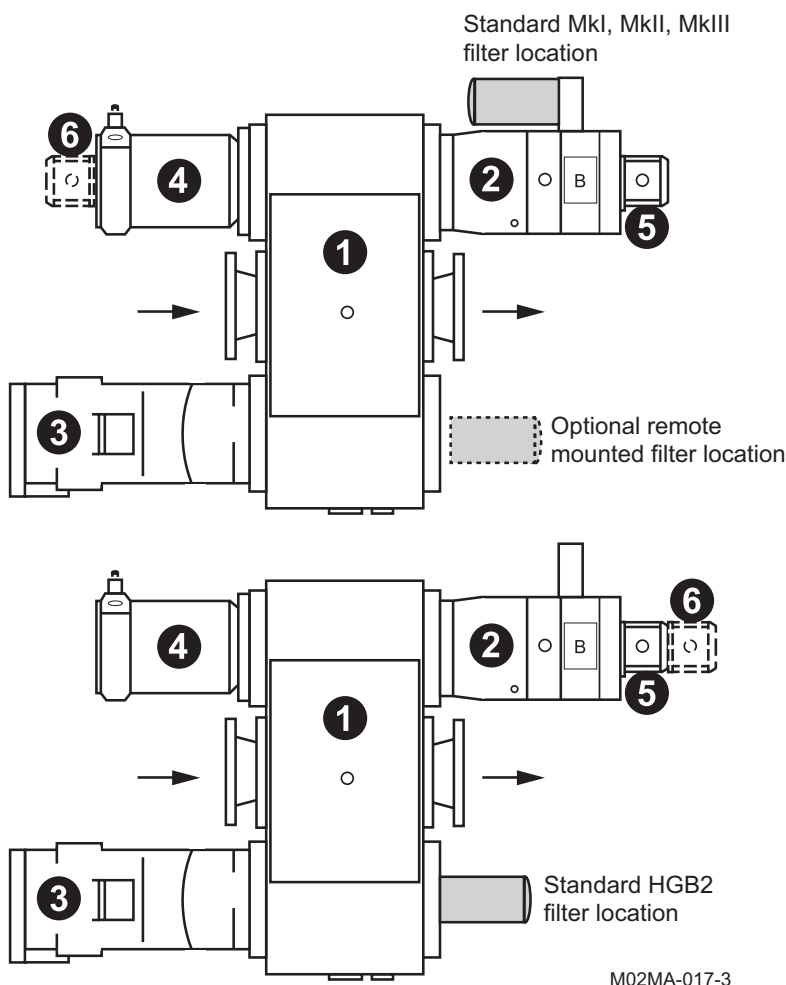
With the vehicle engine not running, remove the filter alongside the transmission pump.

Fit a new filter as quickly as possible to minimise the loss of any hydraulic oil.

**Note:**

This is a high pressure filter. Ensure the correct filter is fitted, 'Pattern Parts' may not be suitable.

Start engine and engage Hydrodrive. Allow system to tick over for a few minutes to purge air from the circuits.



**KEY**

- 1 Hydrodrive gearbox.
- 2 Vehicle propulsion pump.
- 3 Vehicle propulsion motor
- 4 Exhauster fan pump.
- 5 Sweeping function pump (SF).
- 6 Additional/optional equipment pump (AOP).

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## CHAPTER

## 2

## Hydraulic System

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## HYDRAULIC SYSTEM - INTRODUCTION



### Safety Notice



- **Do not remove any hydraulic components without first ensuring that any residual pressure has decayed. If in doubt ask.**
- **Only competent trained personnel should work on this equipment.**

### General Description

The hydraulic system may be divided into four hydraulic circuits fed from a common hydraulic reservoir.

- 1 Sweep system and load discharge. (VT and VS)
- 2 Options system for Supawash etc. (VT and VS)
- 3 Fan Drive (VS Only)
- 4 Transmission system. (VS Only)

Hydraulic filtration is provided by suction filters within the hydraulic tank, together with replaceable type 'in line' return filter mounted externally on the upper face of the hydraulic tank.

## CIRCUIT PRESSURES

### Test points

Test points are provided on the hydraulic system to carry out pressure checks.

Identification	Function	Machine Type
H -15Z6	Boost pressure, Reverse pressure and Antiskid	VS
H -15Z7	Pump control pressure	VS
H -15Z3	Boost pressure, Forward pressure	VS
H -15Z2	Boost pressure	VS
H -15Z5	Motor control pressure	VS
H -15Z7	Coast pressure	VS
H - 1Z2	Sweep system	VT & VS
H -13Z5	Fan drive system	VS
H -12Z2	Options system i.e. Supawash	VT & VS
H - 8Z2	Discharge functions	VT & VS
H -14Z2	Rear Wanderhose/Powaboom	VT & VS

### Body Discharge System

To set system pressures, select option 12 from the main menu.

#### System Pressure:

Select option 1 from menu 4.12 and follow the on screen prompts:

Connect a suitable 250 bar gauge to test point H-8Z2 on the discharge system block on the LH side of the machine. Once connected, acknowledge this by pressing the rotary encoder on the display.

Start the engine and run at the appropriate speed and acknowledge by pressing the rotary encoder on the display.

Check pressure and adjust if required relief valve H-8V3 on the discharge system block to 190bar. Acknowledge the pressure is set by pressing the rotary encoder on the display.

**Do not run the pressure test for more than 30 seconds.**



**Hopper Lower Pressure:**

Select option 2 from menu 4.12 and follow the on screen prompts:

Connect a suitable 250 bar gauge to test point H-8Z2 on the discharge system block on the LH side of the machine in front of the rear wheels. Once connected, acknowledge this by pressing the rotary encoder on the display.

Start the engine and run at the appropriate speed and acknowledge by pressing the rotary encoder on the display.

Check pressure and adjust if required relief valve H-9V2 on the discharge system block to 110 bar. Acknowledge the pressure is set by pressing the rotary encoder on the display.

**Do not run the pressure test for more than 30 seconds.**

**Sweeping System****Supawash / Front Brush Option Pressure:**

First remove the hose from port MA on the Supawash block located on the LHS of the Subframe in front of the centre cross-member. Plug port MA and plug the end of the hose.

Select option 3 from menu 4.12 and follow the on screen prompts:

Connect a suitable 250 bar gauge to test point H-12Z2 on the Supawash block. Once connected, acknowledge this by pressing the rotary encoder on the display.

Start the engine and run at the appropriate speed and acknowledge by pressing the rotary encoder on the display.

Check pressure and adjust if required relief valve H-12V2 on the Supawash block to 220bar. Acknowledge the pressure is set by pressing the rotary encoder on the display.

Reconnect the hydraulic hose.

**Do not run the pressure test for more than 30 seconds.**

**Powaboom / Rear Wanderhose Option Pressure**

Select option 4 from menu 4.12 and follow the on screen prompts:

Connect a suitable 250 bar gauge to test point H-14Z2 on the Powaboom block located on the RHS of the Subframe rear cross-member. Once connected, acknowledge this by pressing the rotary encoder on the display.

Start the engine and run at the appropriate speed and acknowledge by pressing the rotary encoder on the display.

**Check Hydraulic Pressure Powaboom**

Check and adjust if required relief valve H-14V2 (See Hydraulic Circuit Sheet 10 C-3) Acknowledge the pressure is set by pressing the rotary encoder on the display.

Reconnect the hydraulic hose.

**Do not run the pressure test for more than 30 seconds.**

## ***VS - Single Engine***

### **Suction Fan Pressure - VS**

TBD

### **Fan Drive System - VS**

Fit a 250 bar minimum pressure gauge to test point P1 on block H-13Z1 located in front of the fancase in the Powapack tub.

Open rear door, open inlet flap.

Run the truck engine and engage Hydrodrive, engage work mode and raise the engine speed to maximum 1700 rpm.

There should be a nominal reading of 20 bar which is the standby pressure. If this requires adjustment see chapter 22 VS section.

Operate the fan switch in the Boost Mode. The pressure reading should be 210 bar. If this requires adjustment, the relief valve is shown in Chapter 1.

### HYDRAULIC SYSTEM - INITIAL OPERATION

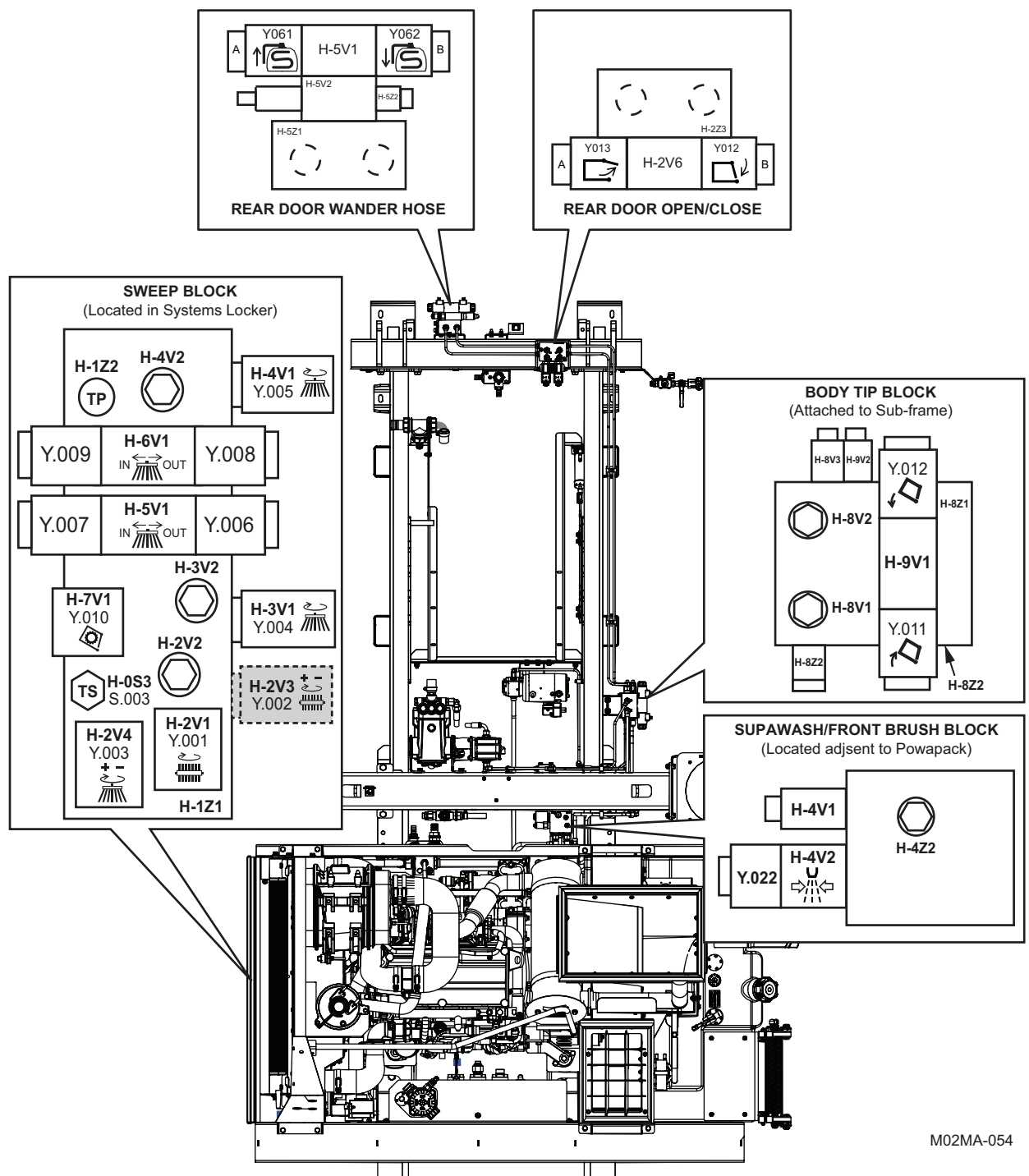
When the hydraulic system is first commissioned, or after changing a hydraulic hose on the hydraulic pumps on the body discharge circuit, it is necessary to purge any air from the system.

Firstly operate the electric discharge pump to open the rear door.

Then start the auxiliary engine on VT units, or engage the hydrodrive gearbox on VS units, and open and close the rear door three times to ensure all air is purged from the system.

Failure to carry out this procedure may cause the rear door locks to function incorrectly.

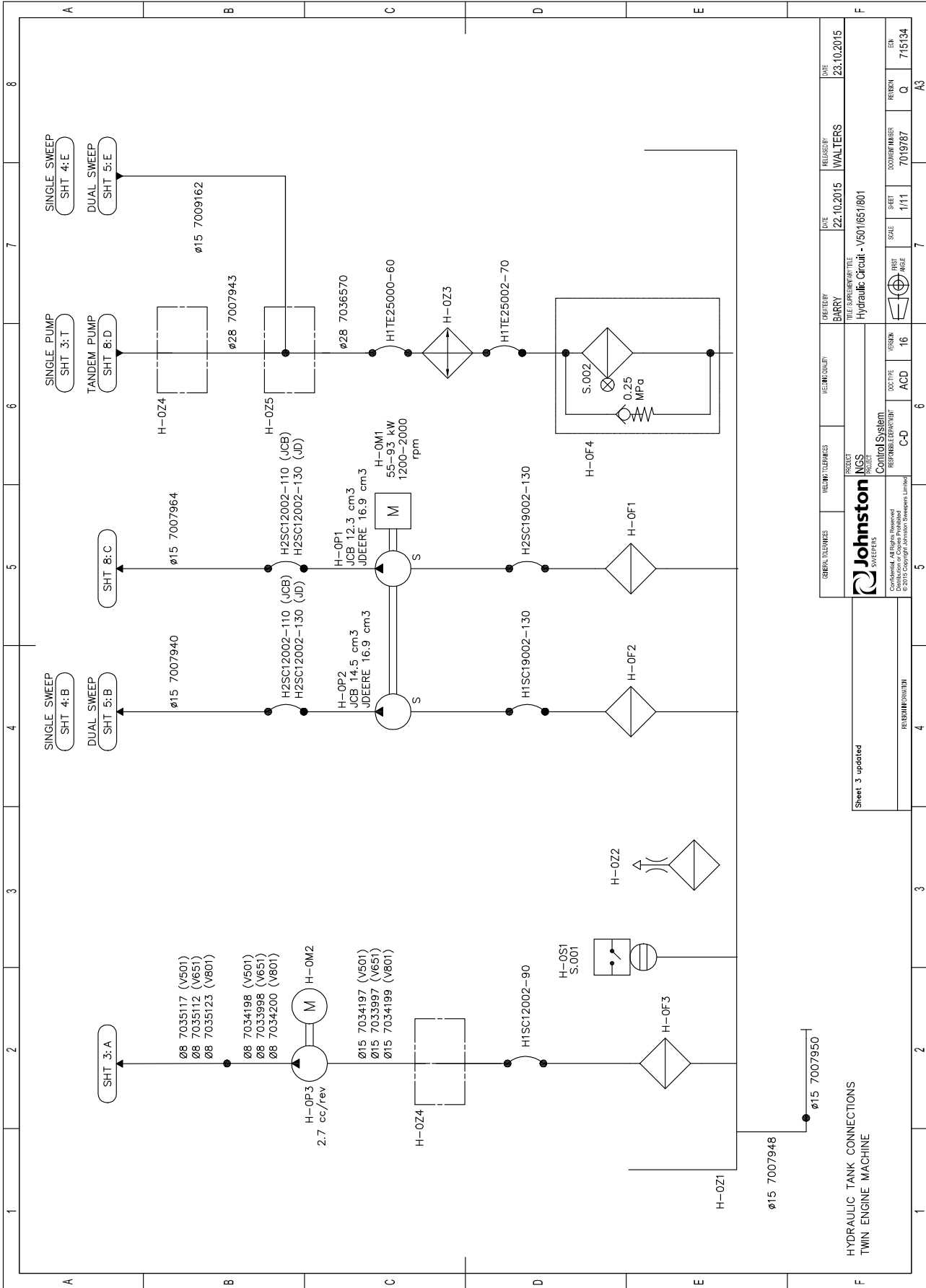
### VALVE IDENTIFICATION



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M02MA-054

Hydraulic Tank Connections - Twin Engine Machine - Sheet 1/11 Rev Q

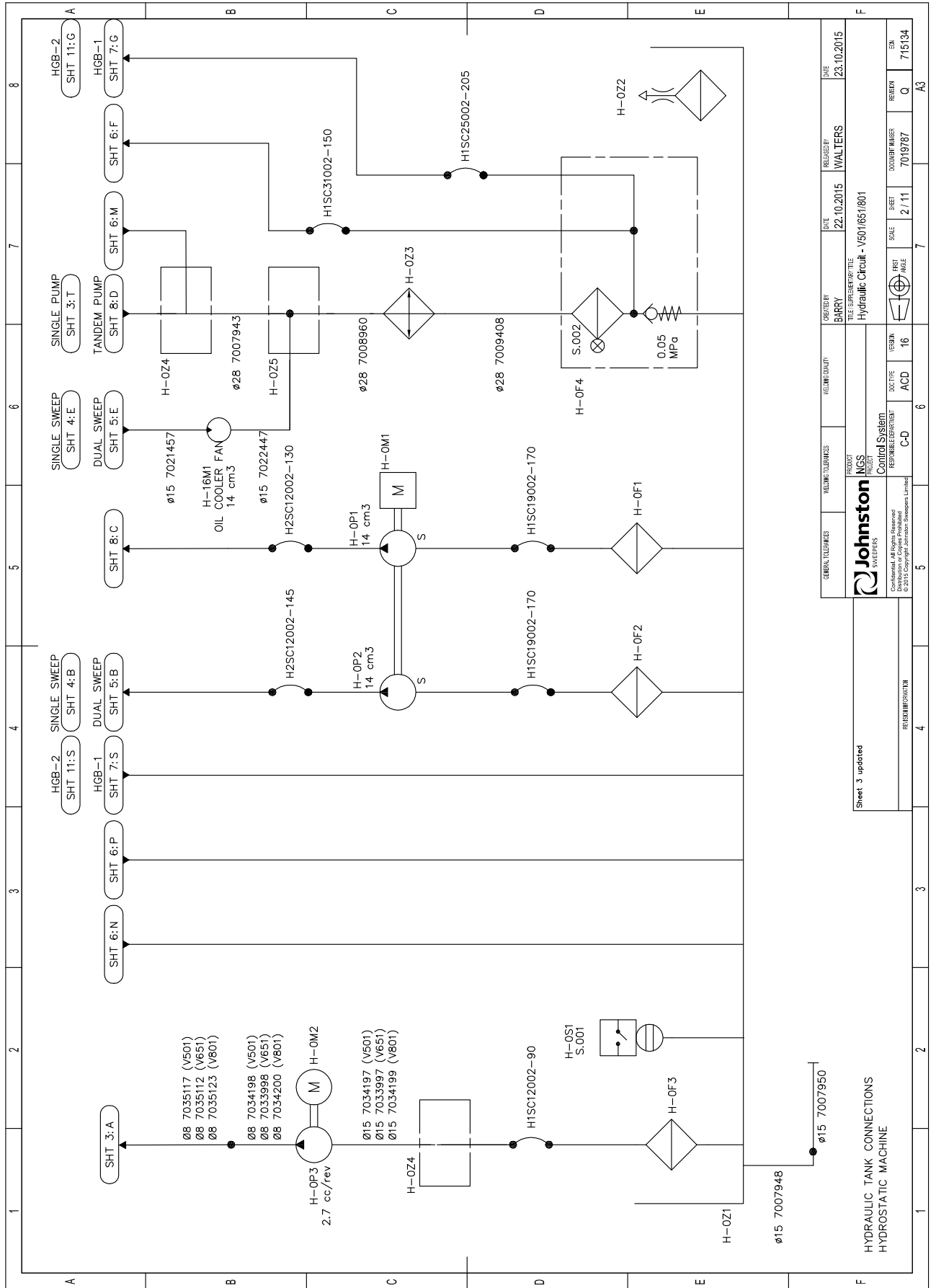


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PRODUCT Control System			PROJECT RESPIRABLE EXHAUST	SHEET 1/11	DRAWING NUMBER 7019787	EN 715134
CONFIDENTIAL - All Rights Reserved © 2015 Copyright Johnston Sweepers Limited			DOCTYPE ACD	SCALE 1:1	REVISION Q	EN 715134
SHEET 3 updated			REVISION 16	7		
REVISIONS C-D			A3	6		

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Hydraulic Tank Connections - Hydrostatic Machine - Sheet 2/11 Rev Q

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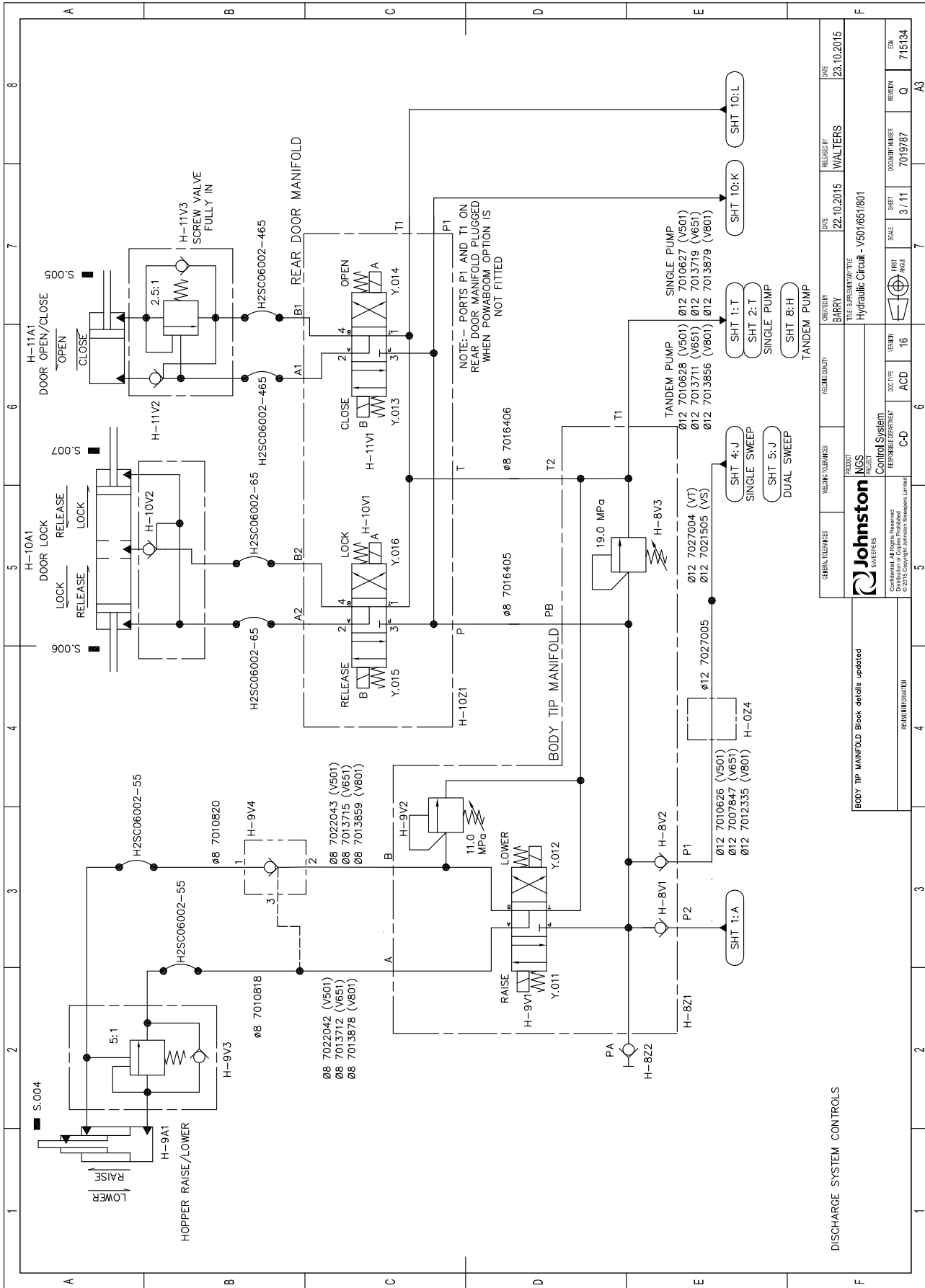


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C-D						
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ACD						
VERSION						
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EN						
715194						
A3						

Sheet 3 updated  
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HYDRAULIC TANK CONNECTIONS  
 HYDROSTATIC MACHINE

Discharge System Controls - Sheet 3/11 Rev Q



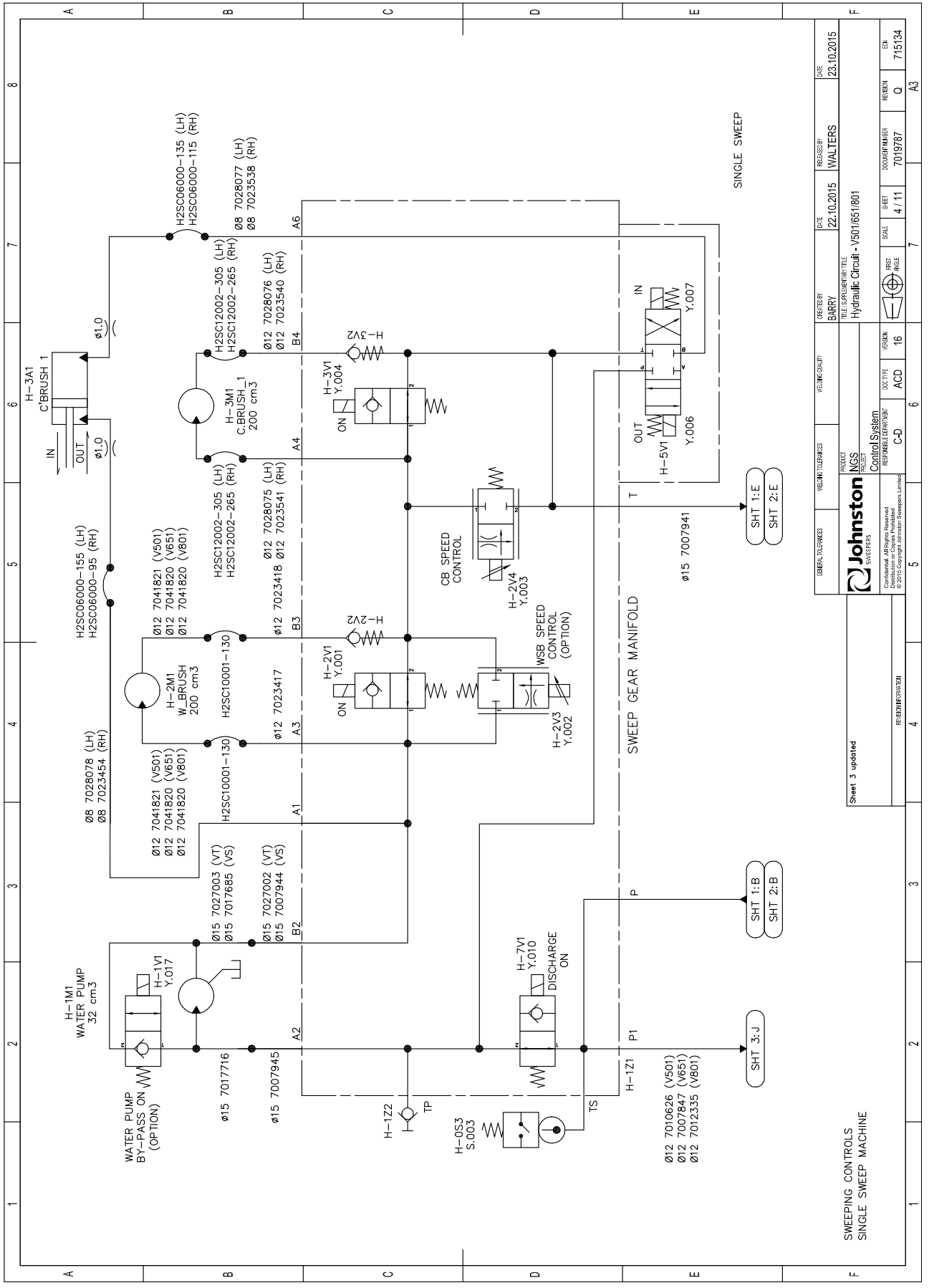
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Confidential. All Rights Reserved © 2015 Copyright Johnston Sweepers Limited		Control System	Hydraulic Circuit - V501/651/801	
REVISION	DESCRIPTION	DATE	BY	APP'D
16	ACC	3/11	7019787	Q
16	ACC	3/11	7019787	Q
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DISCHARGE SYSTEM CONTROLS

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Single Sweep Controls - Sheet 4/11 Rev Q

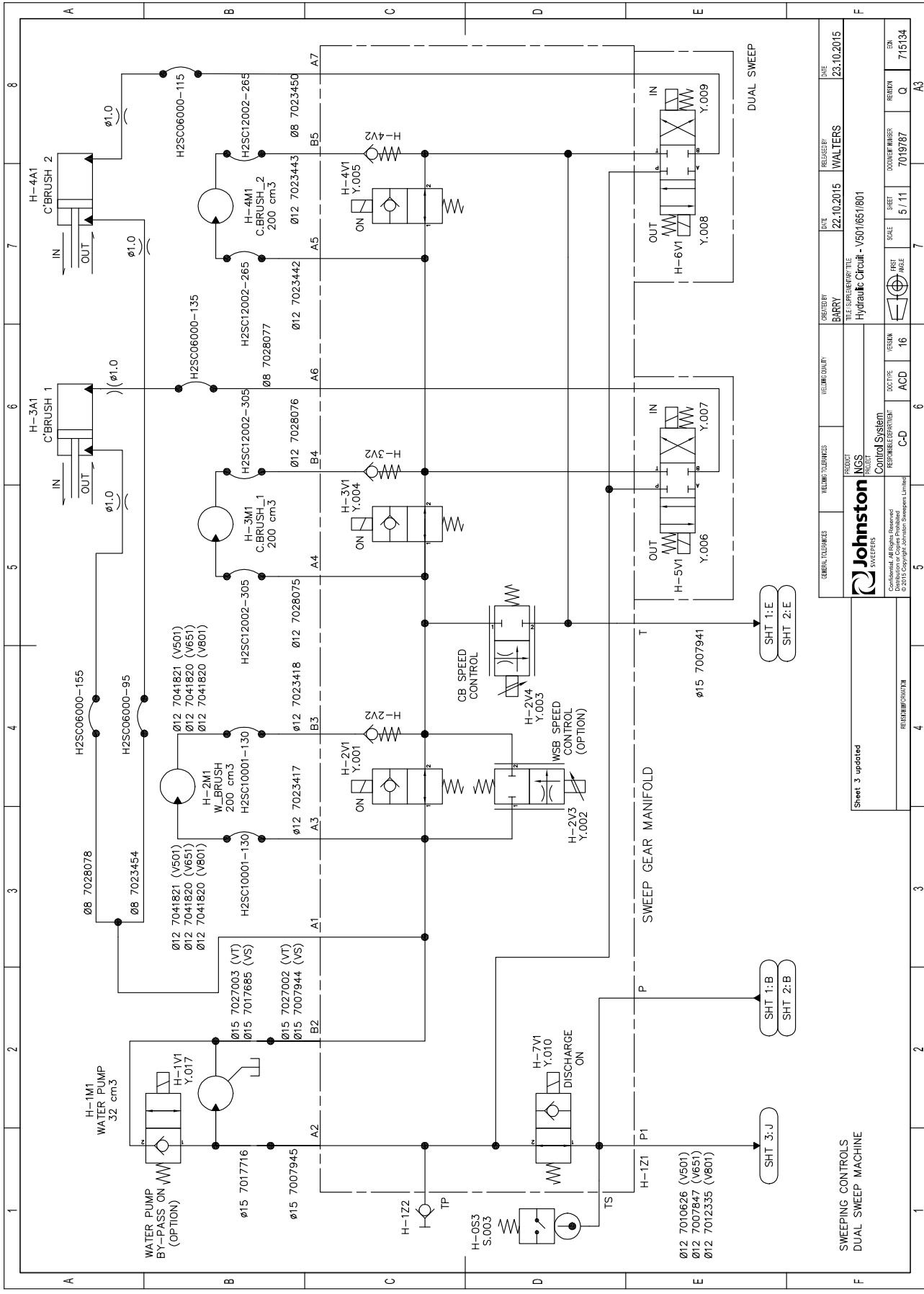
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PROJECT: MGS Control System						
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Sheet 3 updated	REVISIONS/NOTES
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### Dual Sweep Controls - Sheet 5/11 Rev Q

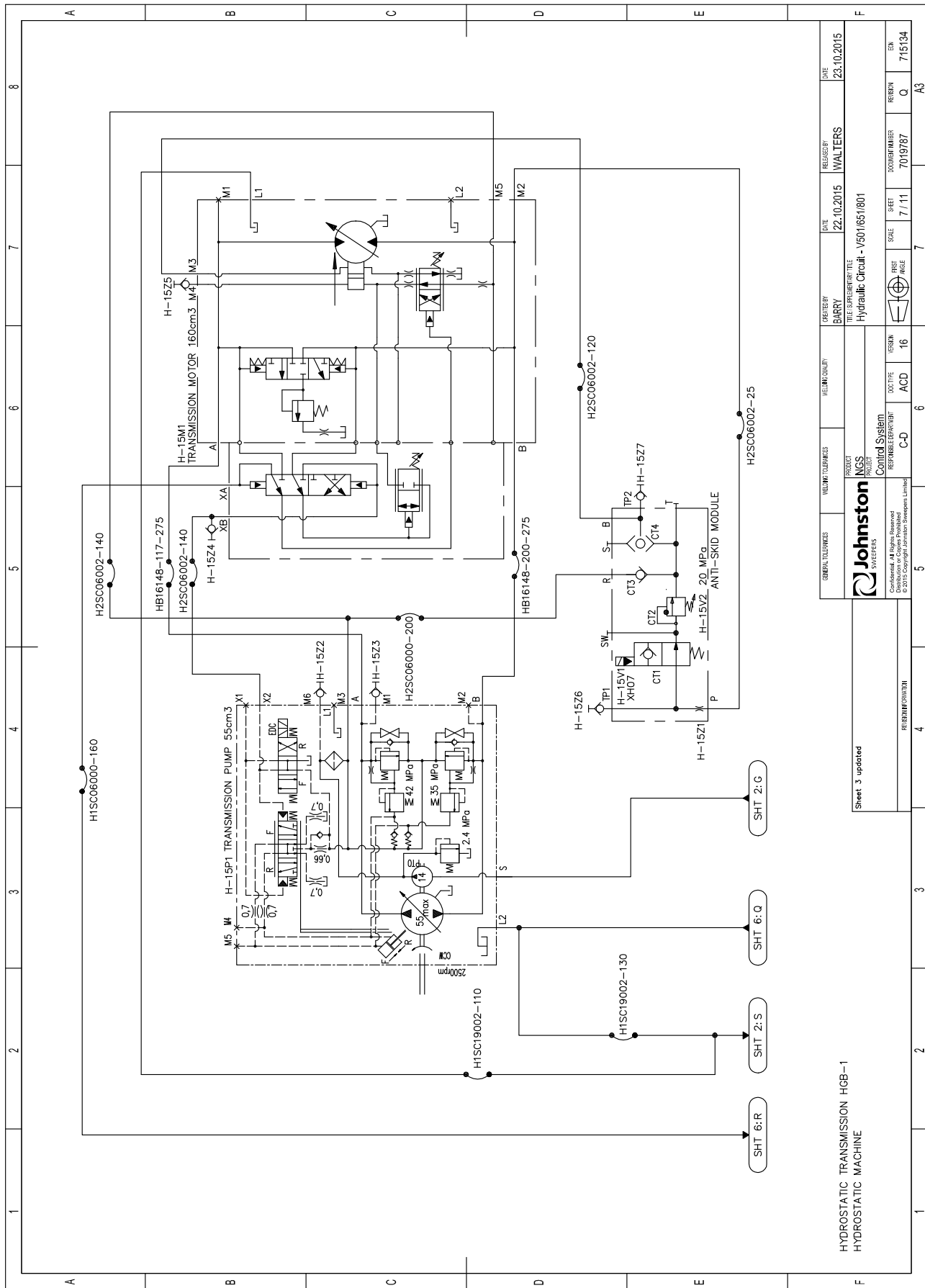



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Confidential All Rights Reserved © 2015 Copyright Johnston Sweepers Limited		RESPONSIBLE DEPARTMENT C-D		DRAWING NUMBER 7019787	SHEET 5 / 11	SCALE 1:1	ENH 715134
Sheet 3 updated		REVISION/QUANTITY		ACC		A3	
SWEEP CONTROLS		DUAL SWEEP MACHINE		SHT 1:A		SHT 2:E	

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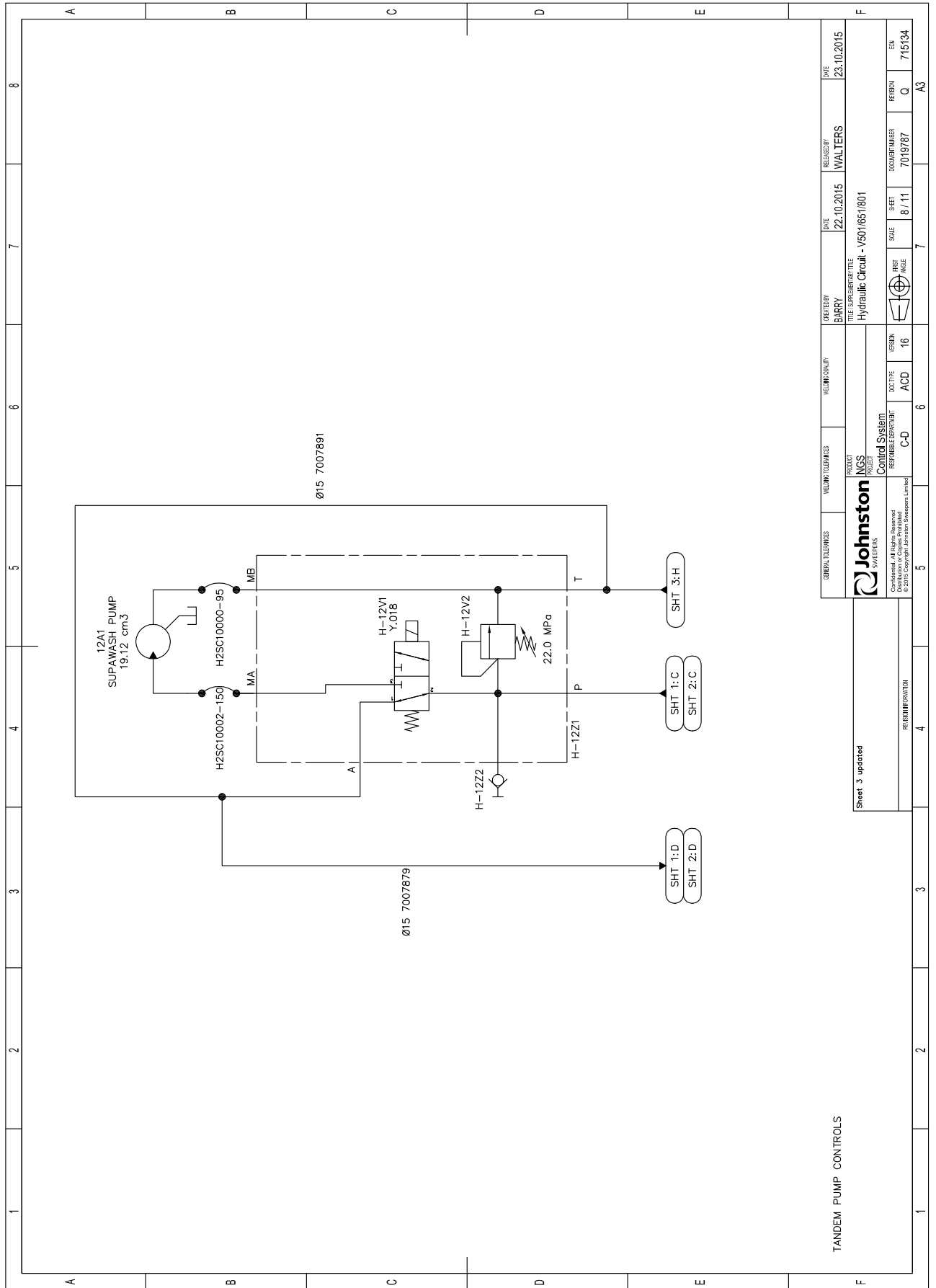
**Hydrostatic Transmission (HGB-1) - Sheet 7/11 Rev Q**


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 <b>Johnston</b> SWEETERS Confirmed. All Rights Reserved © 2015 Copyright Johnston Sweepers Limited			TITLE / SUPPLEMENT / FILE Hydraulic Circuit - V501651/801	DRAWING NUMBER 7019787	SHEET 7 / 11	DATE 23.10.2015
PRODUCT NGS Control System			DOC TYPE C-D	VERSION 16	SCALE A3	REVISION Q
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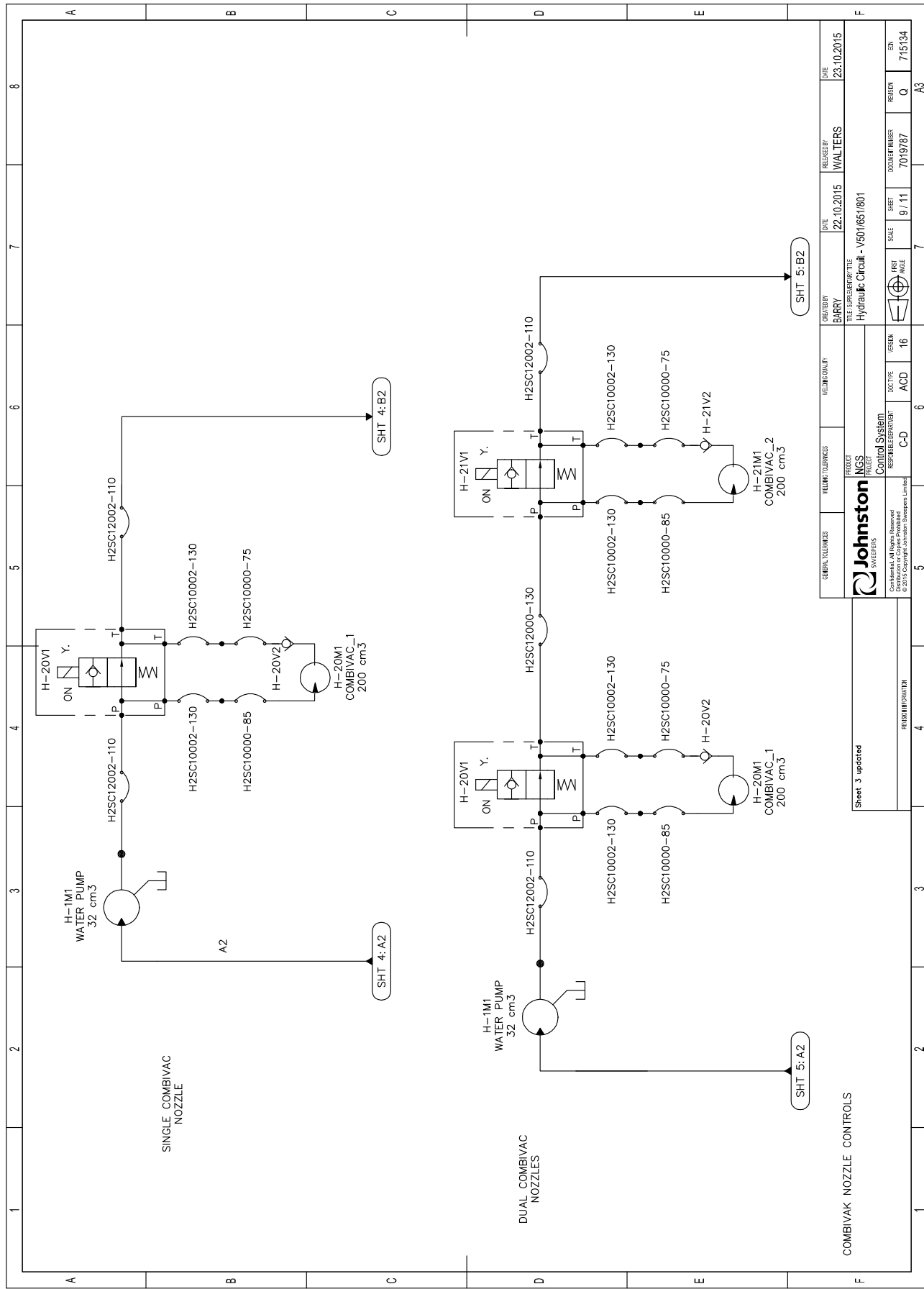
Tandem Pump Controls - Sheet 8/11 Rev Q

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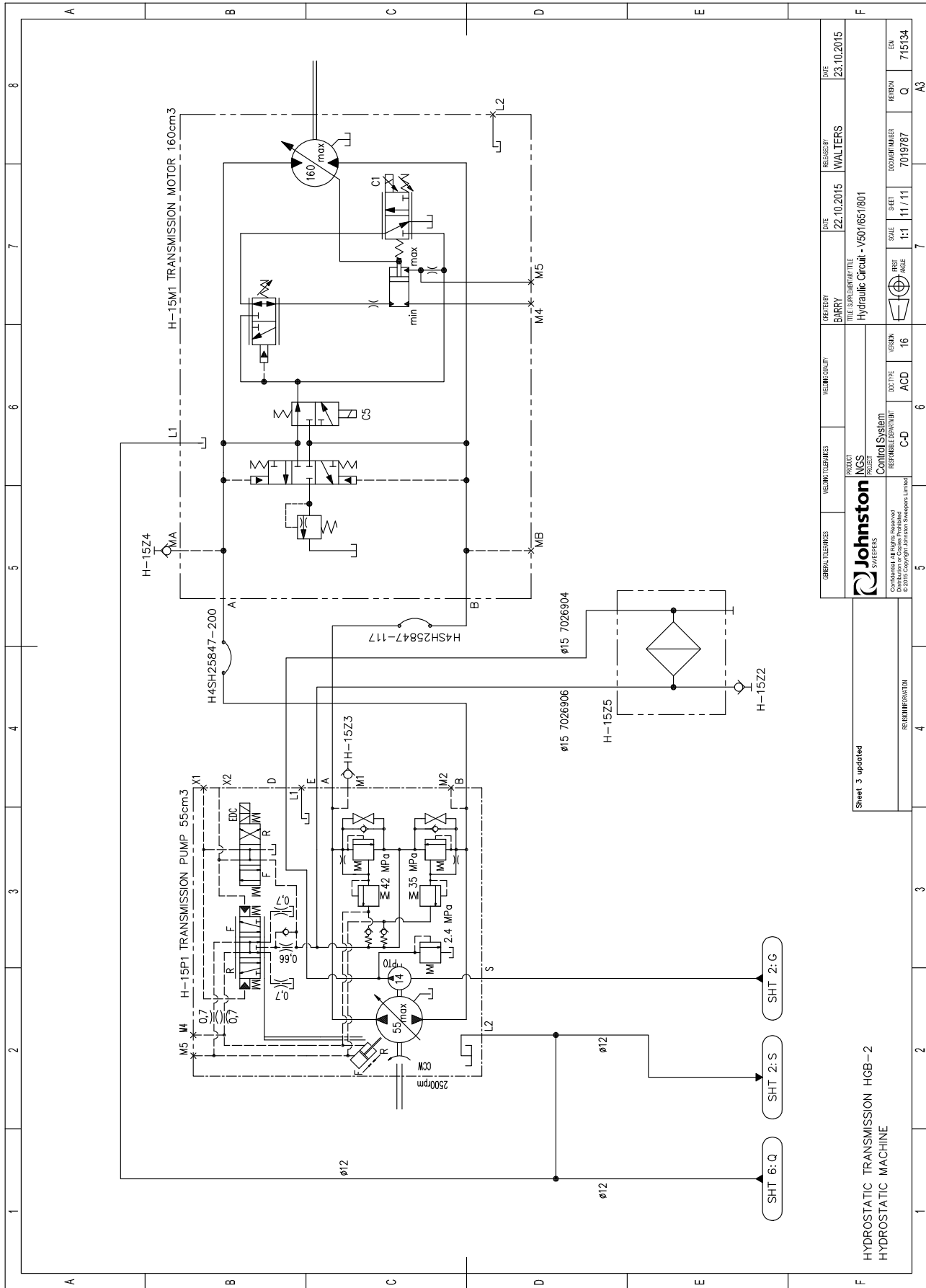
Combivak Nozzle Controls - Sheet 9/11 Rev Q



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Hydrostatic Transmission (HGB-2) - Sheet 11/11 Rev Q



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C-D		16		7019787		Q		715134	
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Sheet 3 updated									
HYDROSTATIC TRANSMISSION HGB-2		HYDROSTATIC MACHINE							

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## CHAPTER

## 3

**Electrical System****Table of Contents**

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## INTRODUCTION

### General Description

The system is integrated with that of the chassis in that it shares its battery and power source. The auxiliary engine is equipped with a second alternator to supplement power generation. The system activates all operational functions of the machine.

### System Description

The electrical system circuit diagrams are sub divided into modular sub circuits all of which use the same identification number ending with a revision alpha code, i.e. **A, B, C** etc. All circuit diagrams are up-issued simultaneously irrespective to change, so they will all display the identical alpha code.

To assist fault finding and troubleshooting, the solenoids have an LED in the electrical connection plug which illuminate when power is achieved.

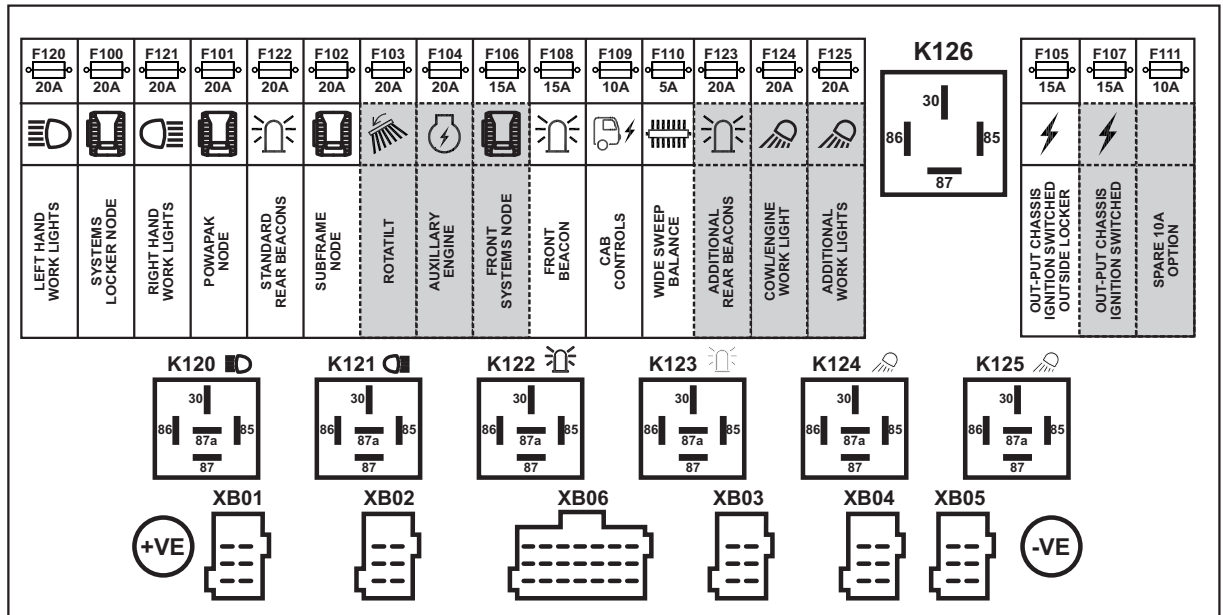
The electrical system is protected by various fuses.

**NOTE: A wiring schematic pdf, with hyper-links to aid fault finding, is included on the Technical Manual CD supplied with this machine.**



### COMPONENT IDENTIFICATION

#### Systems Locker



M02MA-006-3

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## JVM (JOHNSTON VISUAL MODULE)

### Engine/Chassis Control

#### CANbus J1939

CAN stands for Controller Area Network. It represents dedicated wiring that connects the control units of a vehicle (ECU). For the V Range sweepers the J1939 CANbus connects the auxiliary engine ECU to the in cab Centre Console unit allowing control of engine RPM and other engine data to be exchanged.

The system permits the vehicle's various on-board electronic systems to instantaneously exchange huge amounts of data.

It represents a two-way communication system that is widely used in vehicles, mainly due to the reduction in the number of conductors and the amount of interference.

#### System CAN - CANOPEN

CANopen is also a CAN based higher layer protocol as is J1939.

It provides a standardized network which can be fully customised with "off the shelf" controllers for high speed communication with limited wiring required.

It is already used in numerous applications including machine control, maritime and power generation as well as off-road vehicles.

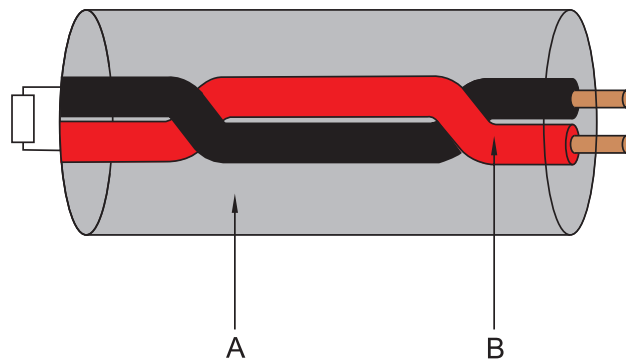
CANopen used on the roadsweeper application allows for a finite and customized control of the sweeper, as well as providing clear visual display of operation and data capture to monitor sweeper use and performance.

#### CAN Line Setup

The cable used for the 'CAN' line fitted on the vehicle is a twisted pair of cables (B).

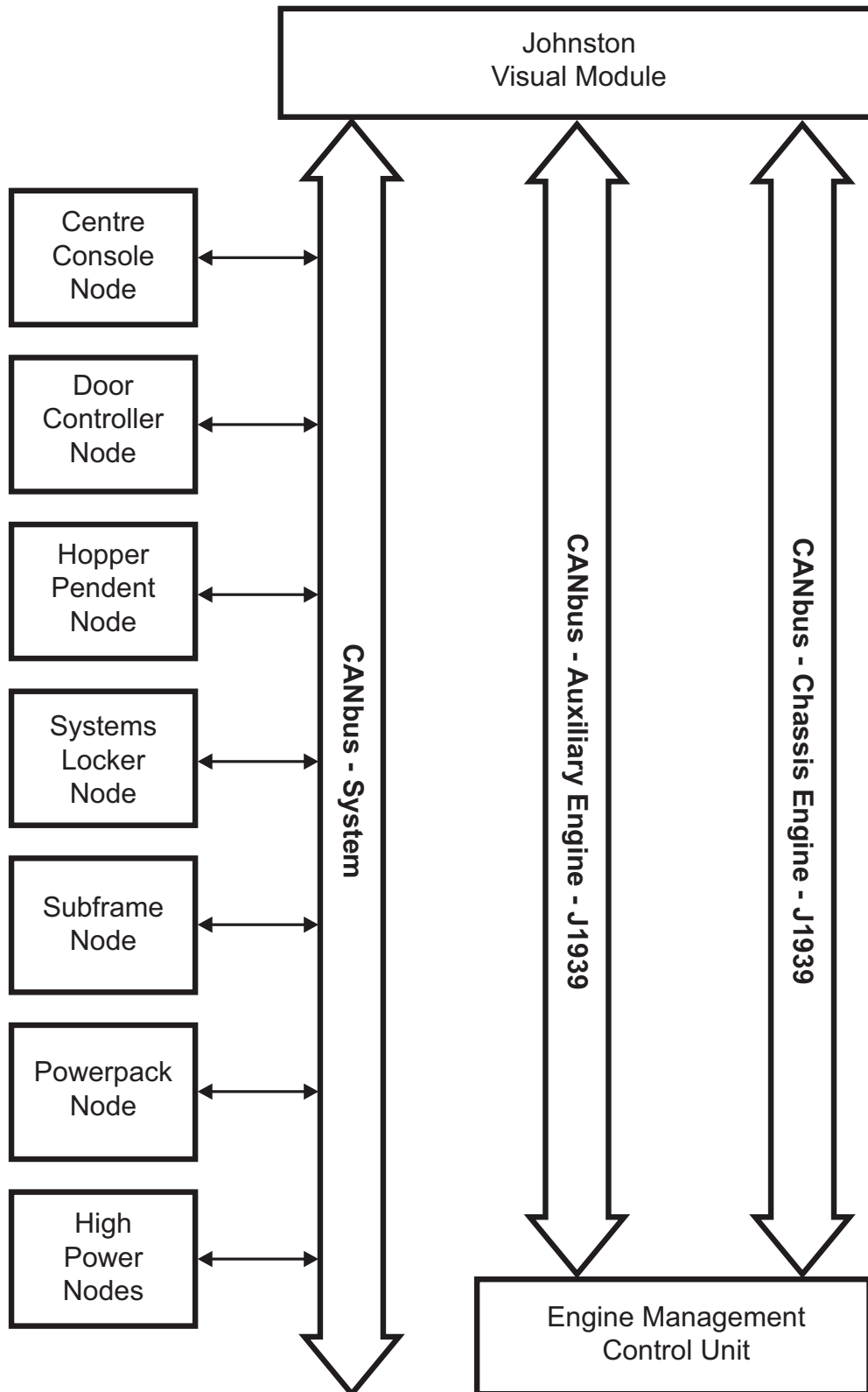
It has these characteristics in order to eliminate any electrical disturbance on the signals.

The sheathing (A) is grey in colour.



M02OG-107

VDB Communication Line Schematic



M02OG118

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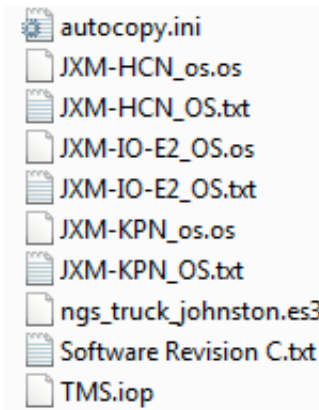
## How To Update Control System Software

### Step One: Prepare USB Flash Drive

- 1.1. Obtain the “TMS\_SoftwareServicePackage\_ *partnumber* .x.zip” from Johnston Customer Service.  
The last digit of the file name will indicate the Software Pack Revision level.  
**For example:** TMS\_SoftwareServicePackage\_ *partnumber* \_C.zip = **Revision level C.**
- 1.2. Unzip the file: “TMS\_SoftwareServicePackage\_ *partnumber* .x.zip”
- 1.3. Erase ALL data contained on the USB Flash drive (Part No: 7022225) see below.

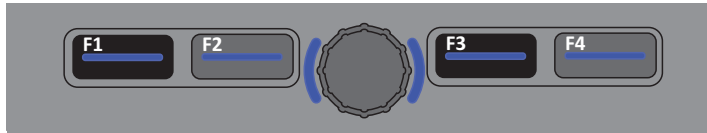


- 1.4. Add the contents of the folder “TMS\_SoftwareServicePackage\_ *partnumber* .x.zip” to the USB flash drive.
- 1.5. Check to ensure that the USB flash drive file structure is identical to the image shown below.



**Step Two: Software Download**

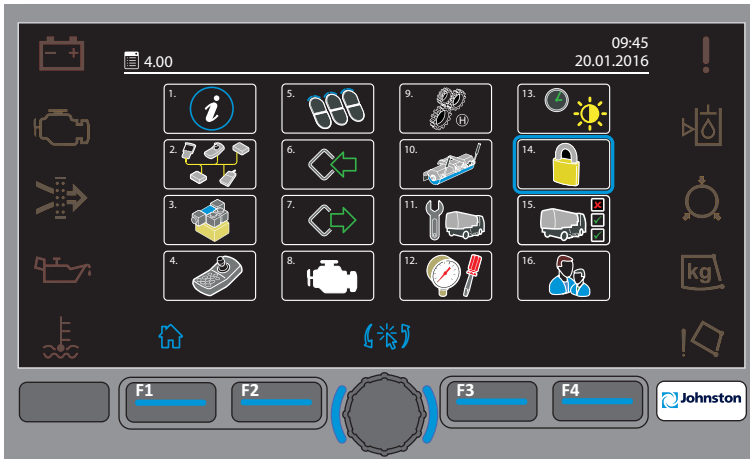
- 2.1. Ensure the ignition is off.
- 2.2. Carefully open the rubber cover on the front of the JVM to expose the USB port.
- 2.3. Insert the USB flash drive into USB port.



- 2.4. Press and hold buttons F1 & F3 on the display;
- 2.5. Switch on the ignition.
- 2.6. Release buttons F1 & F3 when the following text appears;  
*“start operating system in STOP mode”*
- 2.7. Software will now download from the USB flash drive automatically.  
Note: Software download can take up to 10 minutes depending on the size of the update.  
  
**\*\*\*\*NEVER SWITCH OFF THE IGNITION DURING THE DOWNLOAD PROCESS\*\*\*\***
- 2.8. Once the software download is complete the following message will appear;  
*“Press any key or touch screen to continue”*  
  
Press any of the JVM buttons to continue.
- 2.9. The JVM will now reboot. Once rebooted, turn off ignition of machine to complete update.  
  
**\*\*\*\*First shutdown of machine after software update may take 10 min.  
Never isolate the vehicle or disconnect the harness while this takes place\*\*\*\***
- 2.10. Continue to step three.

**Step Three: Passcode Entry**

3.1. Press button F3 to access the Main Menu 4.0.



**Menu 4.0 Main Menu**

3.2. Select Menu 4.14 - Security

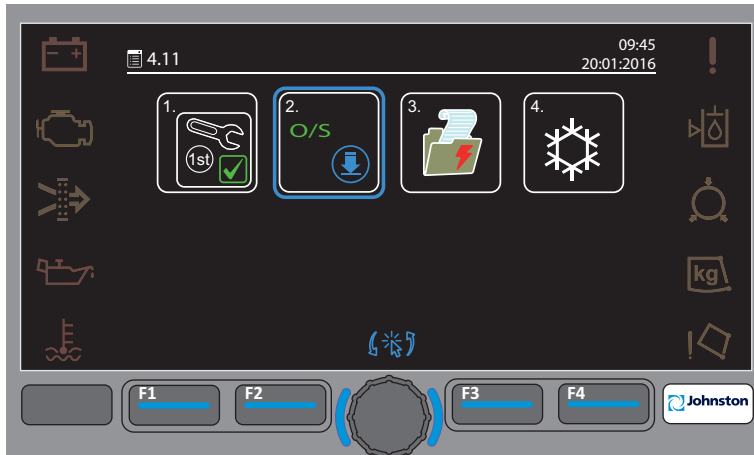


**Menu 4.14 System Security**

- 3.3. Enter the "Service" passcode: 88335.
- 3.4. Press the 'enter' key (F4) to complete the passcode entry.
- 3.5. Press F1 to Exit the menu .

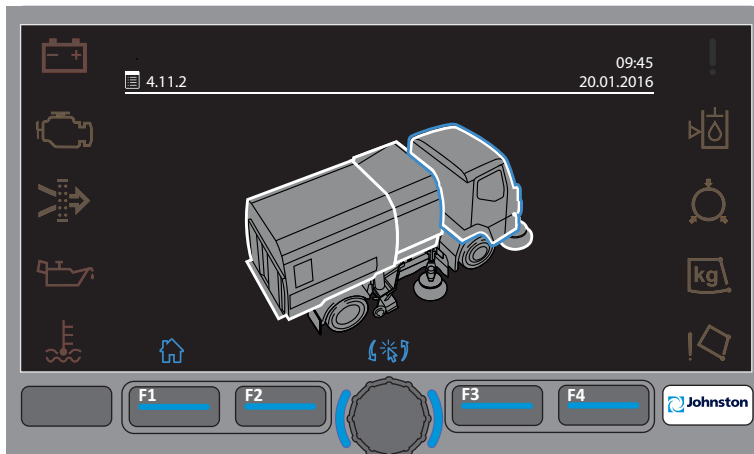
**Step Four: Operating System (OS) Update**

4.1. Go to Menu 4.11 – Service, and select option 2, OS Downloads.



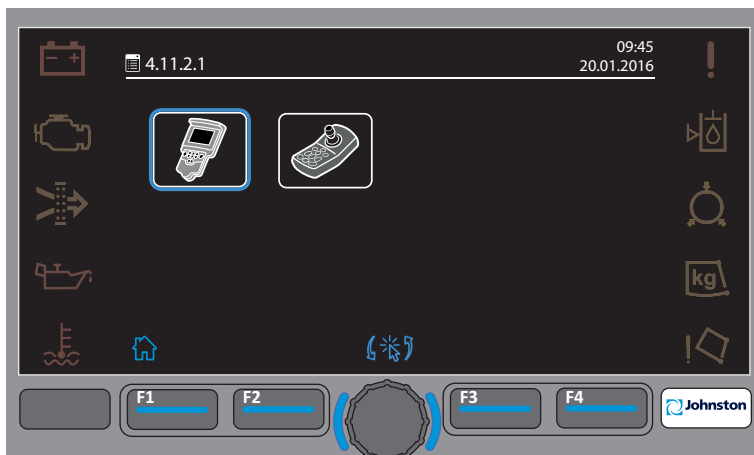
**Figure Five: Menu 4.11 Service**

4.2. Move the blue halo and select (for example) the machine cab area.



**Figure Six: Menu 4.11.2 Cab Area Selection**

4.2. Move the blue halo and select the Centre Console cab Node.



**Figure Seven: Menu 4.11.2.1 Select Centre Console Node.**

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**Step Four: Operating System (OS) Update (continued)**

- 4.3. Compare the “Current OS” version with the “New OS” version numbers. If the OS version numbers are different, then the Node OS must be updated.

**Menu 4.11.2.1.2 Centre Console OS Download**

- 4.4. To download the “New OS”, press the centre button on the JVM to start the OS update. The blue bar will indicate the progress of the download.

**NOTE: DO NOT SWITCH OFF THE IGNITION, OR ISOLATE THE VEHICLE DURING THE DOWNLOAD PROCESS**

- 4.5. Once the green tick appears, the OS download is complete.
- 4.7. Repeat the process for the Door Controller IO Node, System Locker IO Node, Powapak IO Node, Hopper IO Node and the High Current Nodes.
- 4.8. Once all OS Updates are complete, exit from the Menus and switch off the ignition.
- 4.9. Wait one minute and then switch on the ignition.
- 4.10. Remove USB stick from the JVM display.

**Clear Emergency Codes**

If during operation any emergency codes (EMCY) codes are raised these can be checked using the 4.2 menu or by pressing the soft key F2 and selecting the area and node where the error occurred.

The codes are cleared by automatically by turning off the ignition and allowing the JVM to shut down.

**Note:**

When a fault is repeated 4 consecutive times during one ignition cycle the affected Node will automatically shut down the output. The output will automatically be re-activated after the ignition has been turned off and back on.



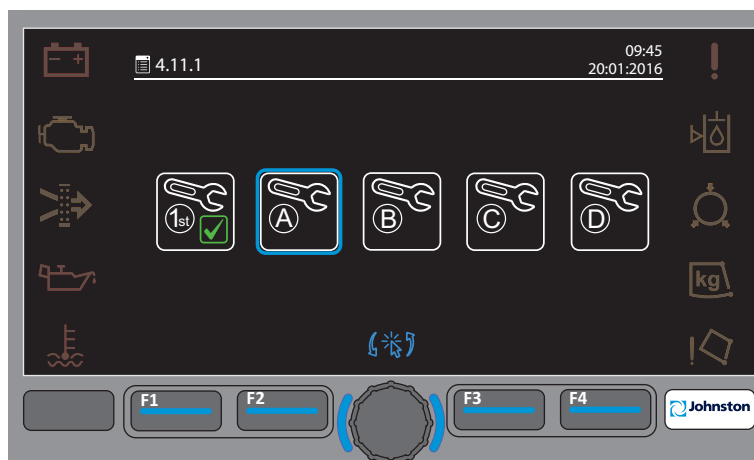
### Resetting the Service Acknowledgment indicator

Once a service has been completed it must be acknowledged on the JVM display by resetting the service indicator as follows:

1. Switch on the ignition.
2. Select the Main Menu (F3) on the JVM display.
3. Rotate the Encoder to highlight sub menu 4.11 (Service) and press to select.



4. Rotate the Encoder to highlight sub menu 4.11.1 (Service Acknowledgment) and press to select.



5. The JVM will automatically select which service requires acknowledgment and highlights the corresponding icon with the blue halo.
6. To acknowledge that the service has been completed, press and hold the F3 button + the F4 button for five seconds.
7. A green tick will appear to confirm the service is complete.
8. Exit from the menus and switch off the ignition.

## Data Capture Download

The V Range has a standard feature of 'Data Capture'. Data capture allows the vehicle operator or fleet manager to view or download data logged information directly onto a Johnston USB stick and download onto any PC.

Customer benefits of data capture are;

Allows fleet managers/operators of V Range machines to monitor how individual V Range machines are operated and identifies which machines are operating efficiently through engine RPM, fuel economy and other data values.

### The data capture features are:

- Total engine hours;
- Engine hours today;
- Total distance travelled sweeping (Optional);
- Distance travelled sweeping today (Optional);
- Avg Fuel Consumption to Date;
- Avg fuel consumption today;
- Hours at last service;
- Hours until next service.

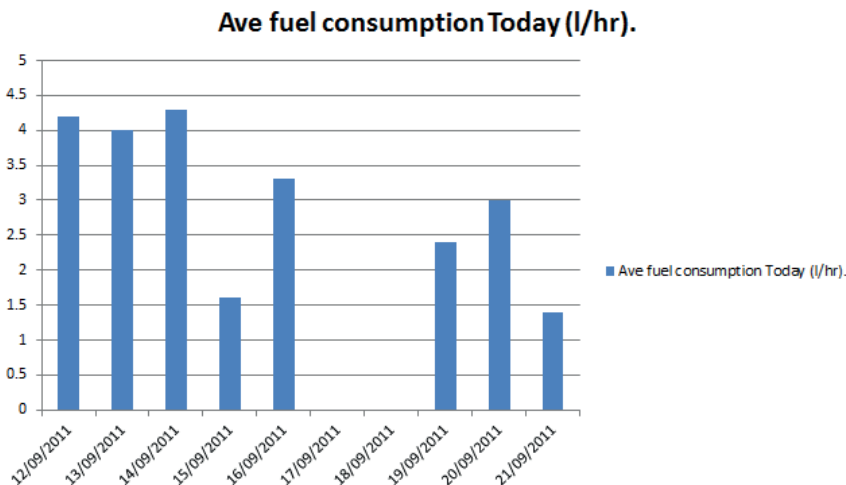
### Note:

Some data capture features are excluded from the Stage 3a engine choice and Hydrostatic.

It allows fleet managers/operators to easily manage servicing. The data capture file records the "Engine Hours At Last Service" and "Engine Hours Until Next Service" allowing quick identification of required servicing by analysis of the data capture files.

Data capture files can provide a full history of machine operations from servicing requirements to distance travelled on a daily basis.

Data capture files can be exported to an Excel document and visual results displayed in the format of a graph etc.

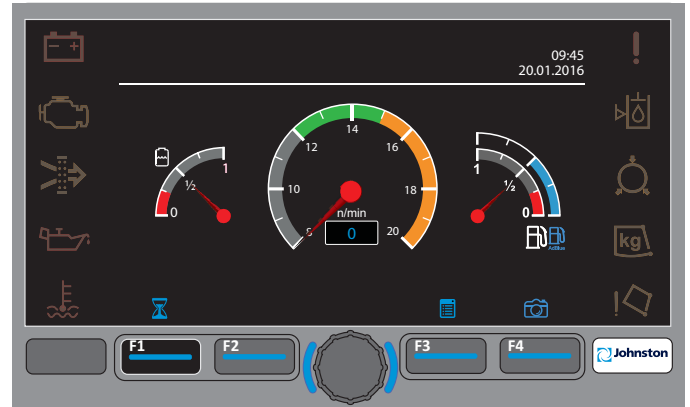


M02OG121

Logged data values can be viewed from the JVM (Johnston Visual Module) display. Press F1 (Hour Glass icon) from the base screen. See following illustrations for more details;

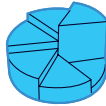


**F1 - Vehicle Logging**



**1.1 Part Totals**

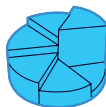
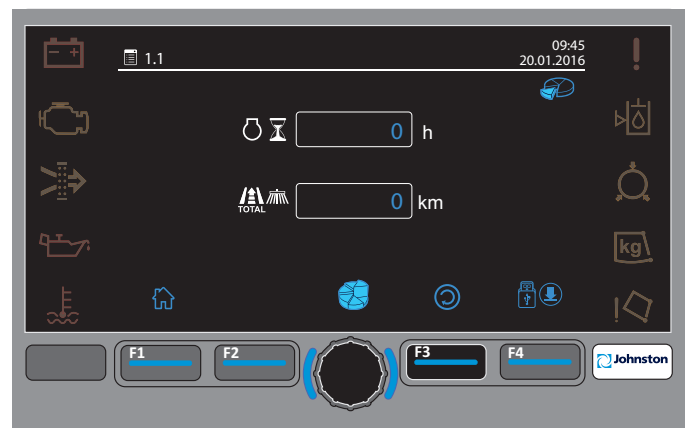
The icon top right shows the current screen



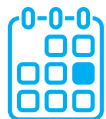
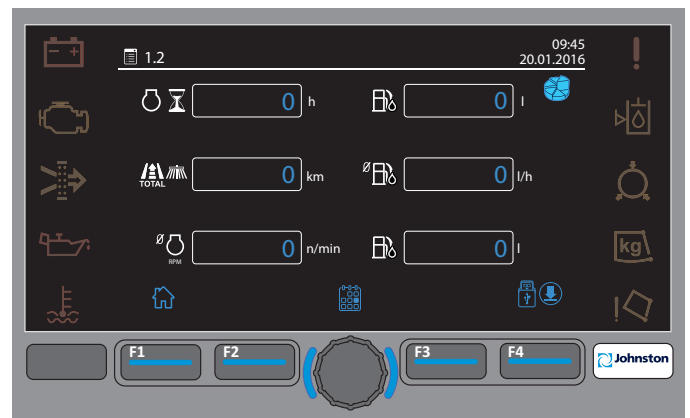
The icon bottom centre shows the next page. (E.G Grand Totals) Press the encoder to select the next page.



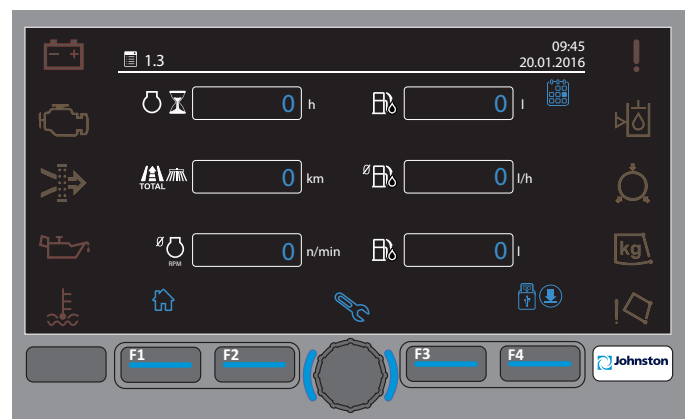
**F3 - Reset** - Will reset the part totals back to zero.



**1.2 Grand Totals**

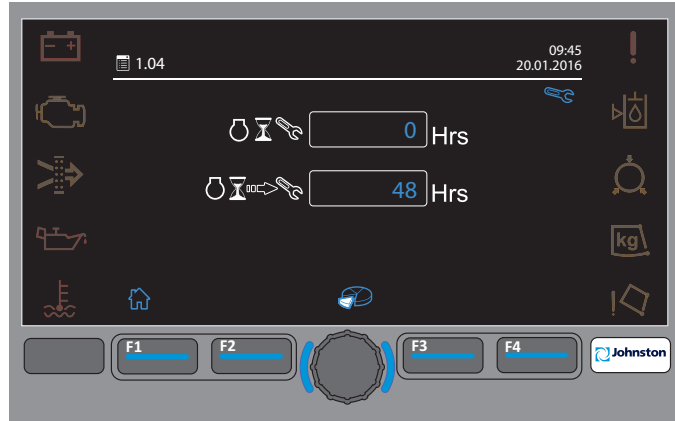


**1.3 Daily Totals**



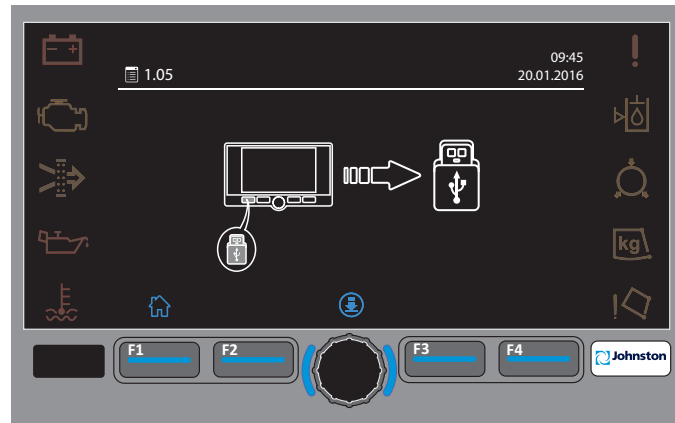
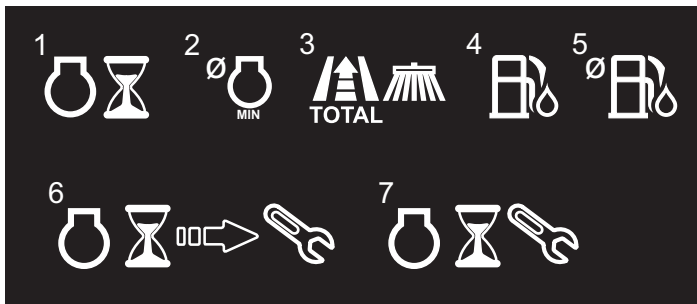
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**Vehicle Logging (continued)**

**1.4 Service Hours**

**1.5 USB Download (Data Capture)**

Insert an Johnston approved USB stick into the USB port (located on front of the JVM - bottom left hand side).

Press centre button on JVM to download.


**Key to Logging Screen Icons**


1. Engine Hours
2. Average Engine - RPM
3. Total Distance - Swept
4. Fuel Consumption
5. Average Fuel Consumption
6. Engine Hours - To Next Service
7. Engine Hours - Since Next Service

Logging data is displayed in menus 1.1, 1.2, 1.3 and recorded to a “Data Capture” file on the JVM.

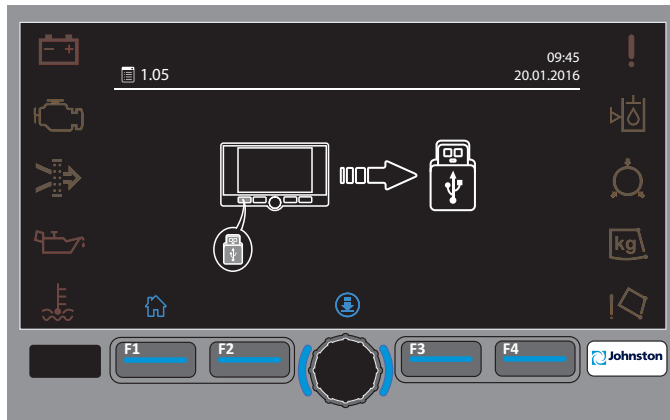
Information is recorded “per day” i.e; for each day a new row of logging data is saved to the “Data Capture” file.



The “Data Capture” file can be downloaded from the JVM to a Johnstone approved USB memory stick.

The “Data Capture” file format is CSV (Comma Separated values), this is a common format which may be viewed on any PC.

1. Go to the logging screens; press hour glass icon.



2. Press F4 in any of the sub-menus; 1.1, 1.2, 1.3, (download icon). Menu 1.5 will be displayed.
3. Insert the USB Memory stick.
4. Press the middle button on the display. The file download will start. Once complete a green tick will appear.
5. Remove the USB stick from the display.

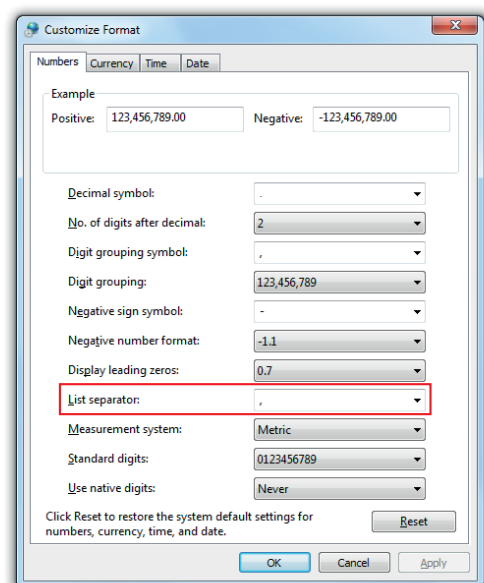
The “Data Capture” file downloaded to the USB stick is named in the format: *serialnumber\_*DataCapture.csv.

The “Data Capture” file may be viewed on any PC, using EXCEL if possible.

### PC Regional Settings

Ensure that the regional settings of the PC are set. “System Separator = ,”

To check the regional settings of the PC go to Control Panel > Region & Language> additional settings, “List Separator: ,”



**Index 01 - Sheet 01/64 Rev D**

1	2	3	4	5	6	7	8
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Sheet 2	Index						
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Sheet 4	Electrical Circuit Symbol 2						
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Sheet 7	Electrical Circuit Model Map						
Sheet 8	Fused Power And Ignition Distribution						
Sheet 9	Fused Power And Ignition Distribution						
Sheet 10	Operating Panel Switch / PCB Node						
Sheet 11	Key Pad / PCB Node						
Sheet 12	Discharge Pendant Controller/ PCB Node						
Sheet 13	Flat Ribbon IDC PCB Connectors						
Sheet 14	Power/Ignition feed I/O Nodes						
Sheet 15	Power/Ignition Feed Rotatilt Aux Engine and Nodes						
Sheet 16	Power/Ignition Feed Beacon Cab and WSB Balance						
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Sheet 21	Can-Bus System Can-0 and Aux Engine Can-1						
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Sheet 23	Front Systems Interface Connection						
Sheet 24	Spare Options						
Sheet 25	Systems Locker Node Hydraulic valves						
Sheet 26	Systems Locker Node Electrical Water Valves						
Sheet 27	Powapak Node Engine Pack Sensors/Control and Work lamps						
Sheet 28	Powapak Node Engine Sensors and Control (Generic Engine)						

GENERAL TOLERANCES		MEDIUM TOLERANCES		FINISH QUALITY		DATE		DATE	
TITLE (SHEET/TITLE)		DRAWN BY		CHECKED BY		DATE		DATE	
NGS Truck Mounted Sweeper Circuit Drawing		Index		Index		7		7	
PROJECT		PROJECT		PROJECT		PROJECT		PROJECT	
RESPONSIBLE DEPARTMENT		RESPONSIBLE DEPARTMENT		RESPONSIBLE DEPARTMENT		RESPONSIBLE DEPARTMENT		RESPONSIBLE DEPARTMENT	
SCALE		SCALE		SCALE		SCALE		SCALE	
NTS		NTS		NTS		NTS		NTS	
SHEET		SHEET		SHEET		SHEET		SHEET	
1		1		1		1		1	
DOCUMENT NUMBER		DOCUMENT NUMBER		DOCUMENT NUMBER		DOCUMENT NUMBER		DOCUMENT NUMBER	
7033871		7033871		7033871		7033871		7033871	
REV		REV		REV		REV		REV	
D		D		D		D		D	
715402		715402		715402		715402		715402	

Sheets 37, 38 and 40 Alternator wiring changes

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- Sheet 30 Subframe Node Sensors/Switches and Weight Load Indicator
- Sheet 31 Work Lights Rear Beacons and Cowl Work Light
- Sheet 32 Additional Rear Work Lights and Additional Warning Lights
- Sheet 33 Front Cab Beacons and Top/Side Marker Lights
- Sheet 34 Aux Engine JCB 24 Volt Power Pod Box
- Sheet 35 Aux Engine JCB 12 Volt Power Pod Box
- Sheet 36 Aux Engine JCB 55kW and 93kW 24 Volt
- Sheet 37 Aux Engine John Deere High Power 86KW
- Sheet 38 Aux Engine John Deere Standard Power 63KW
- Sheet 39 Aux Engine JCB 55kW and 93kW 12 Volt
- Sheet 40 Aux Engine JCB 85KW S3A 24Volt
- Sheet 41 Spare
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- Sheet 48 Powapak Node Hydrostatic Drive Control
- Sheet 49 Powapak Node Hydrostatic Sensors/Control and Work Lamps
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- Sheet 51 Electrical Circuit Model map Demount
- Sheet 52 Demount Disconnection Power/Work Lamps
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- Sheet 54 Rotatilt Hydraulic/Electrical Control
- Sheet 55 Power Wander Hose And Engine Speed Control With Extension
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- Sheet 59 Systems Locker LED Strip Light
- Sheet 60 Wide Sweep Brush Balance
- Sheet 61 AUX Engine JCB 93KW T4
- Sheet 62 AUX Engine JCB 93KW T4 CAN/Power Connections
- Sheet 63 AUX Engine JCB Add Blue Aftertreatment System

CREATED BY	DATE	RELEASED BY	DATE
TITLE/DESCRIPTION/TITLE			
NGS Truck Mounted Sweeper Circuit Drawing			
Index			
SCALE	SHEET	DOCUMENT NUMBER	REVISION
NTS	2	7033371	D 715402
GENERAL TOLERANCES			
PROJECT	RESPONSIBLE DEPARTMENT	DUCT TYPE	VERSION
GENERAL TOLERANCES			
PROJECT	RESPONSIBLE DEPARTMENT	DUCT TYPE	VERSION
SHEETS 37, 38 and 40 Alternator wiring changes			
GENERAL TOLERANCES			





Electrical Circuit Symbol 2 - Sheet 04/64 Rev D

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1	2	3	4	5	6	7	8
	F1	— System Fuse					
	HRW	— Hopper Raised / Rear Door					
	IGN	— Auxiliary Engine Ignition					
	LAS	— Low Air Warning					
	WTE	— Water tank Switch					
	WTM	— Water tank Sensor					
	OPS	— Auxiliary Engine Low Oil Pressure					
	SW	— SupaWash					
	WL	— LWL, RWL — Left/Right Rear Worklamp					
		— WS/WD — Single/Dual Worklamp					
	CWL	— Cowl Worklamp					
	WLI	— Weight Load Indicator					
	WSB	— Wide Sweep Brush					
	WTS	— Auxiliary Engine Water Temp. Warning					
	HOT	— Hydraulic Oil Temperature					
	CLS	— Coolant Level Switch					

GENERAL TOLERANCES	MATING TOLERANCES	MATERIAL QUALITY	CREATED BY	DATE	RELEASED BY	DATE
PRODUCT	PROJECT	RESPONSIBLE ENGINEER	DOC TYPE	UP/DOWN	SALE SHEET	ANGLE
NGS Truck Mounted Sweeper Circuit Drawing	Electrical Circuit Symbol 2				NTS	4
		REVISION NUMBER	DOCUMENT NUMBER	REVISION	REVISION	EKA
			7033371	D		715402
						A3

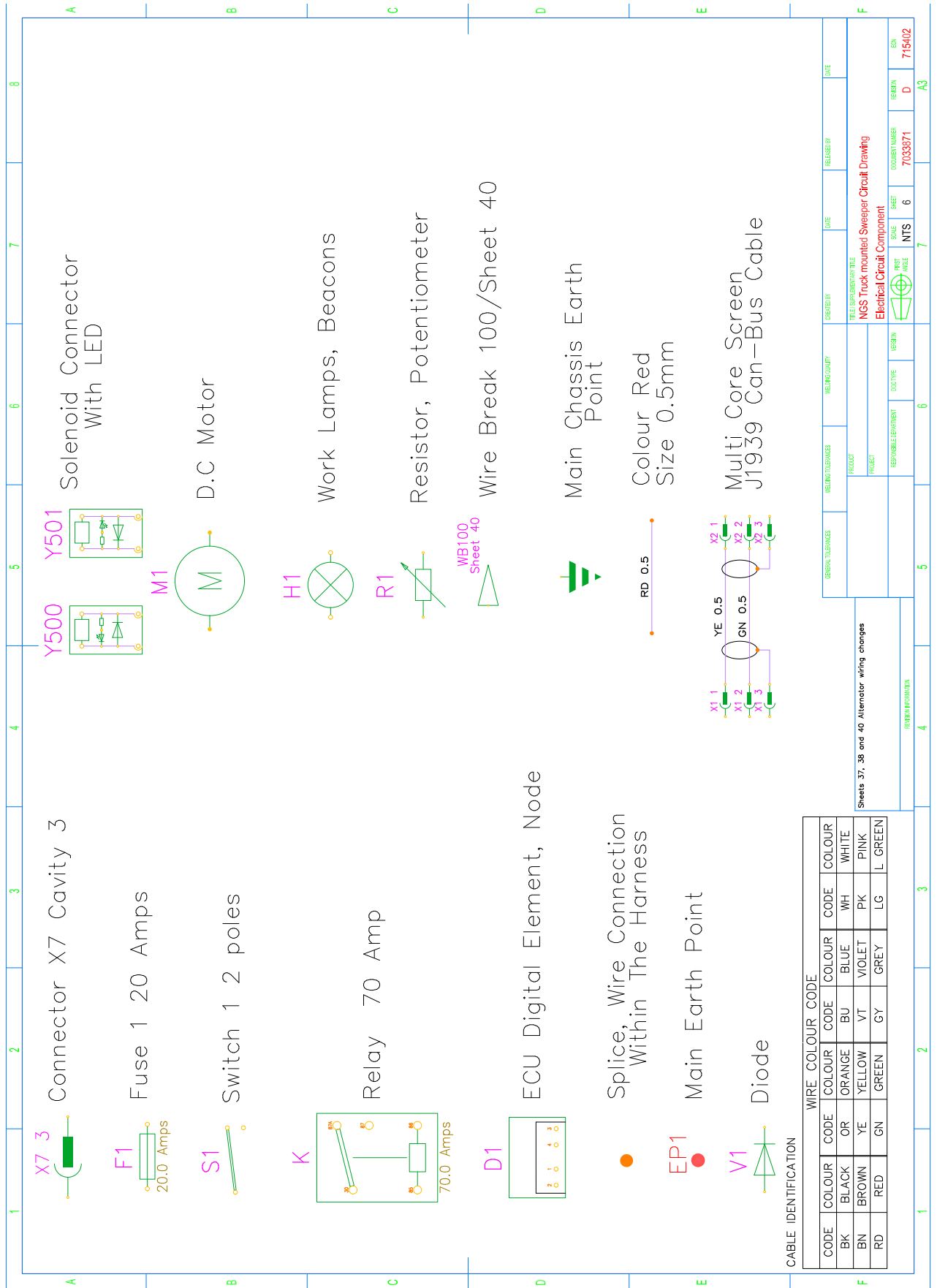
Electrical Circuit Symbol 3 - Sheet 05/64 Rev D

	1	2	3	4	5	6	7	8
A		— EF — Aux Engine Fuel Level			— HS — Select Normal Drive			
		— DO — Rear Door Open			— SH — Select Hydrostatic Drive			
		— DC — Rear Door Close			— SH — Semi Hydrostatic			
B		— HL — Hopper Lower			— MCC — Multi Camera Control			
		— HR — Hopper Raise			— CA — Camera 1 To 4			
		— CP — Cab Fuse and Power			— RT — Channel Brush Rotatilt (LH)			
C		— DIS — Display Node JVM-407			— RT — Channel Brush Rotatilt (RH)			
		— PEN — Pendant Node			— NZ — Nozzle			
		— KEY — Key Pad Node JXM-KPN			— PS — Wide Sweep Brush PowaScrub			
D		— VM10 — Pneumatic Valve Island Can			— ELEC — Electrical			
		— IO NODE- JXM-10 E2 Node			— HYDRO — Hydraulic			
E		— FB — Telescoping Front Brush						
F	Sheets 37, 38 and 40 Alternator wiring changes				GENERAL SERVICES			
	GENERAL INFORMATION				PROJECT	RESPONSIBLE DEPARTMENT	DOCTIVE	VERSION
	TITLE DESCRIPTION TITLE				DATE	REVISION	DATE	
	NGS Truck Mounted Sweeper Circuit Drawing				Electrical Circuit Symbol 3	5	7	
	SCALE				SHEET	DOCUMENT NUMBER	REVISION	EDN
	1:1				5	7033871	D	715402
	A3							

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Electrical Circuit Component - Sheet 06/64 Rev D

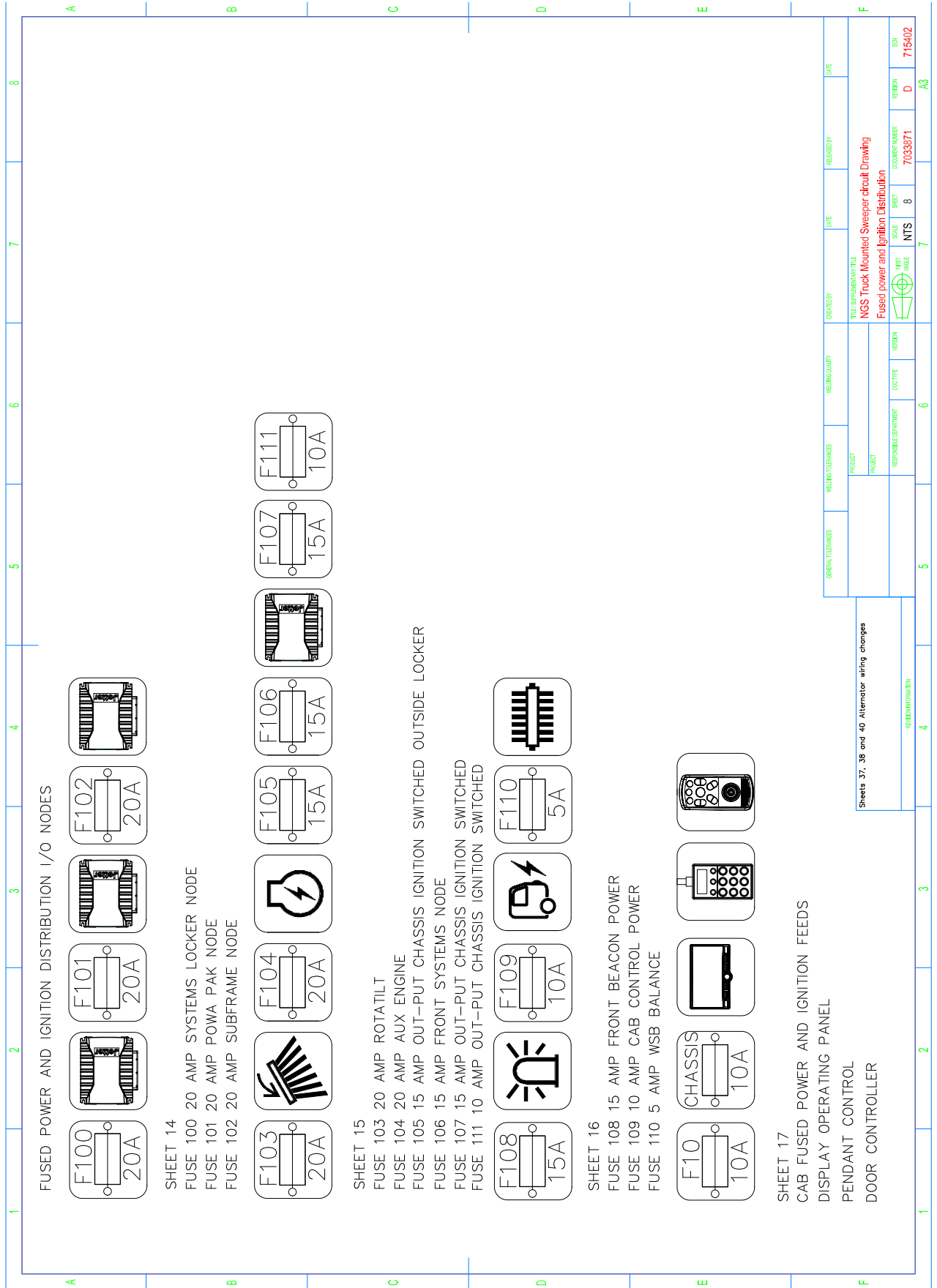
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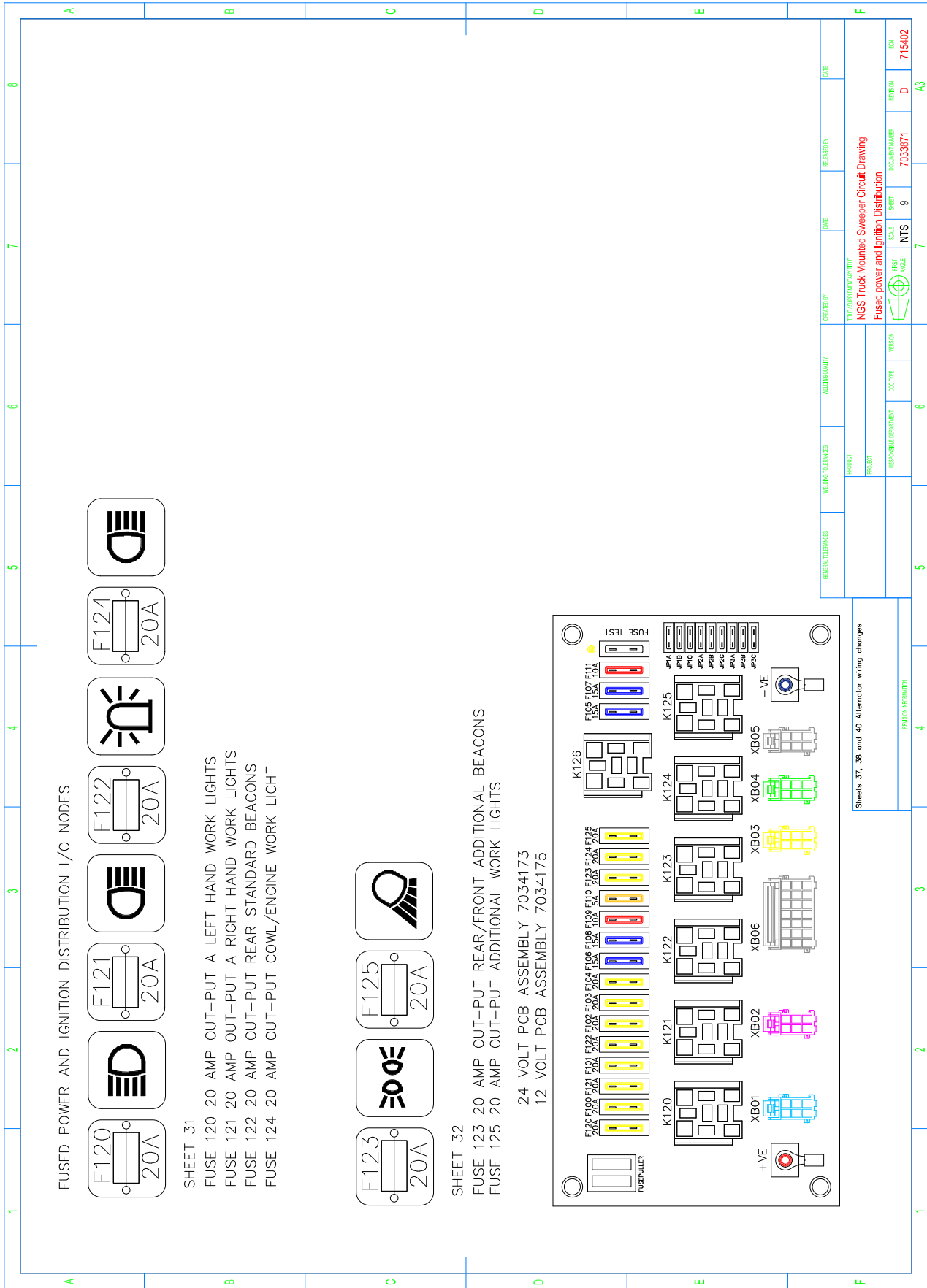
Fused Power and Ignition Distribution 01 - Sheet 08/64 Rev D

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GENERAL TOLERANCES	MEETING TOLERANCES	WELDING QUALITY	DESIGNED BY	DATE	RELEASED BY	DATE
PRODUCT	PROJECT	VERSION	NGS Truck Mounted Sweeper circuit Drawing			
RESPONSIBLE DEPARTMENT	DOC TYPE	VERSION	Fused power and Ignition Distribution			
SCALE	NTS	SCALE	NTS	SHEET	8	7
REVISION/REVISION	REVISION	DATE	715402	REVISION	D	A3

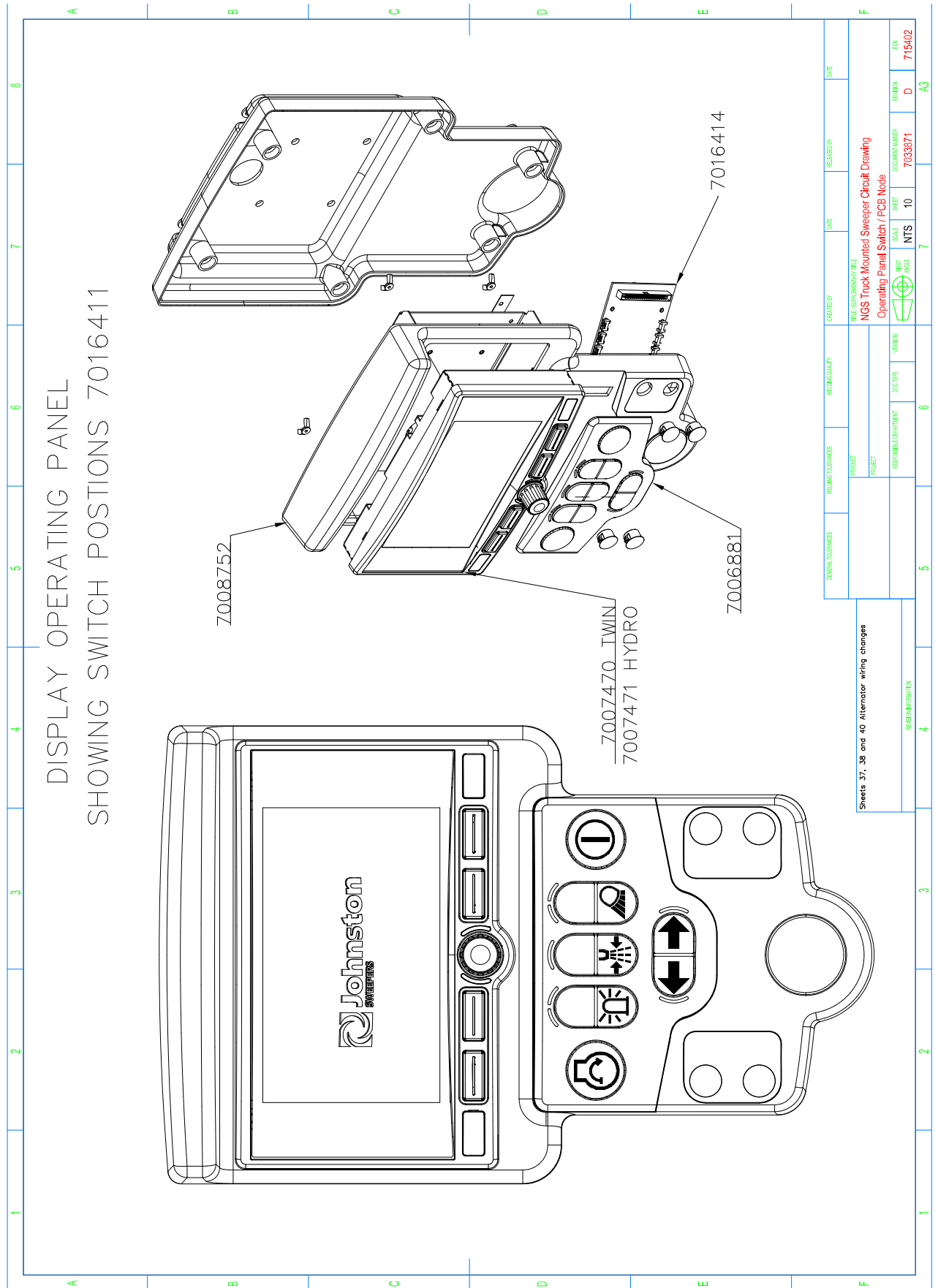
**Fused Power and Ignition Distribution 02 - Sheet 09/64 Rev D**



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Operating Panel Switch / PCB Node - Sheet 10/64 Rev D

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GENERAL TELEVISIONS	VIDEO TELEVISIONS	RELAY QUALITY	PREPARED BY	DATE	REVISIONS	DATE

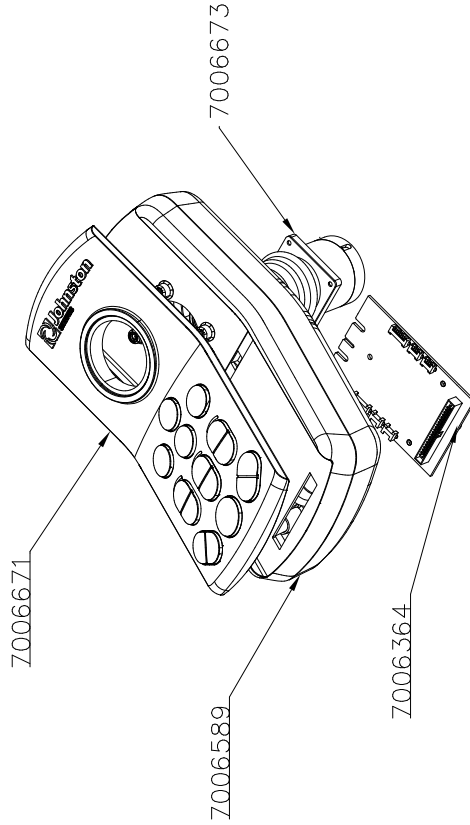
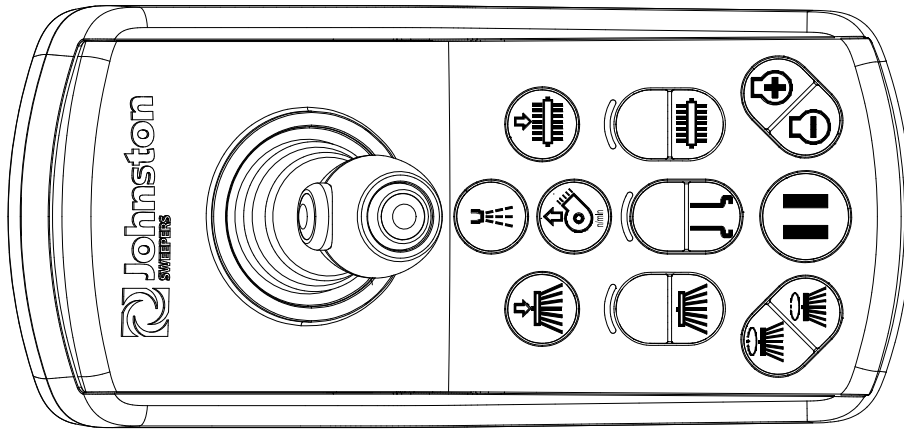
PROJECT	PROJECT	RESPONSIBLE ENGINEER	DOC TYPE	VERSION	SCALE	SHEET	REVISION	EQA
					NTS	10	D	715402

Sheets 37, 38 and 40 Alternator wiring changes

REVISION INFORMATION

**Key Pad / PCB Node - Sheet 11/64 Rev D**

KEYPAD AND NODE 7006676



GENERAL TOLERANCES	MATING TOLERANCES	FINISH QUALITY	CREATED BY	DATE	RELEASED BY	DATE
<b>PRODUCT</b> NGS Truck Mounted Sweeper Circuit Drawing <b>PROJECT</b> Key Pad / PCB Node			<b>TITLE SUPERHEAVY TITLE</b> Key Pad / PCB Node			
<b>RESPONSIBLE PERSON</b> [Icon]		<b>SCALE</b> NTS 1:1	<b>SHEET</b> 11	<b>DOCUMENT NUMBER</b> 7033871	<b>REVISION</b> D	<b>REV</b> 715402
SHEETS 37, 38 and 40 Alternator wiring changes		REVISIONS: [Icon]		A3		

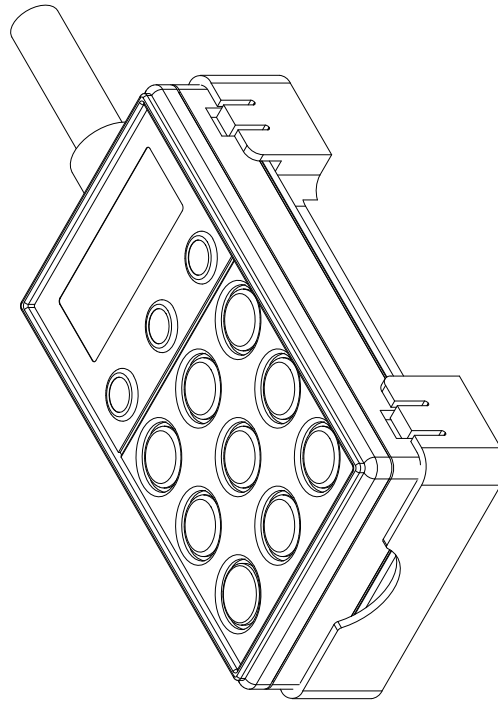
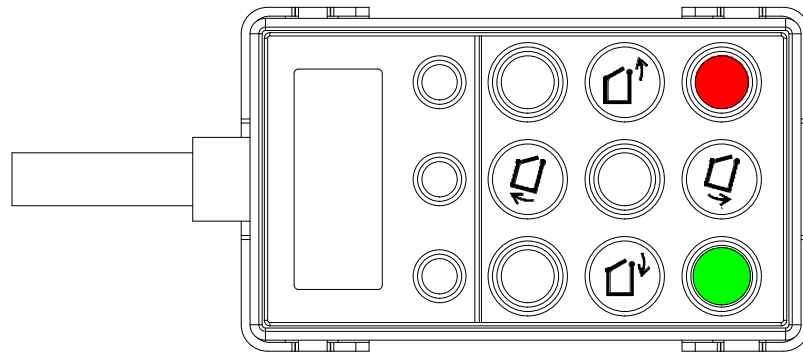
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Discharge Pendant Controller / PCB Node - Sheet 12/64 Rev D

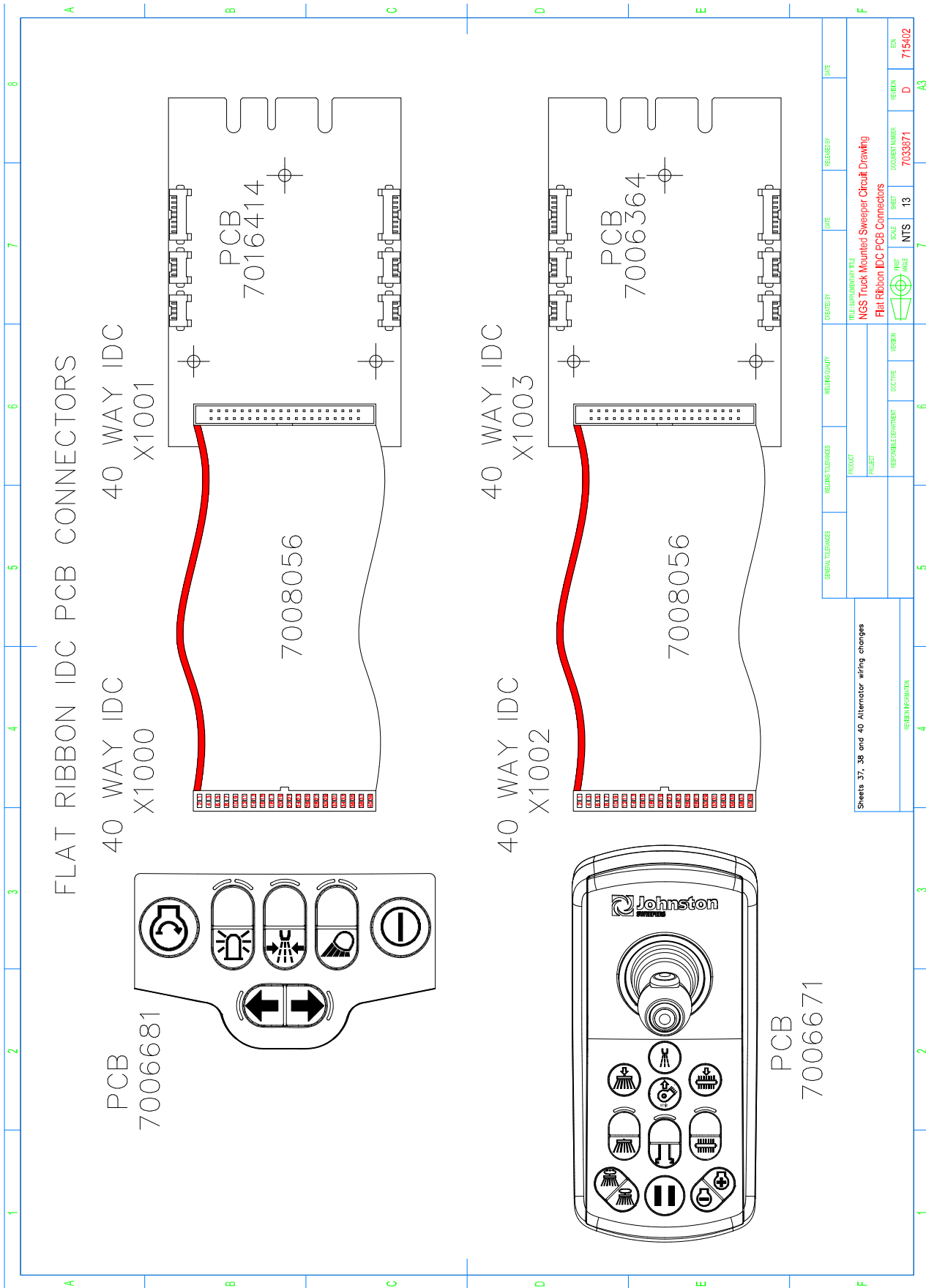
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DISCHARGE PENDANT CONTROLLER 7008222



SHEETS 37, 38 and 40 Alternator wiring changes		REVISION/REVISION NUMBER		REVISION		DATE		RELEASED BY	
PRODUCT		RESPONSIBLE DEPARTMENT		DOC TYPE		SCALE		SHEET	
PROJECT		RESPONSIBLE PERSON		DOC NUMBER		FIRST ANGLE		SHEET	
GENERAL TOLERANCES		MATERIAL TOLERANCES		MATERIAL QUANTITY		DESCRIPTION		DATE	
TITLE (AS PER DRAWING TITLE)		PROJECT		DOC NUMBER		FIRST ANGLE		SHEET	
DISCHARGE PENDANT CONTROLLER/ PCB Node		7008222		70033871		D		715402	
A3		A3		A3		A3		A3	

**Flat Ribbon IDC PCB Connectors - Sheet 13/64 Rev D**



GENERAL TOLERANCES	RELIEF TOLERANCES	WELDING QUALITY	GENERATED BY	DATE	REVISION	DATE
PROFIT	PROFIT	INDICATIONS FILE	NGS Truck Mounted Sweeper Circuit Drawing			
RESPONSIBLE PERSON	RESPONSIBLE PERSON	DOC TYPE	Flat Ribbon IDC PCB Connectors			
SCALE	SCALE	SHEET	DOCUMENT NUMBER	REVISION	ECO	
NTS	NTS	13	7033871	D	715402	

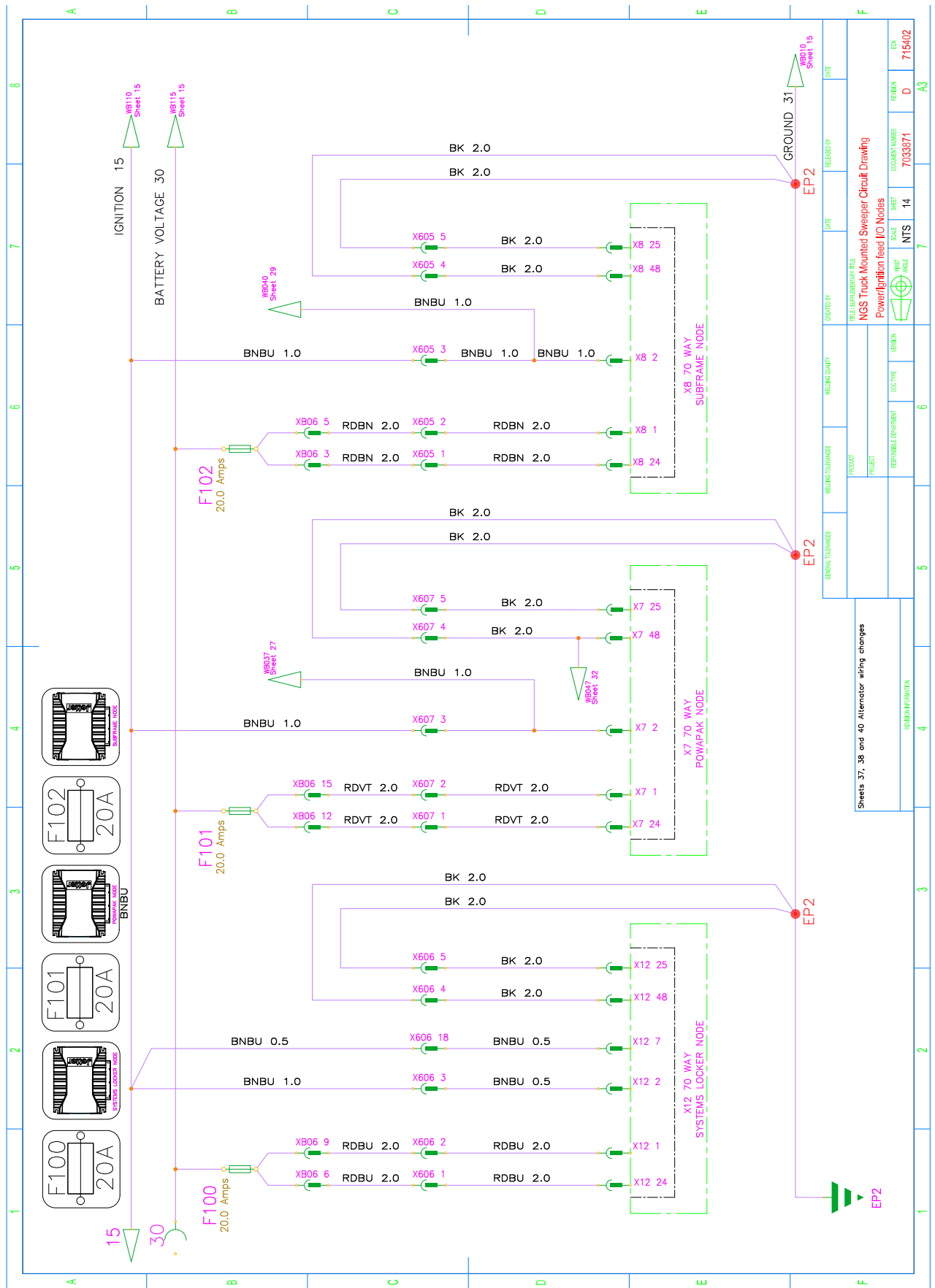
Sheets 37, 38 and 40 Attenuator wiring changes

REVISION INFORMATION

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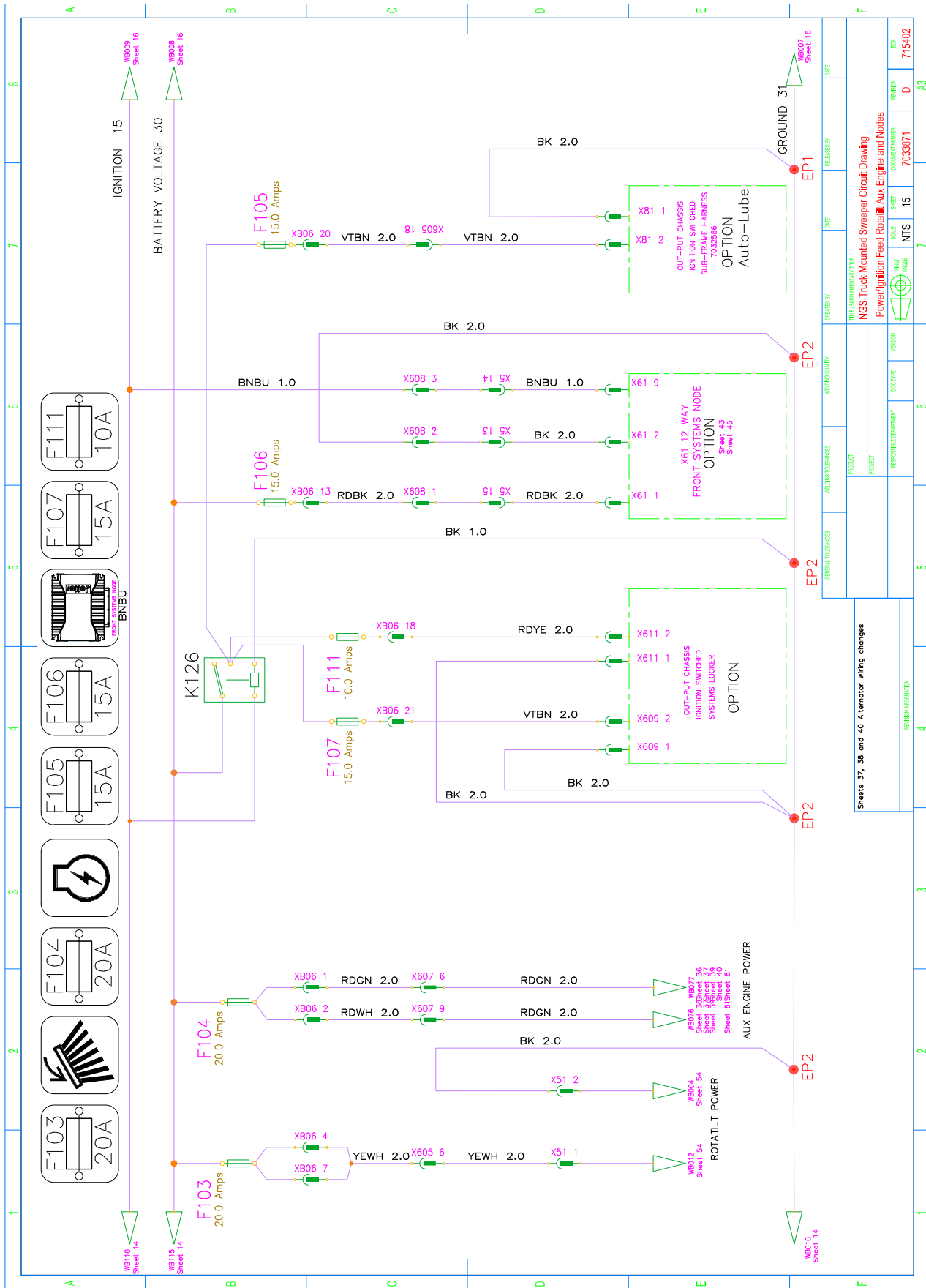
Power/Ignition Feed I/O Nodes - Sheet 14/64 Rev D

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GENERAL TOLERANCES	WIRING QUANTITY	CREATED BY	DATE	RELEASED BY	DATE
TITLE SUBCIRCUIT TITLE <b>NGS Truck Mounted Sweeper Circuit Drawing</b>					
PROJECT <b>Power/Ignition feed I/O Nodes</b>					
RESPONSIBLE DEPARTMENT	DOCTYPER	VERSION	SHEET	SCALE	NTS
			14	1:1	7033871
SHEETS 37, 38 and 40 Alternator wiring changes					
REVISION INFORMATION					
REVISION	DESCRIPTION	DATE	BY	CHK	APP
D					
DRAWING NUMBER: 7033871					
DRAWING DATE: 7/15/02					

Power/Ignition Feed Rotatilt Aux Engine and Nodes - Sheet 15/64 Rev D

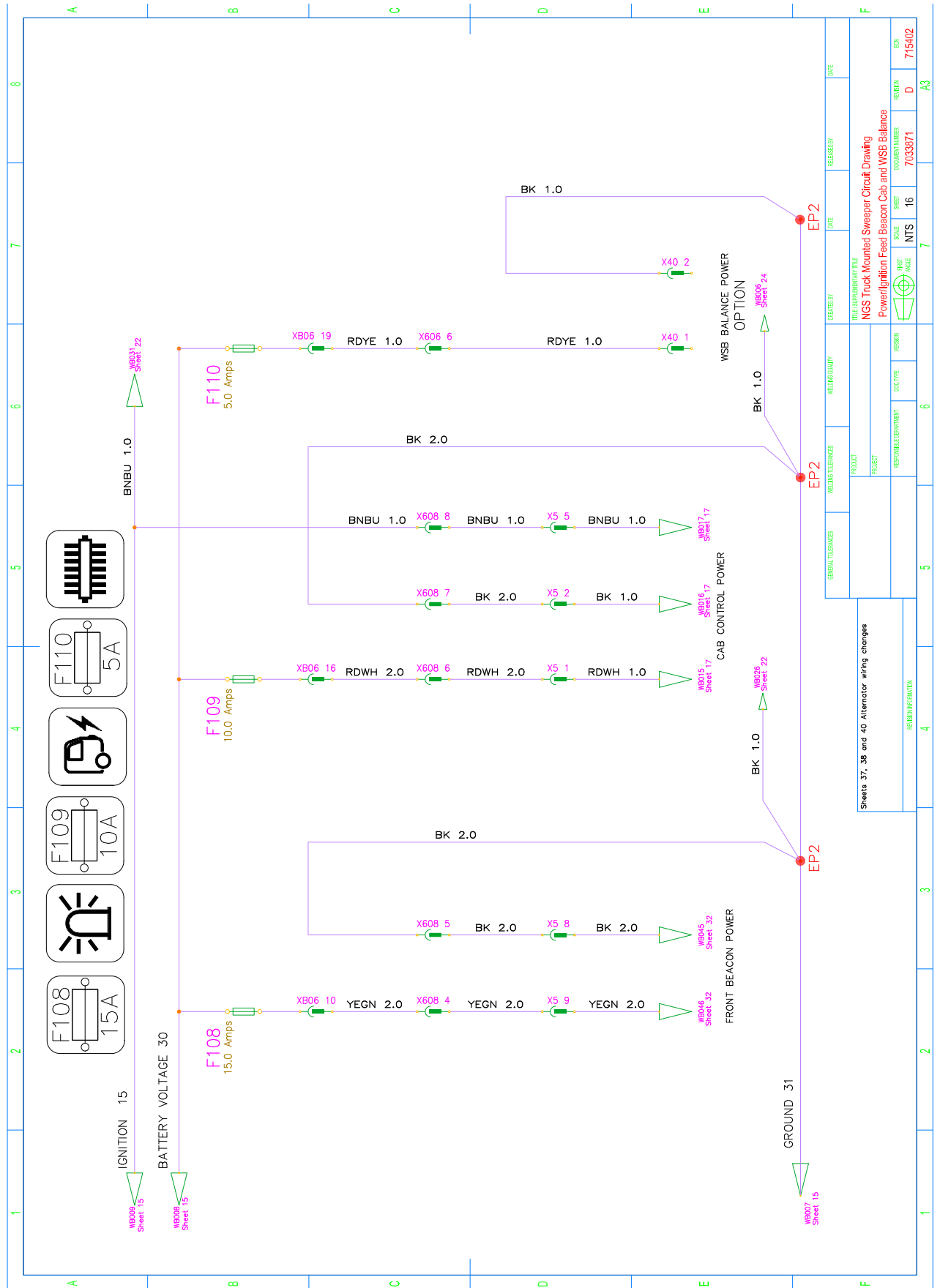


SHEETS 37, 38 and 40 Alternator wiring changes		REVISIONS	
NO.	DESCRIPTION	DATE	BY
1			
GENERAL TOLERANCES		WELDING TOLERANCES	
FINISH		FINISH	
PROJECT		JOB TYPE	
RESPONSIBLE DEPARTMENT		RESPONSIBLE NUMBER	
TITLE SUPERVISOR/TITLE		SCALE	
PROJECT		ANGLE	
DRAWN		SHEET	
CHECKED		COUNT NUMBER	
DATE		REVISION	
DATE		D	
DATE		7033871	
DATE		15	
DATE		NTS	
DATE		715/02	

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Power/Ignition Feed Beacon Cab and WSB Balance - Sheet 16/64 Rev D

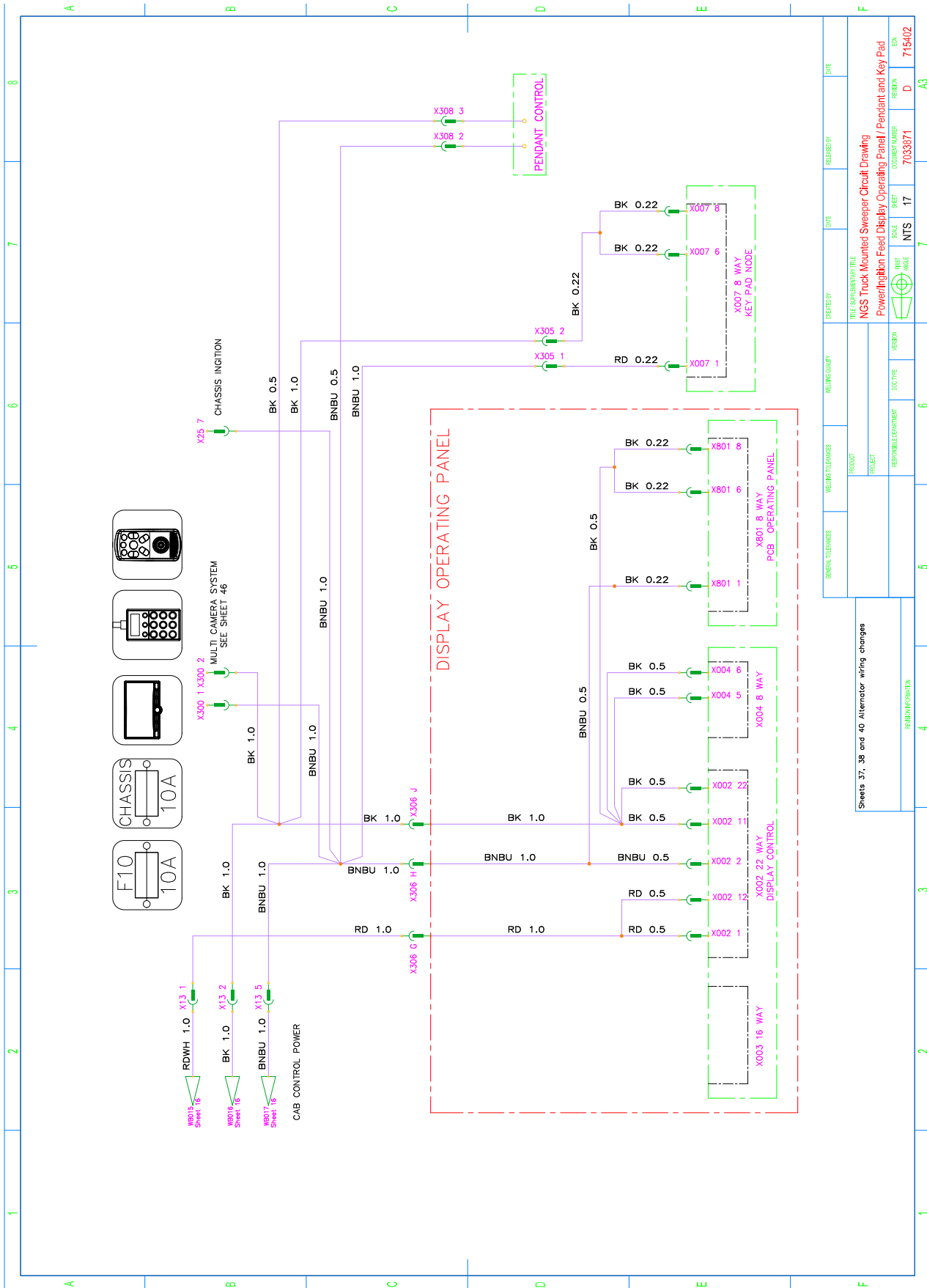
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GENERAL TOLERANCES	PRODUCT	WEIGHT TOLERANCES	WEIGHT QUALITY	CHEMISTRY	FINISH	DATE
THE SUBSIDIARY TITLE						
NGS Truck Mounted Sweeper Circuit Drawing						
Power/Ignition Feed Beacon Cab and WSB Balance						
REVISION	SCALE	SHEET	DOCUMENT NUMBER	REVISION	DATE	7154/02
NTS	1:1	16	7033871	D		

Sheets 37, 38 and 40 Alternator wiring changes

Power/Ignition Feed Display Operating Panel/Pendant & Key Pad - Sheet 17/64 Rev D

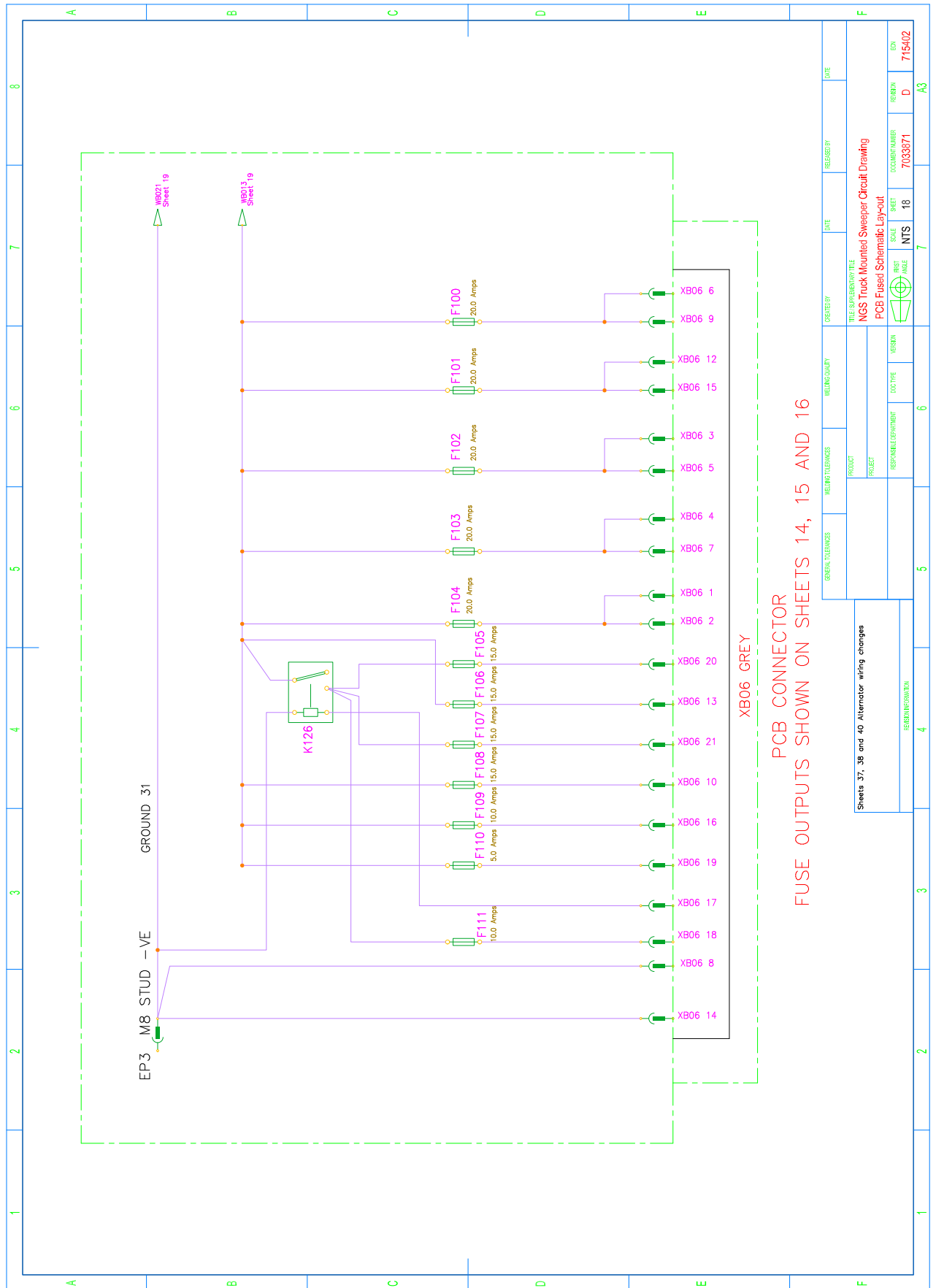


GENERAL USE/REVISES	REPAIR/REPLACES	WELDING QUALITY	OPERATED BY	DATE	REVISION
	PRODUCT PROJECT				
<b>NGS Truck Mounted Sweeper Circuit Drawing</b> <b>Power/Ignition Feed Display Operating Panel / Pendant and Key Pad</b>					
SHEETS 37, 38 and 40 Alternator wiring changes		SCALE	SHEET	EDN	
REVISION INFORMATION		UNIT	ANGLE	DRINK	
		NTS	17	7033871	D
			7		A3

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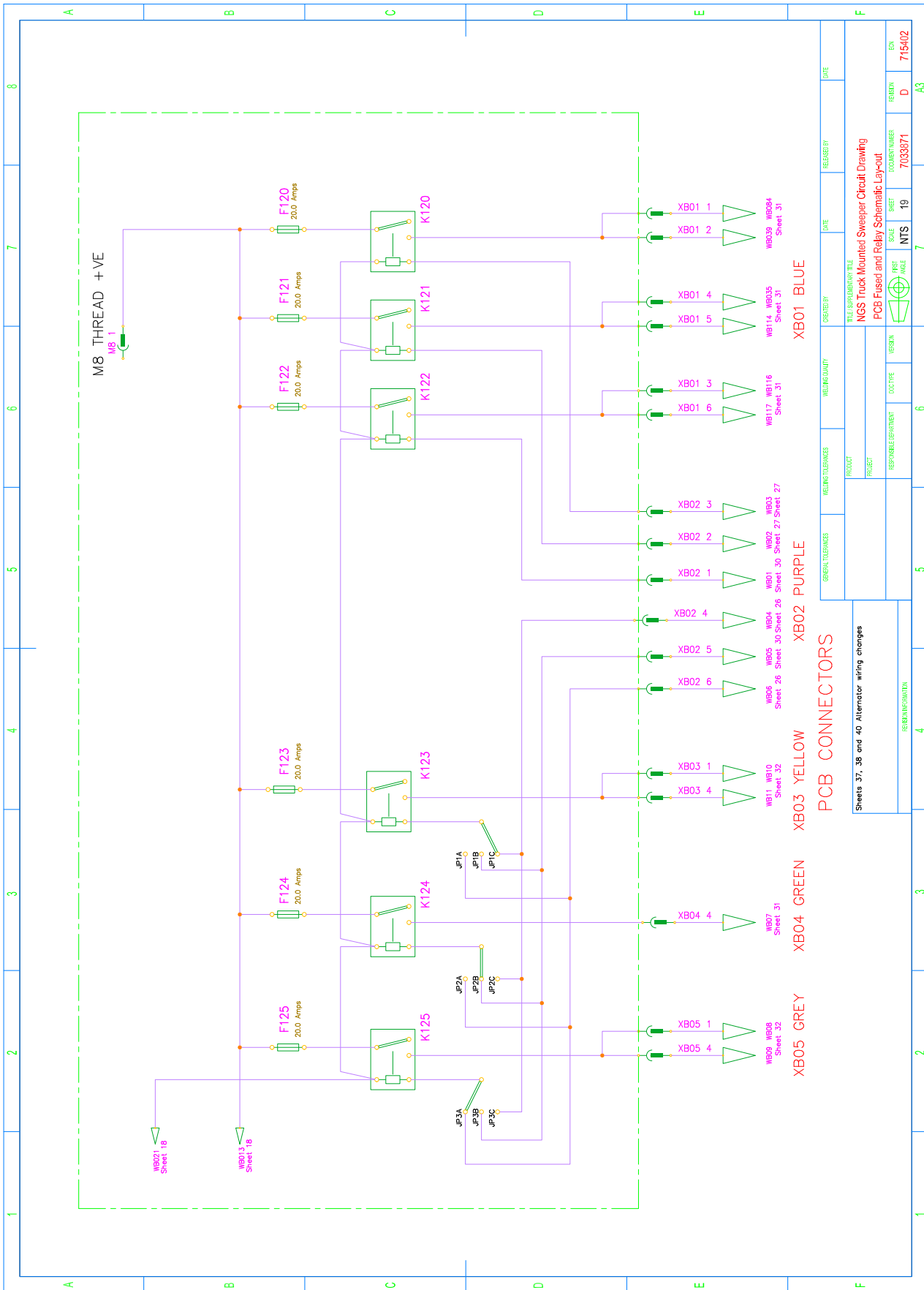
PCB Fuse Lay-out - Sheet 18/64 Rev D

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PCB CONNECTOR  
 FUSE OUTPUTS SHOWN ON SHEETS 14, 15 AND 16

PCB Fuse and Relay Lay-out - Sheet 19/64 Rev D



GENERAL TOLERANCES	MECHANICAL TOLERANCES	WELDING QUALITY	CHECKED BY	DATE	RELEASED BY	DATE
PRODUCT	PROJECT	RESPONSIBLE DEPARTMENT	DOC TYPE	VERSION	SCALE	NTS
SHEET INFORMATION			TITLE OR REFERENCE TO THE DRAWING <b>NGS Truck Mounted Sweeper Circuit Drawing</b> PCB Fused and Relay Schematic Lay-out			
SHEET INFORMATION			DOCUMENT NUMBER	SHEET	REVISION	ECN
SHEET INFORMATION			7033871	19	D	715402
SHEET INFORMATION			NTS	7		A3

**PCB CONNECTORS**

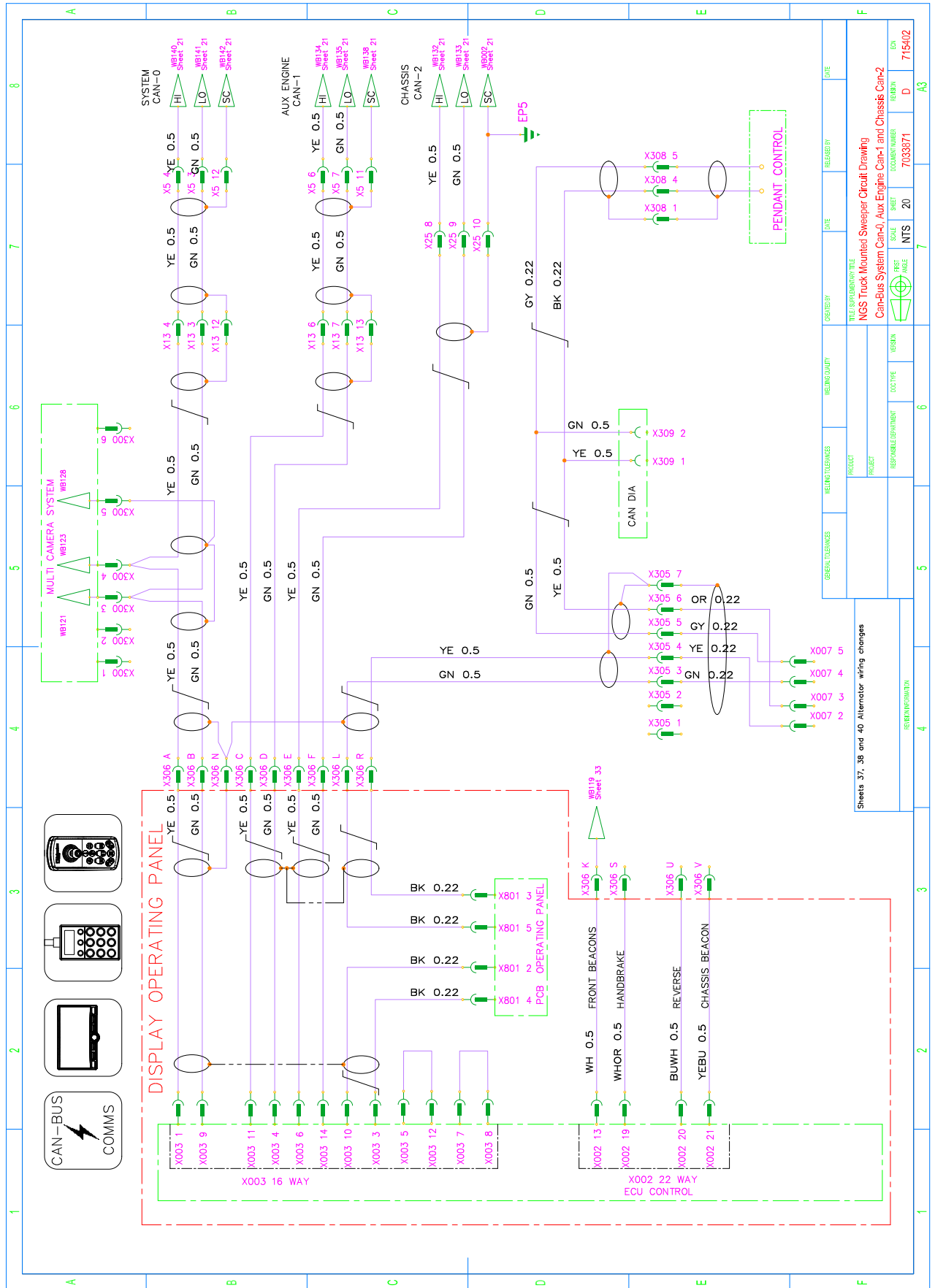
Sheets 37, 38 and 40 Alternator wiring changes

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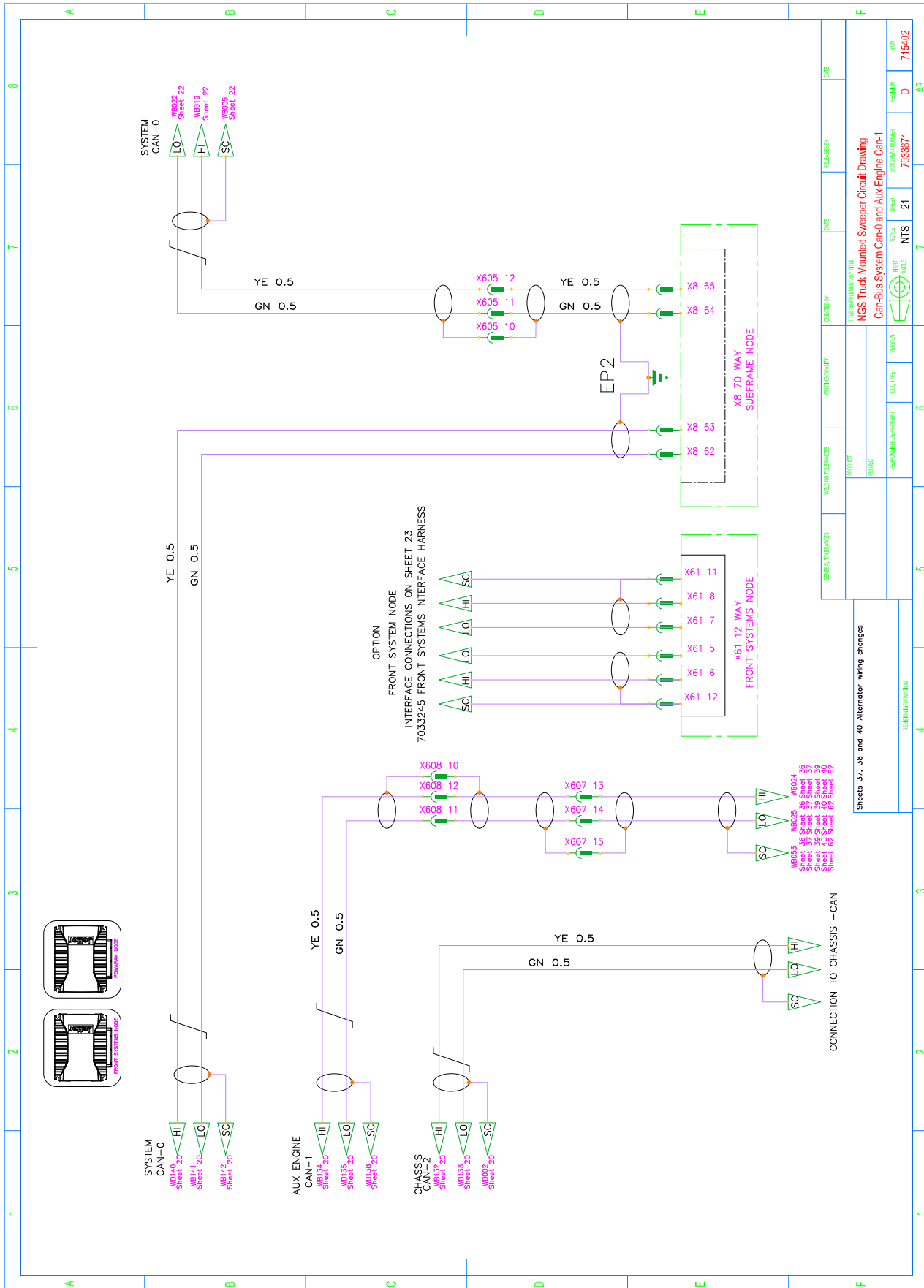
Can-Bus System Can-0, Aux Engine Can-1, and Chassis Can-2 - Sheet 20/64 Rev D

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GENERAL TOLERANCES	RELIEF TOLERANCES	WELDING QUALITY	CREATED BY	DATE	RELEASED BY	DATE
<b>TITLE REPRESENTATIVE</b> NGS Truck Mounted Sweeper Circuit Drawing Can-Bus System Can-0, Aux Engine Can-1 and Chassis Can-2						
<b>PRODUCT</b> PRODUCT		<b>RESPONSIBLE DEPARTMENT</b> DOC TYPE		<b>VERSIEN</b> SCALE		<b>REVISION</b> COUNT NUMBER
REVISION INFORMATION		FIRST ANGLE		NTS		20
						715402

Can-Bus System Can-0 and Aux Engine Can-1 - Sheet 21/64 Rev D



GENERAL TOLERANCES	WELDING TOLERANCES	WELDING QUALITY	SECURITY	DATE	RELEASED BY	DATE

TITLE		SCALE		SHEET		ECON	
NGS Truck Mounted Sweeper Circuit Drawing		Can-Bus System Can-0 and Aux Engine Can-1		21		715402	

PROJECT	RESPONSIBLE DEPARTMENT	DOC TYPE	YES/NO	REVISION	DATE
				D	

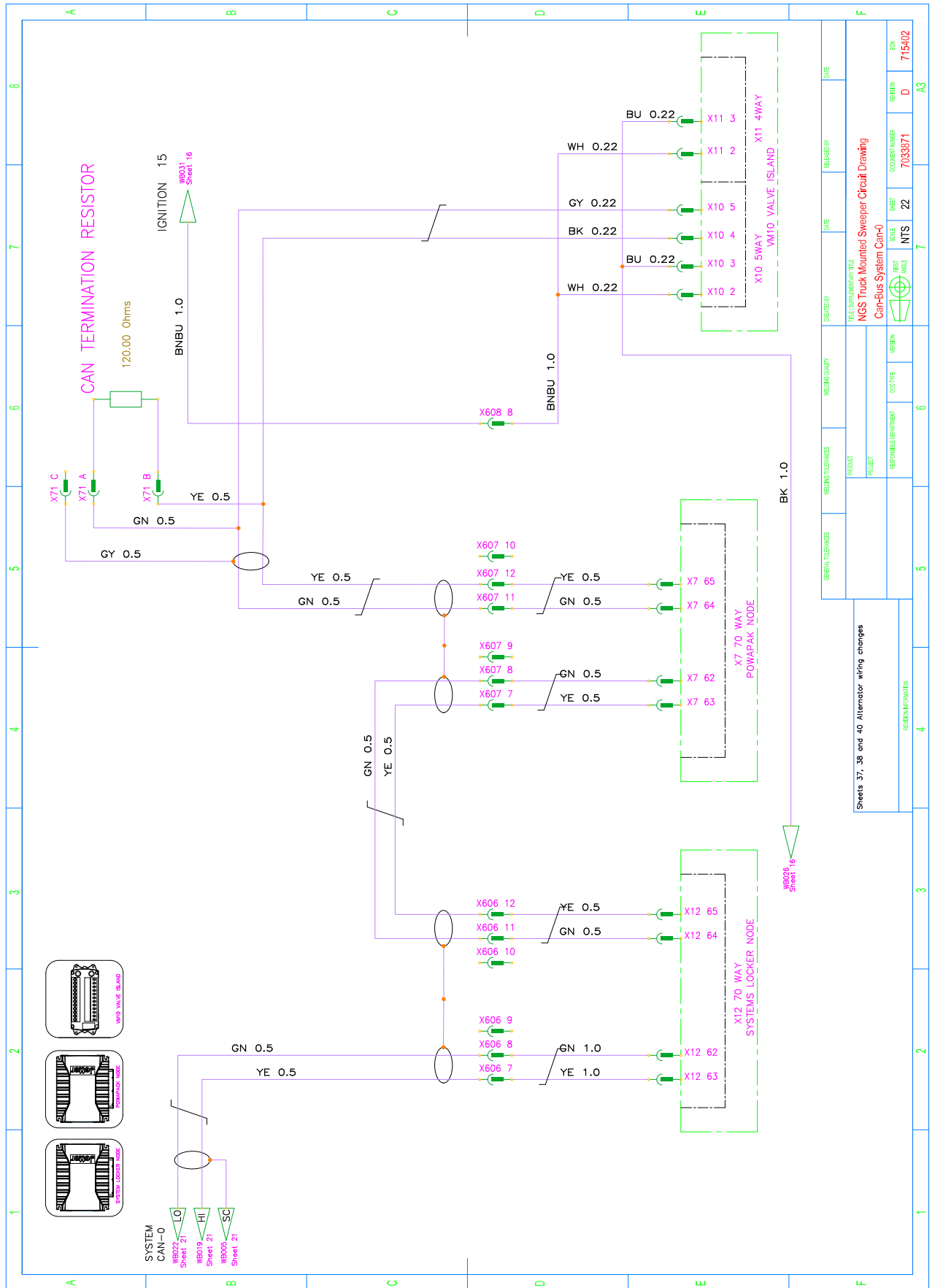
  

REVISION INFORMATION	
Sheets 37, 38 and 40 Alternator wiring changes	

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Can-Bus System Can-0 - Sheet 22/64 Rev D

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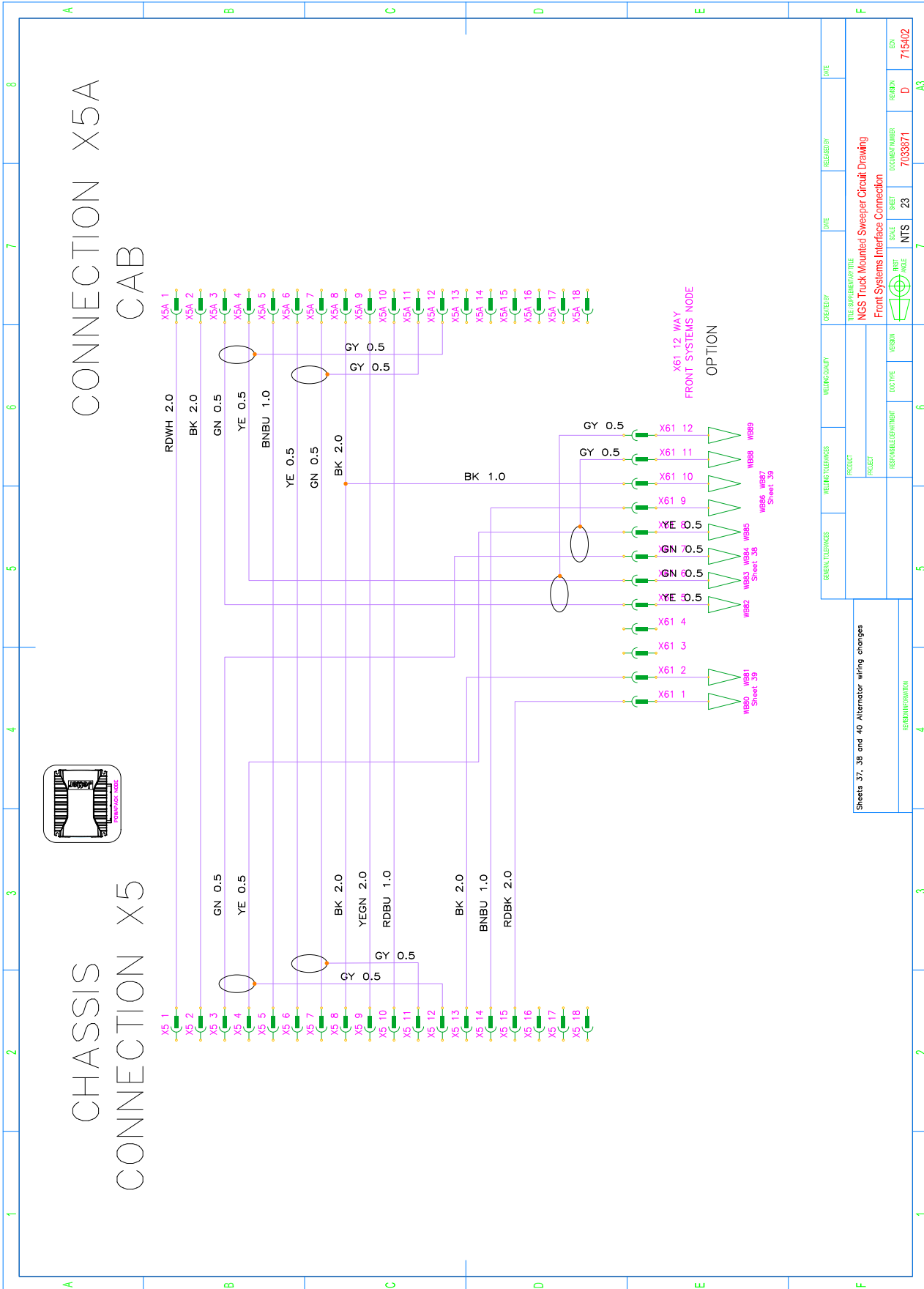


GENERAL TOLERANCES	REVISIONS	WELDING	DATE	REVISION	DATE
PROJECT	PROJECT	DOCTYPE	SCALE	SHEET	CRK
RESPONSIBLE	RESPONSIBLE	VERSION	NTS	22	715402
DEPARTMENT	DEPARTMENT	VERSION	7033871	D	A3

Sheets 37, 38 and 40 Alternator wiring changes

FILE NUMBER TITLE  
**NSG Truck Mounted Sweeper Circuit Drawing**  
 Can-Bus System Can-0

**Front Systems Interface Connection - Sheet 23/64 Rev D**



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Spare Options - Sheet 24/64 Rev D

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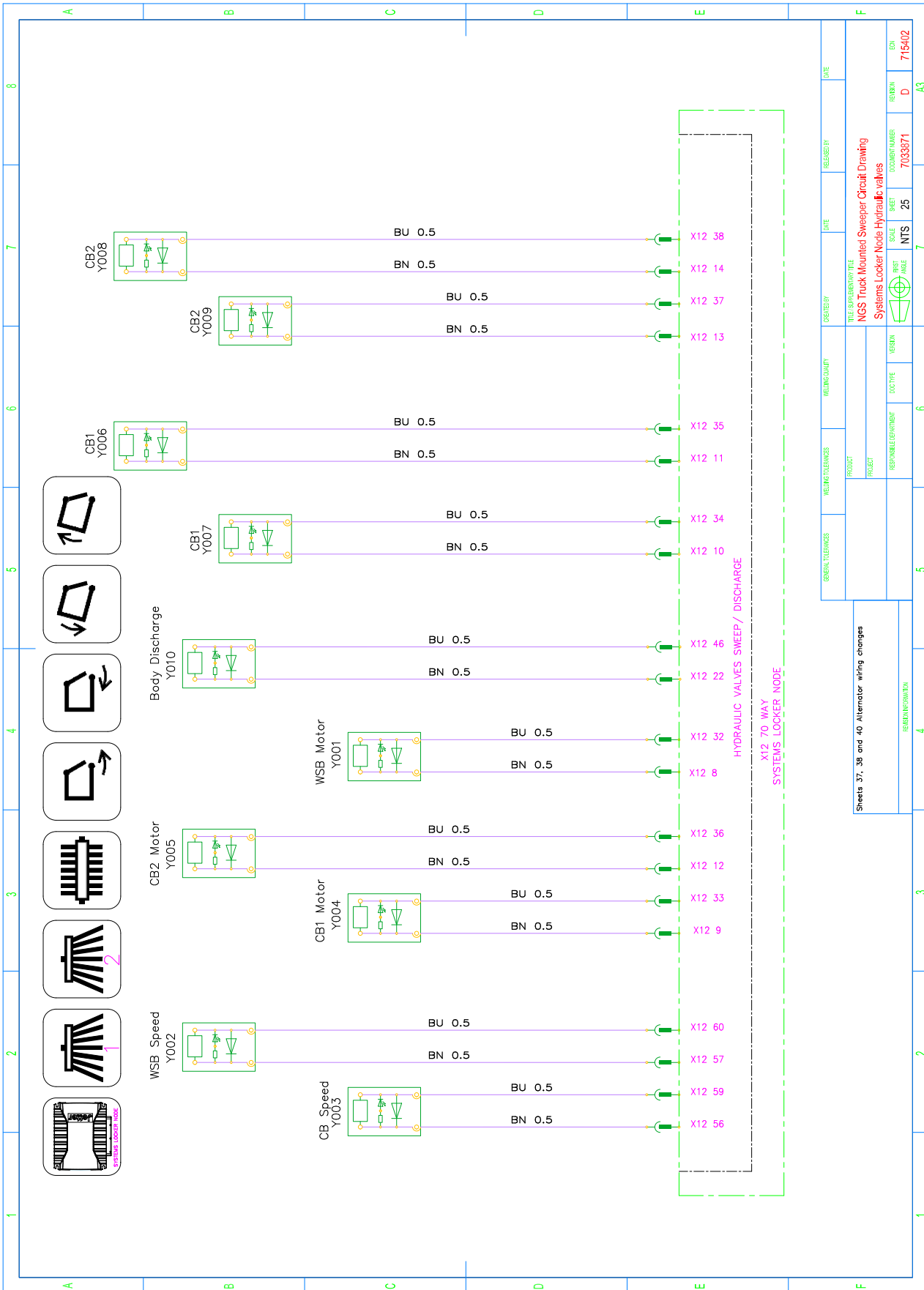
SPARE  
Options

	1	2	3	4	5	6	7	8
A								
B								
C								
D								
E								
F								

GENERAL TOLERANCES	REFERENCE TOLERANCES	WELDING QUALITY	DESIGNED BY	DATE	RELEASED BY	DATE
PRODUCT	PROJECT		THE INFORMATION FILE			
			<b>NSS Truck Mounted Sweeper Circuit Drawing</b>			
			<b>Spare Options</b>			
			SCALE	SHEET	DOCUMENT NUMBER	REVISION
			NTS	24	7033871	D
			FIRST ANGLE			EON
						715402
Sheets 37, 38 and 40 Alternator wiring changes			A3			
REVISION/CHANGES			4			

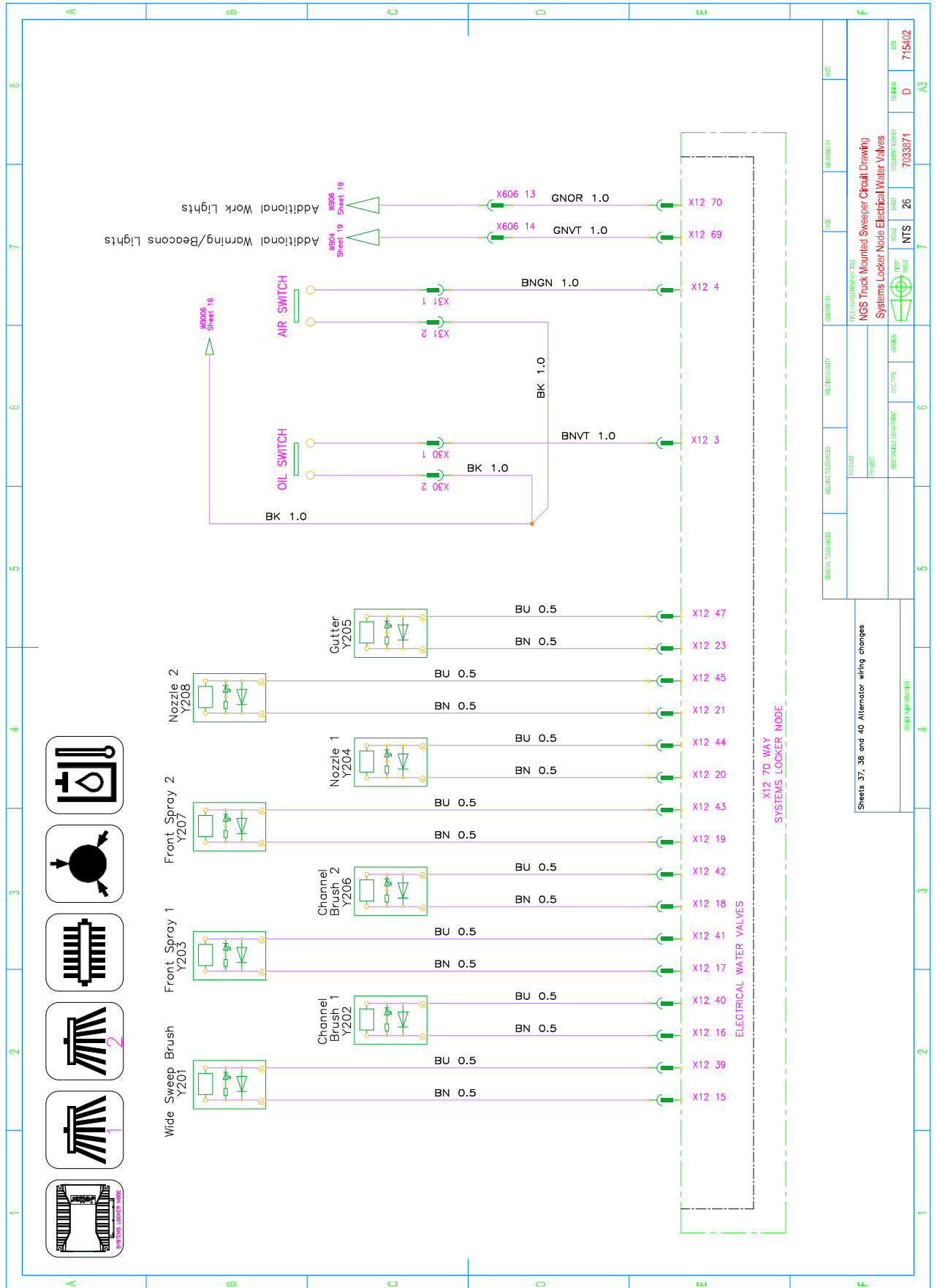
System Locker Node Hydraulic Valves - Sheet 25/64 Rev D



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System Locker Node Electrical Water Valves - Sheet 26/64 Rev D

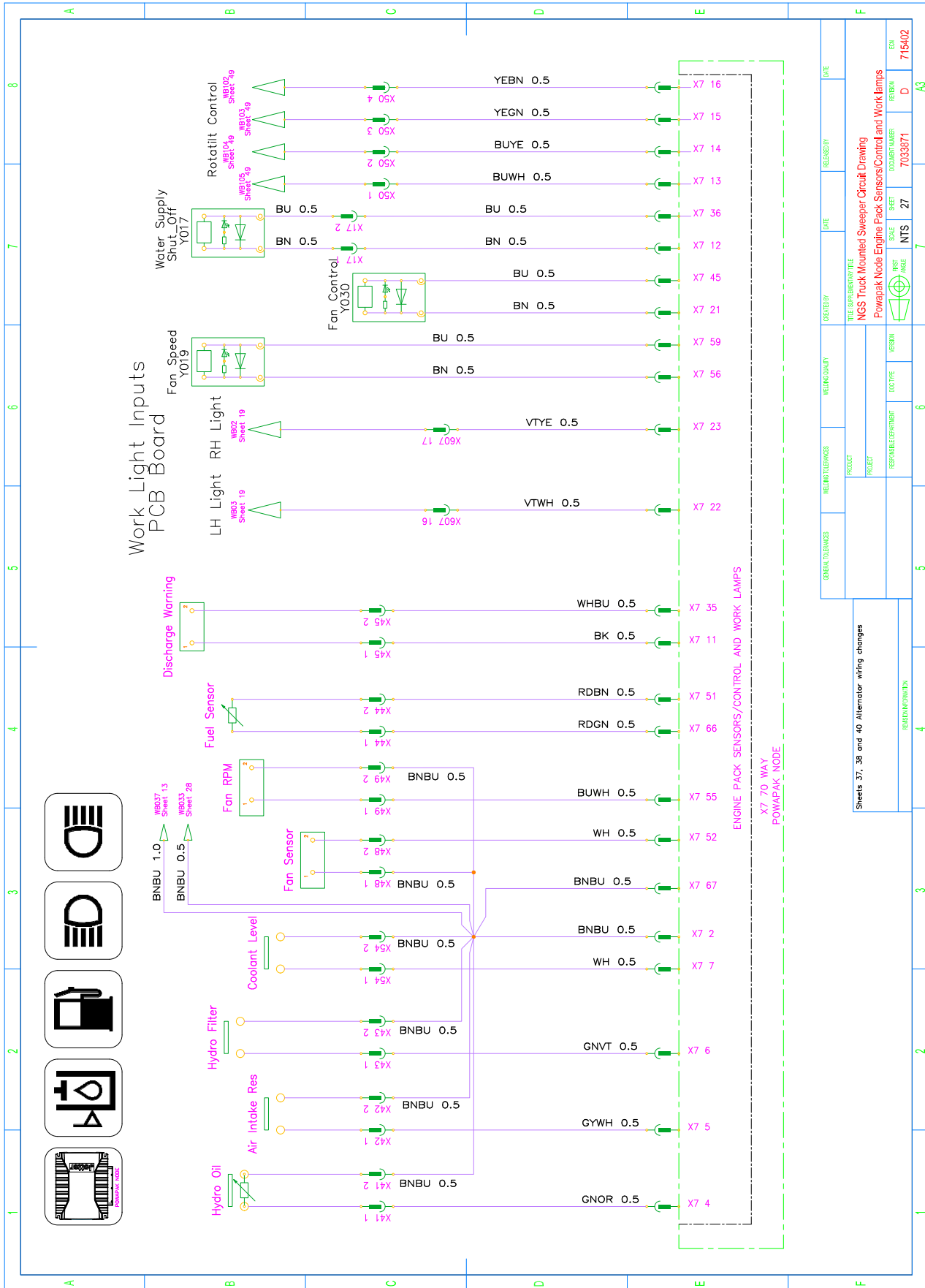
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GENERALISSUES	REVISIONS	REPRODUCTION	CREATED BY	DATE	REVISION	DATE
PROJECT			TITLE INFORMATION FILE			
RESPONSIBLE PART			PROJECT			
SCALE	SHEET	DOCUMENT NUMBER	REVISION	EOK		
NTS	26	7033871	D	715402		
VERSION	VERSION	VERSION	VERSION	VERSION		
REVISION INFORMATION						

Sheets 37, 38 and 40 Alternator wiring changes

Powapak Node Engine Pack Sensors/Control and Work Lamps - Sheet 27/64 Rev D



GENERAL TOLERANCES	REL TOLERANCES	REL DIMS TOLERANCES	REL DIMS TOLERANCES	DATE	DESIGNED BY	DATE
PROJECT			TITLE			
RESPONSIBLE DEPARTMENT			PROJECT			
RESPONSIBLE ENGINEER			SCALE			
DOCTYPER			SHEET			
YERBNA			NTS			
YERBNA			7			
DRAWING NUMBER			7033371			
DRAWING NUMBER			D			
DRAWING NUMBER			715402			

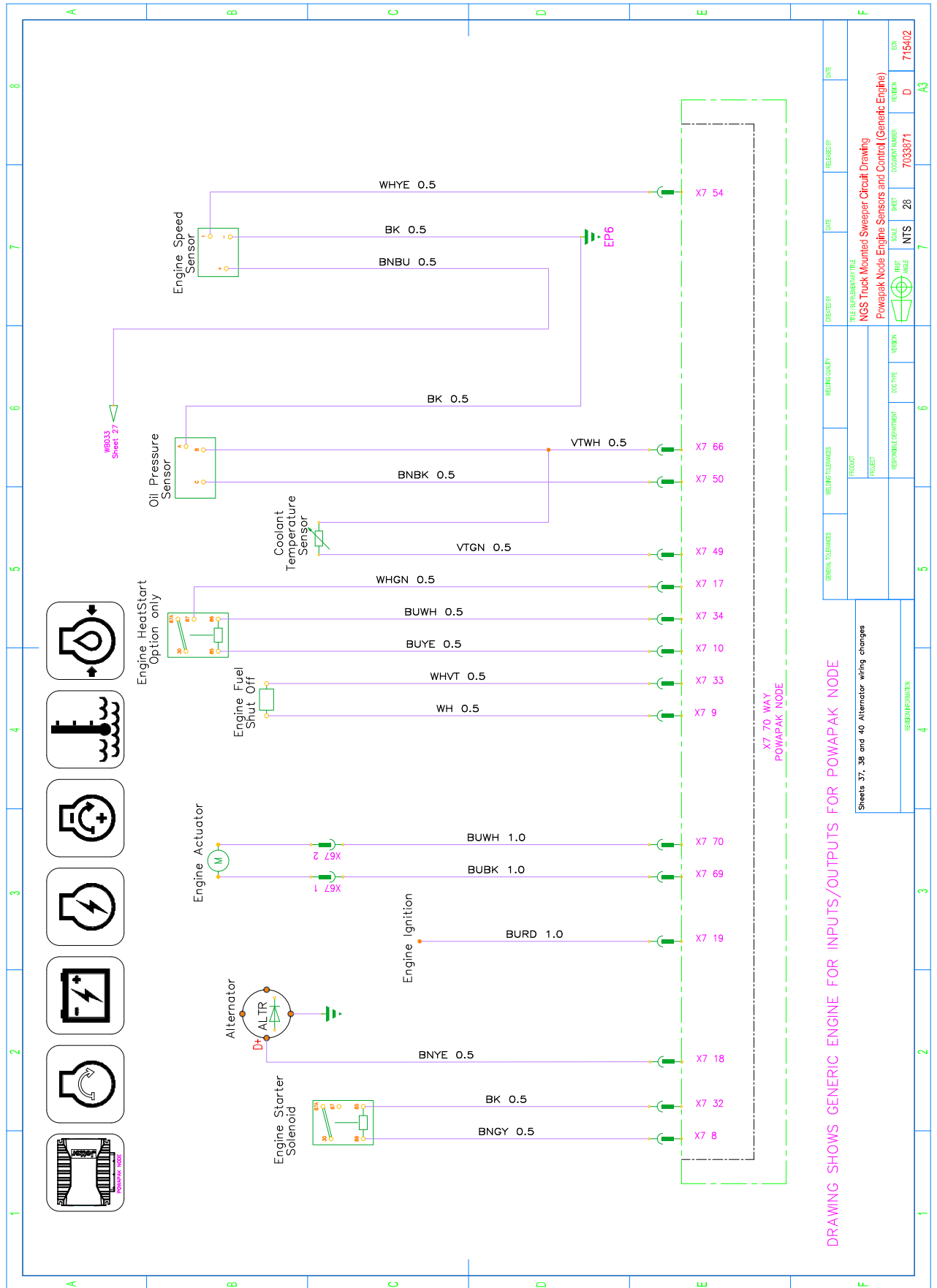
Sheets 37, 38 and 40 Alternator wiring changes	
REVISION INFORMATION	

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Powapak Node Engine Pack Sensors & Control (Generic Engine) - Sheet 28/64 Rev D

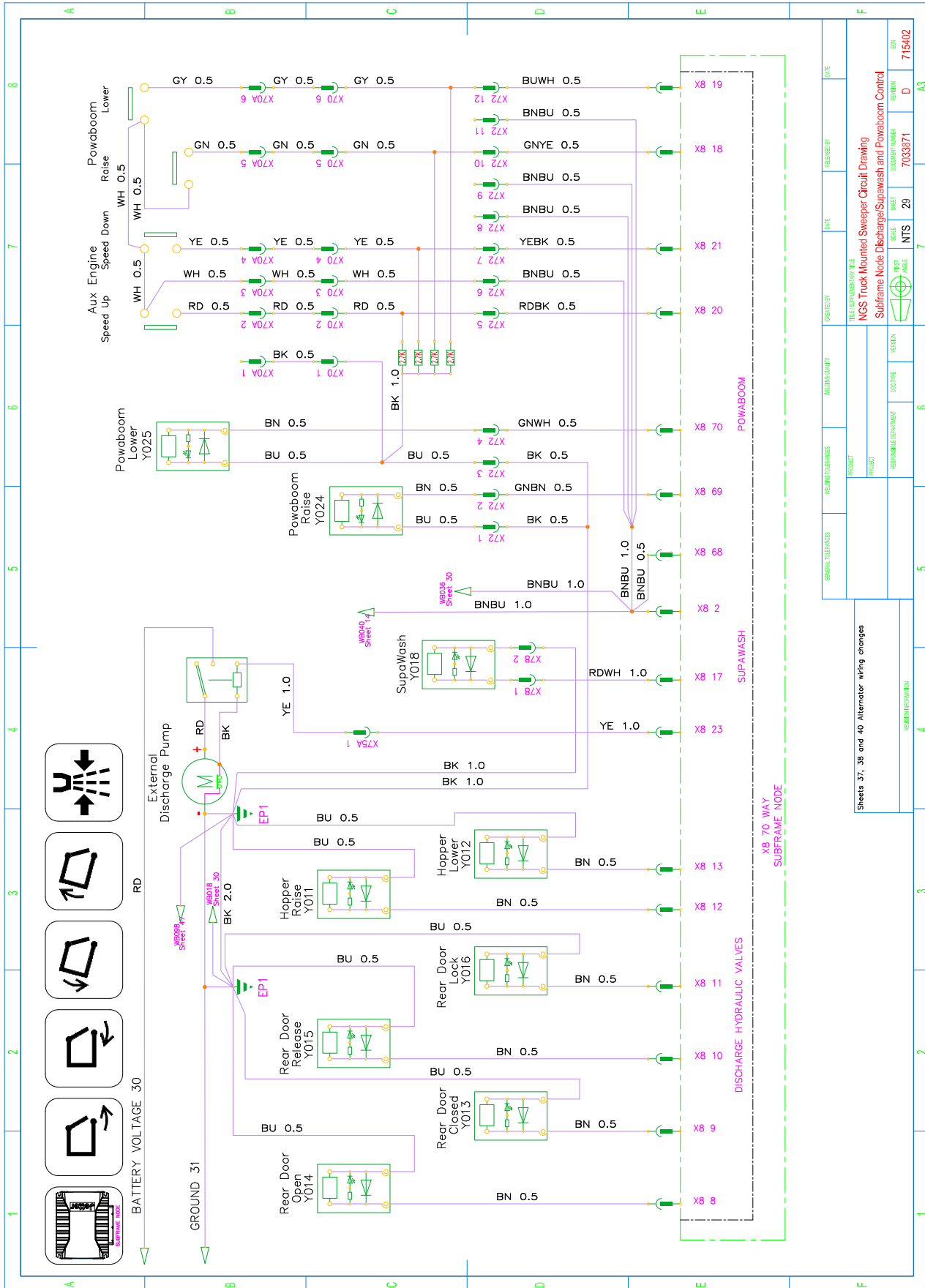
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DRAWING SHOWS GENERIC ENGINE FOR INPUTS/OUTPUTS FOR POWAPAK NODE

Sheets 37, 38 and 40 Alternator wiring changes

Subframe Node Discharge/Supawash and Powaboom Control - Sheet 29/64 Rev D

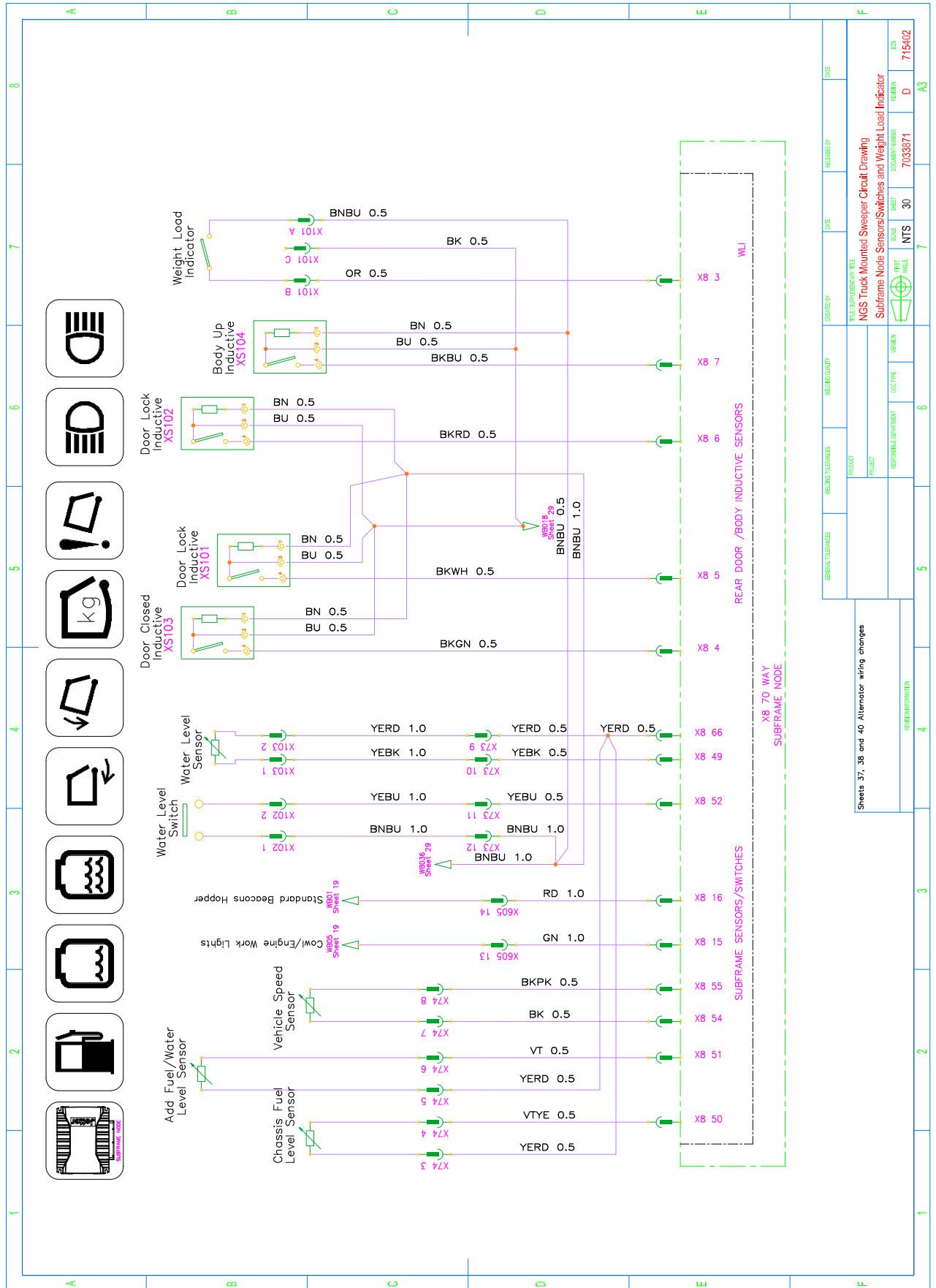


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<p>THE INFORMATION ON THIS DRAWING IS THE PROPERTY OF JOHNSTON</p> <p>PROJECT: NGS Track Mounted Sweeper Circuit Drawing</p> <p>SUBPROJECT: Subframe Node Discharge/Supawash and Powaboom Control</p>						
SHEETS 37, 38 and 40 Alternator wiring changes		RESPONSIBLE PARTY	DOCTYPER	VERBANK	SCALE	SHEET
REVISION INFORMATION		NTS	29	7033871	D	715402

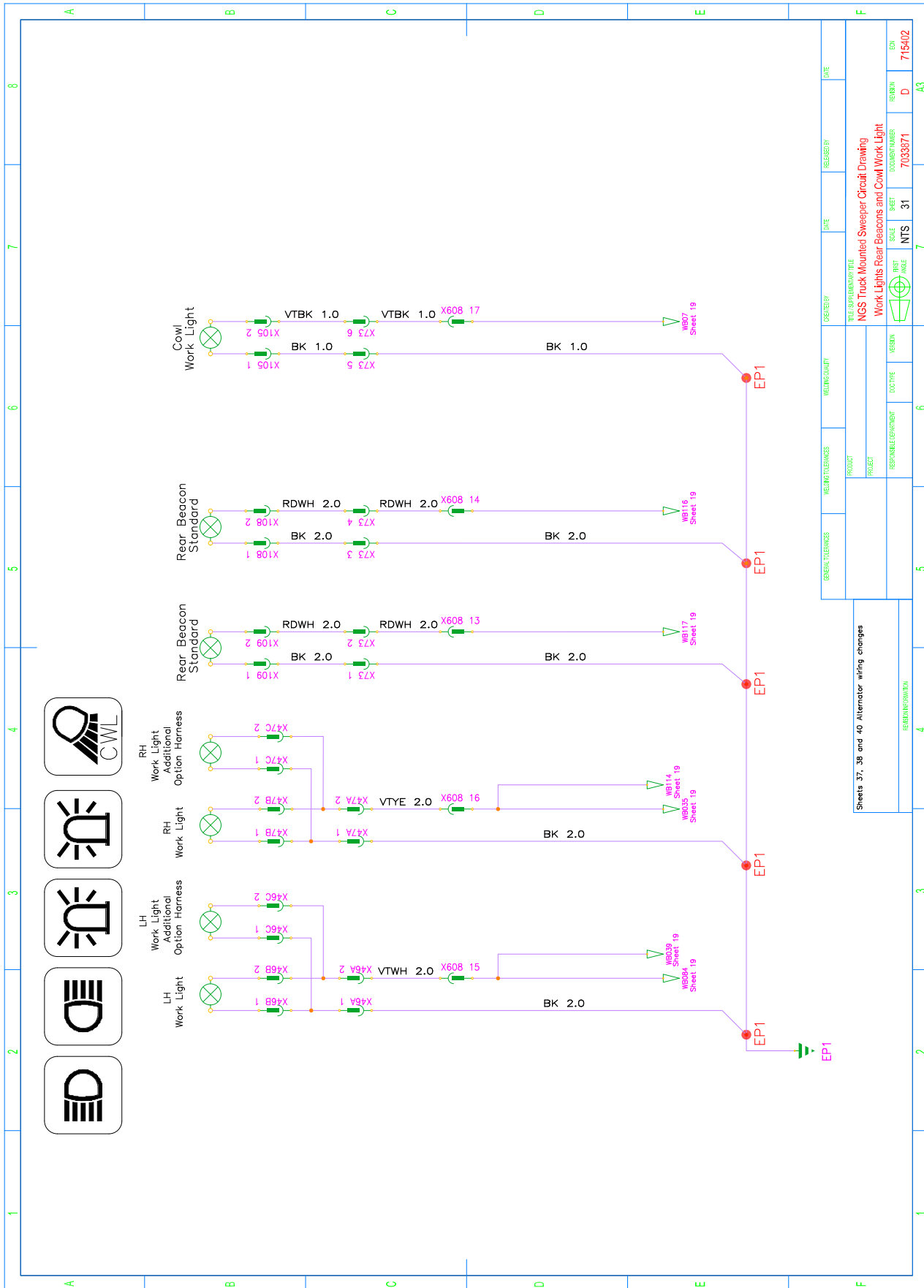
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Subframe Node Sensors/Switches and Weight Load Indicator - Sheet 30/64 Rev D

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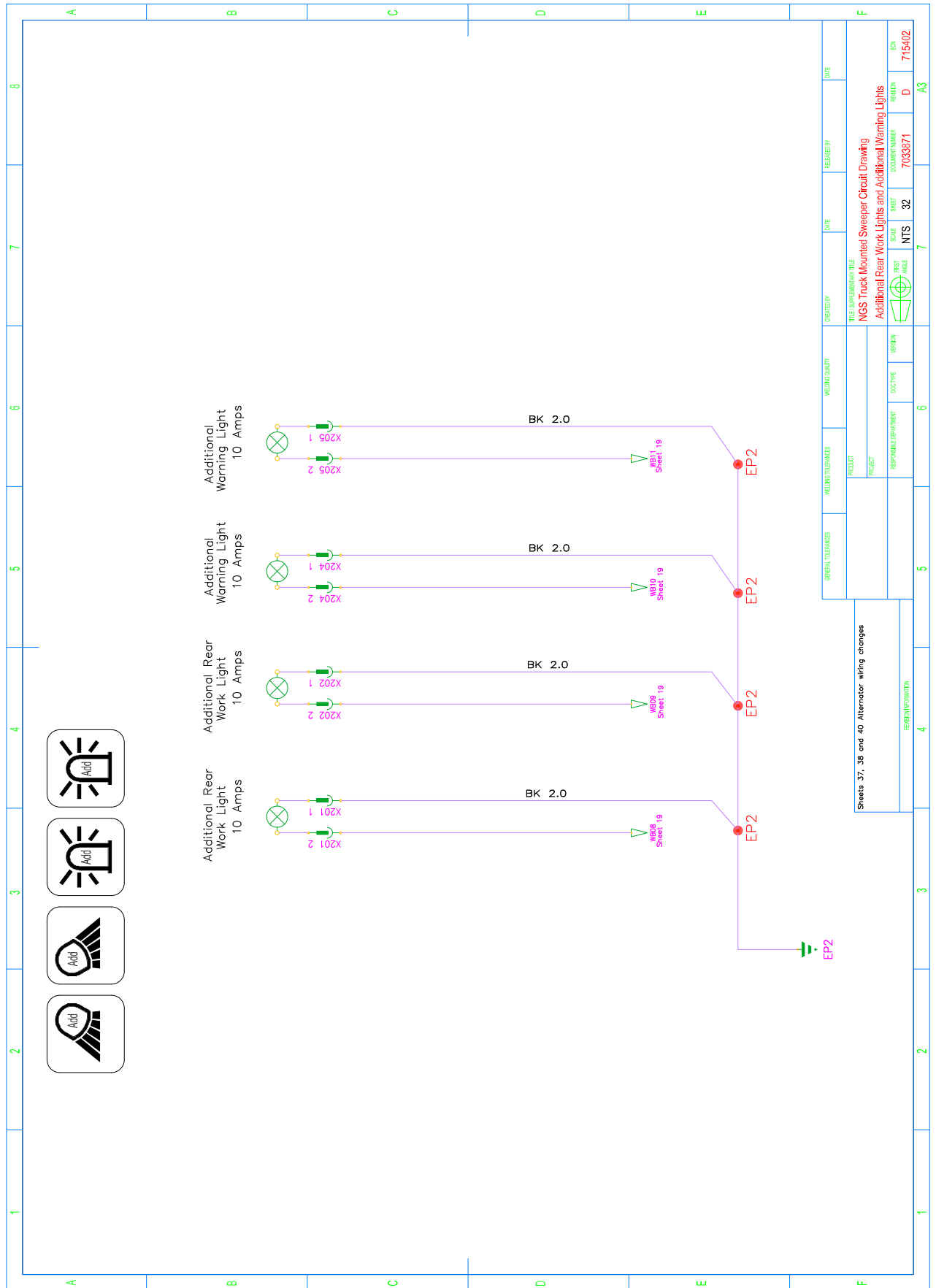
Work Lights Rear Beacons and Cowl Work Light - Sheet 31/64 Rev D



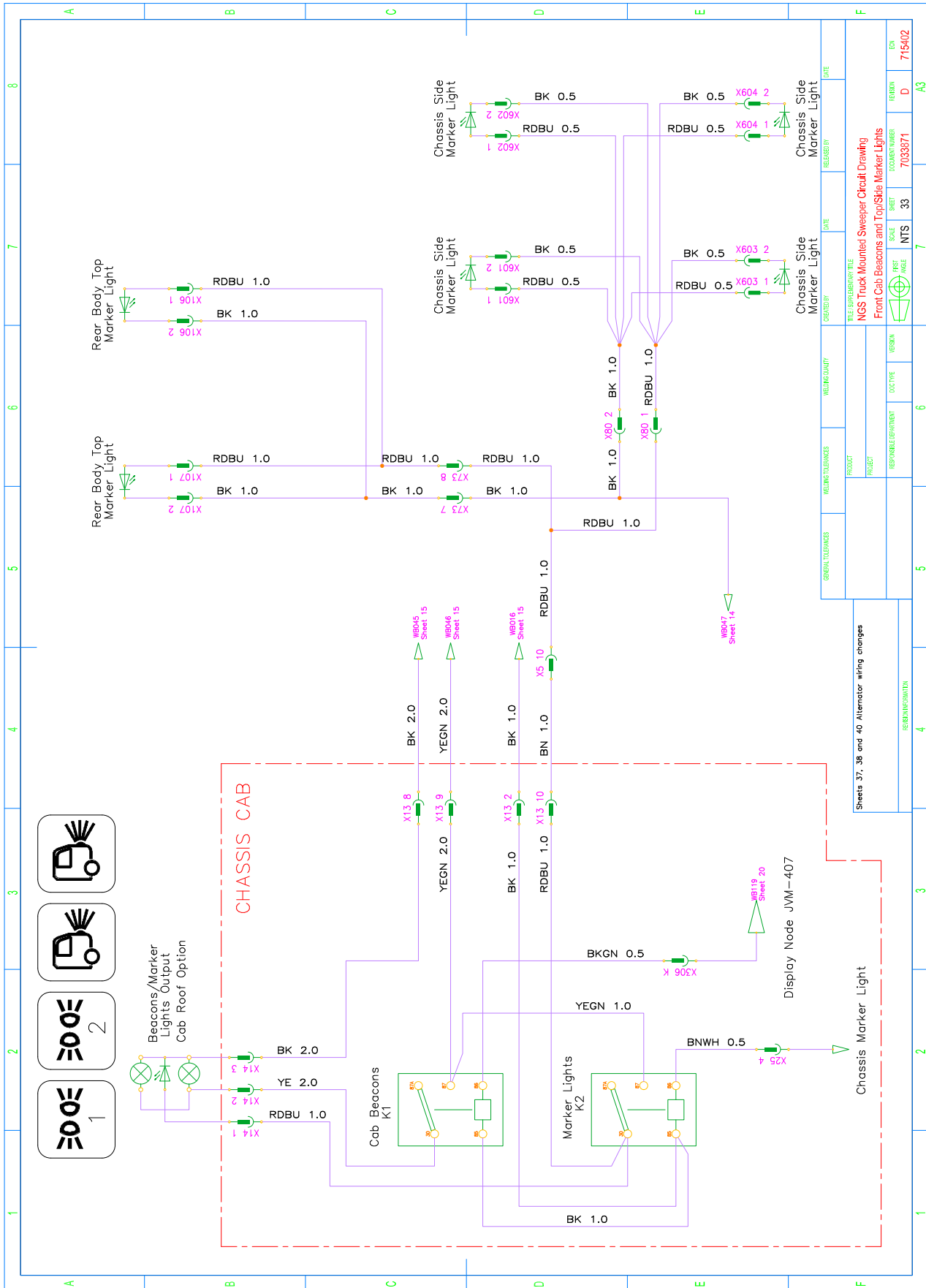
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Additional Rear Work Lights and Additional Warning Lights - Sheet 32/64 Rev D

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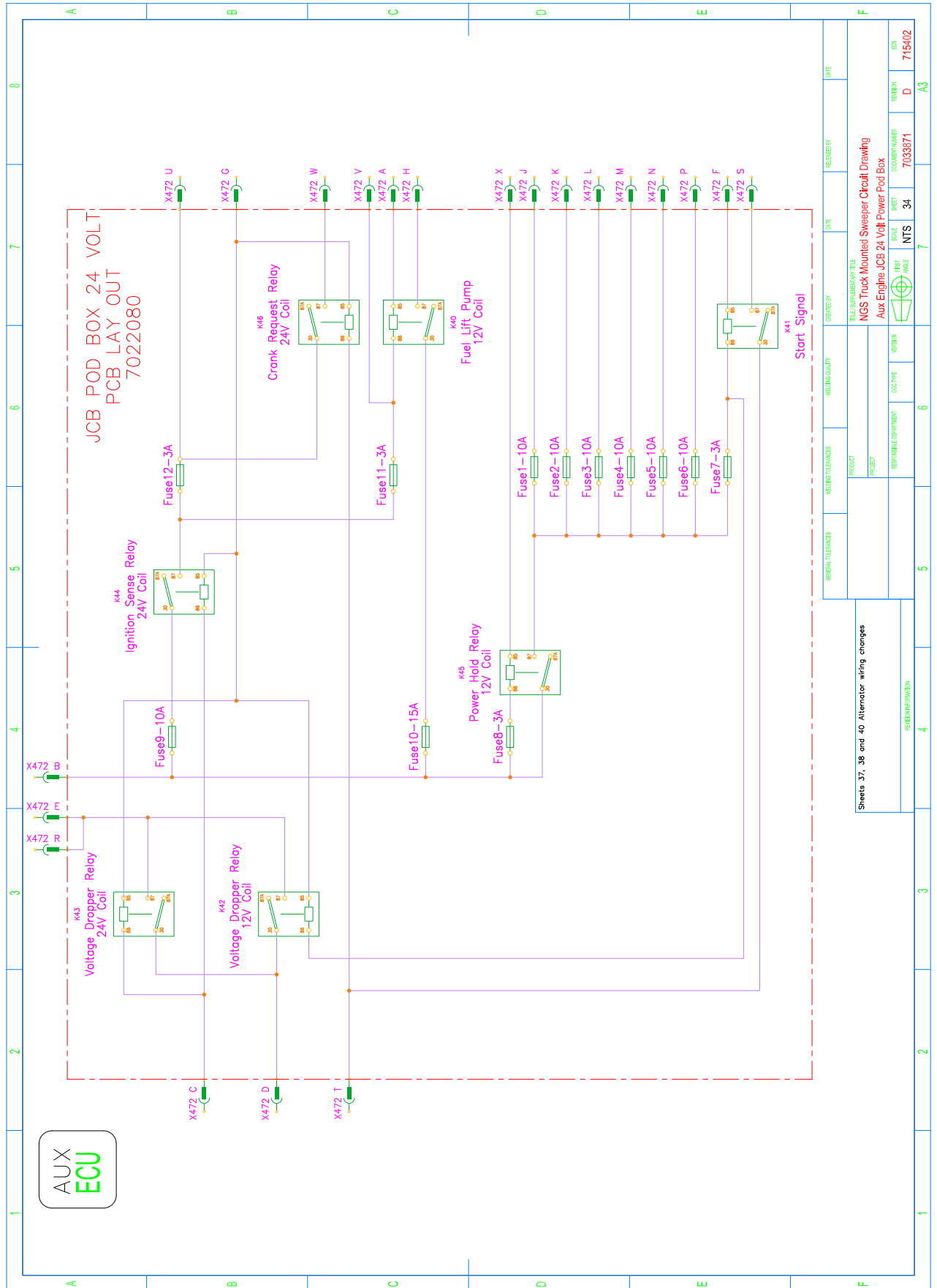
Front Cab Beacons and Top/Side Marker Lights - Sheet 33/64 Rev D



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Aux Engine JCB 24 Volt Power Pod Box - Sheet 34/64 Rev D

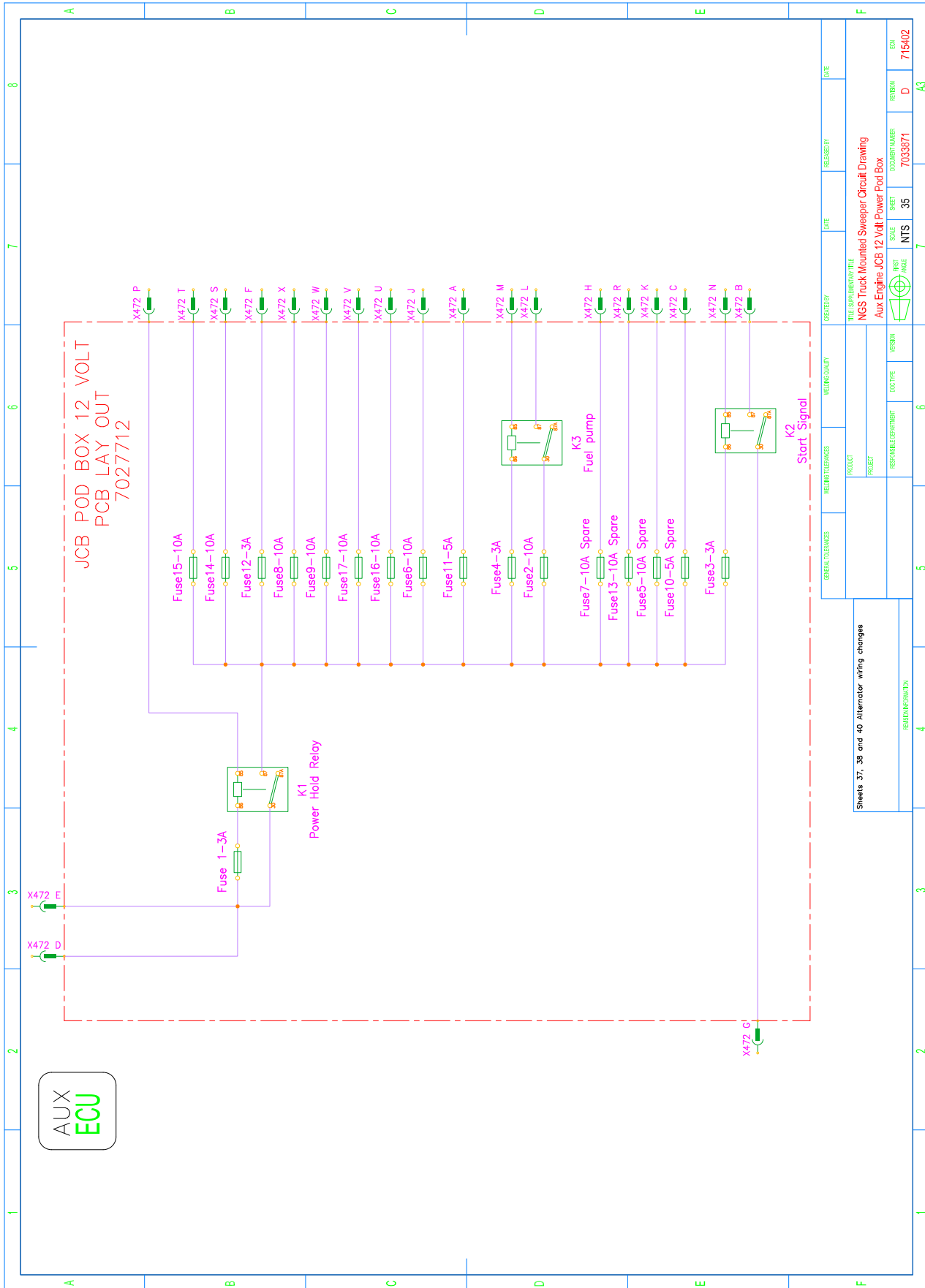
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DATE	RELEASED BY	DATE
CREATED BY	DATE	RELEASED BY
FILE REFERENCE FILE	N5S Truck Mounted Sweeper Circuit Drawing	
PROJECT	Aux Engine JCB 24 Volt Power Pod Box	
RESPONSIBLE DEPARTMENT	DOC TYPE	VER/SKIN
REVISION INFORMATION	NTS	34
	SCALE	7:1
	ANGLE	7
	REVISION	D
	DOC/ITEM NUMBER	7033871
	REVISION	D
	EON	715402

Sheets 37, 38 and 40 Alternator wiring changes

Aux Engine JCB 12 Volt Power Pod Box - Sheet 35/64 Rev D



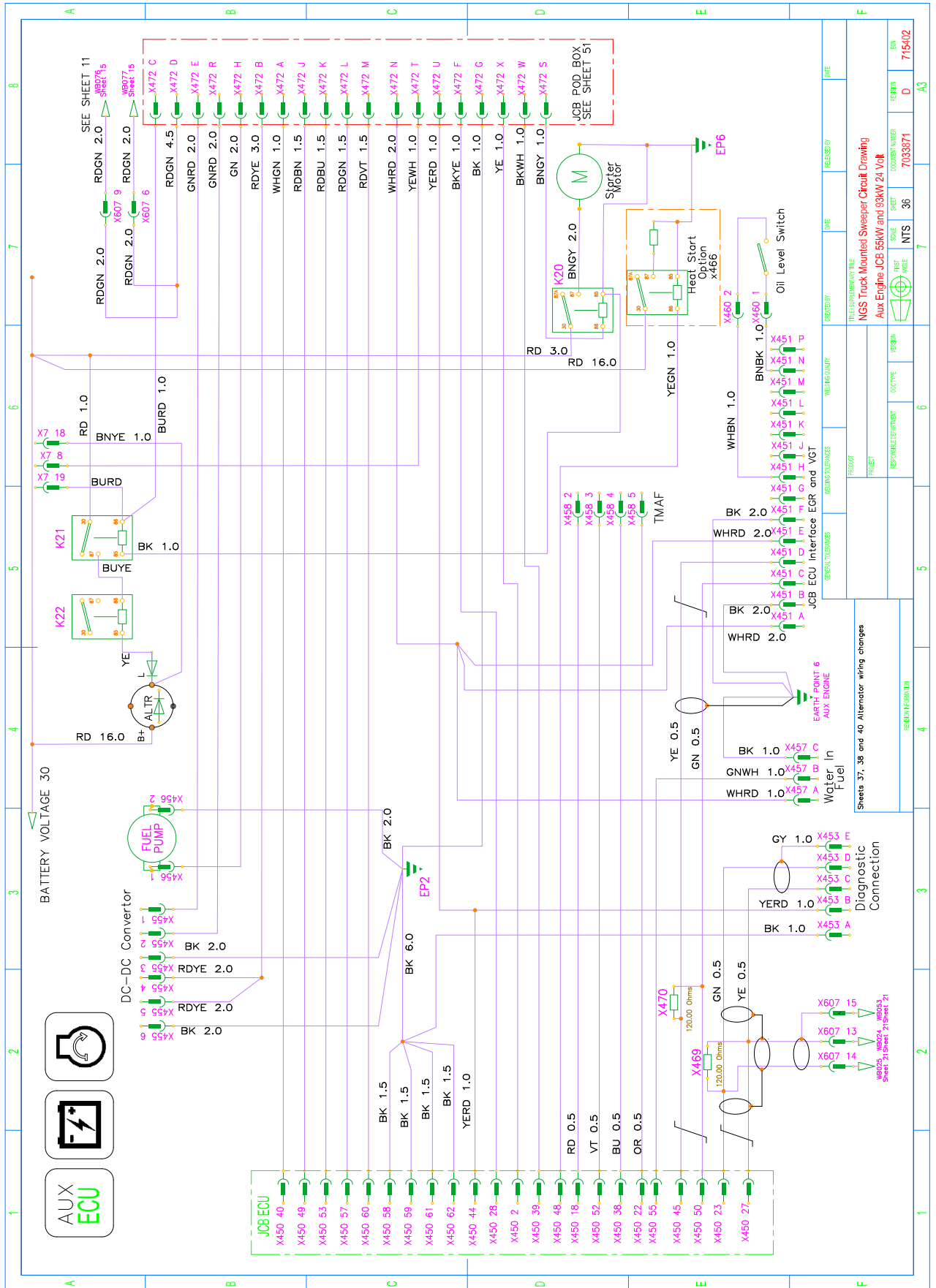
GENERAL TOLERANCES		MEASUREMENTS		CREATED BY		DATE	
SHEETS 37, 38 and 40 Alternator wiring changes		PROJECT		NGS Truck Mounted Sweeper Circuit Drawing		7	
REVISIONS		DOCTYPE		DOCUMENT NUMBER		EON	
7		NTS		7033871		715402	
4		6		D		A3	

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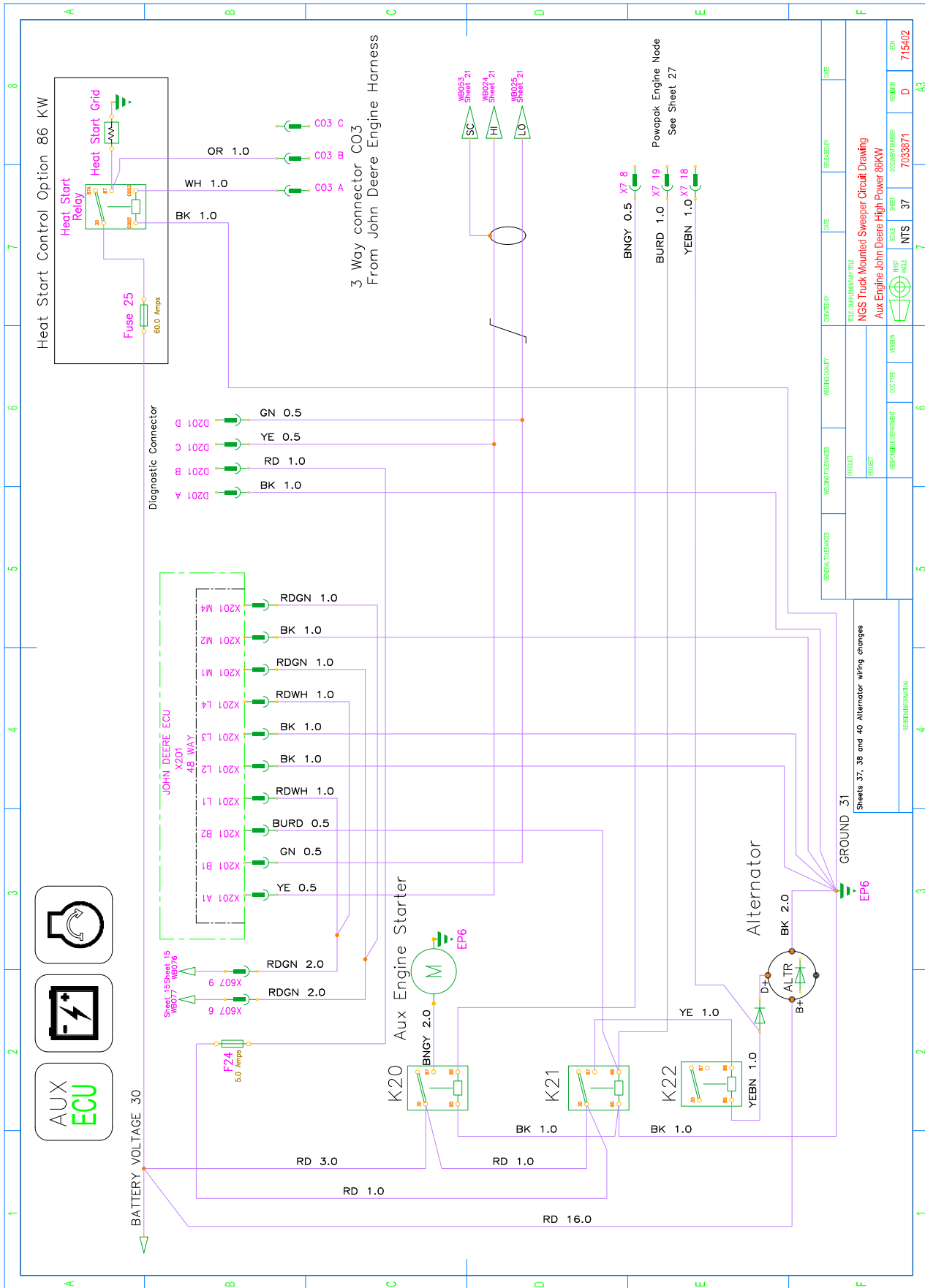


Aux Engine JCB 55kW and 93kW 24 Volt - Sheet 36/64 Rev D

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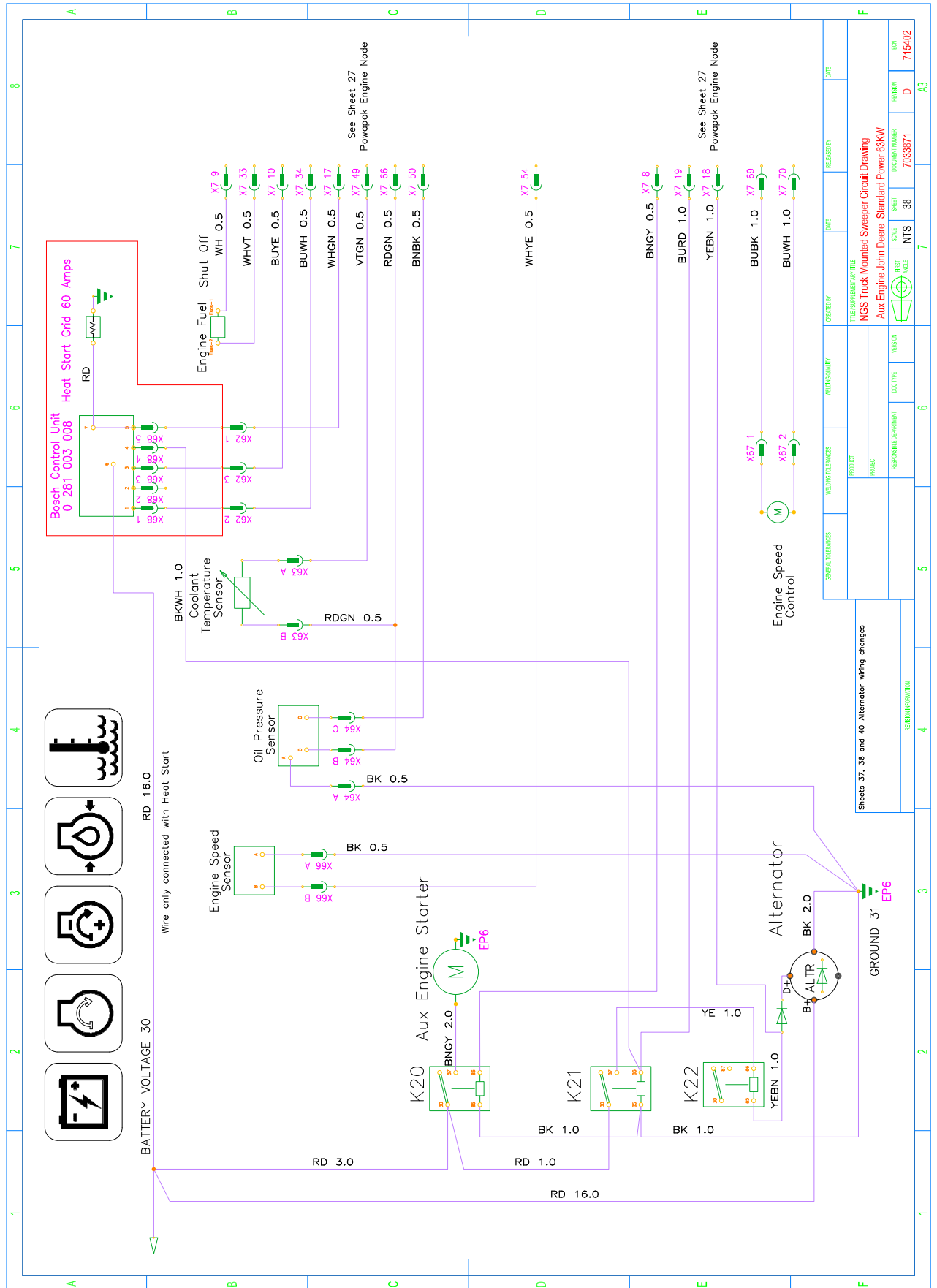
Aux Engine John Deere High Power 86kW - Sheet 37/64 Rev D



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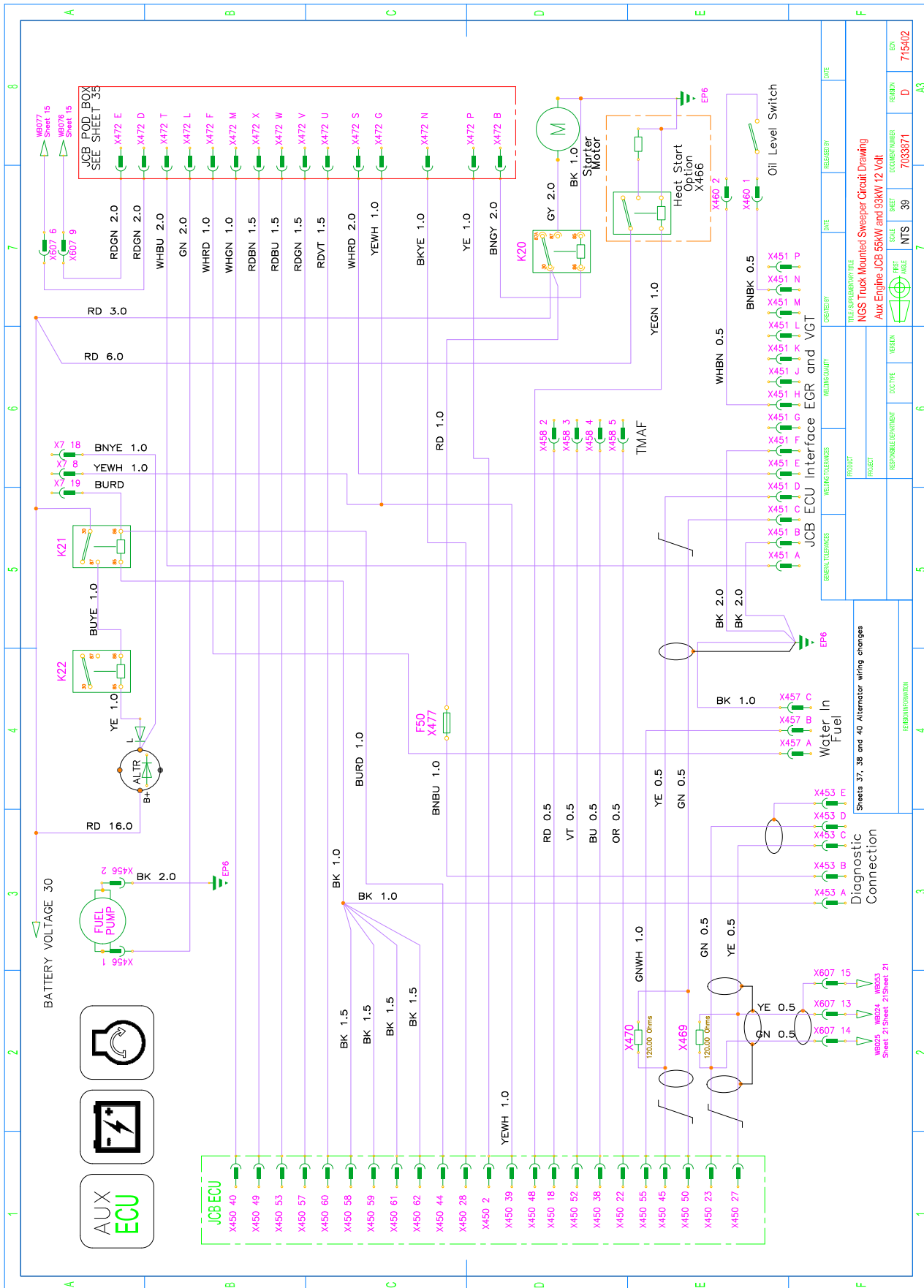
Aux Engine John Deere Standard Power 63kW - Sheet 38/64 Rev D

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GENERAL TOLERANCES	MATERIAL TOLERANCES	WELDING QUALITY	CATEGORY	DATE	RELEASED BY	DATE
THE INFORMATION FILE <b>NGS Truck Mounted Sweeper Circuit Drawing</b> Aux Engine John Deere Standard Power 63KW			SHEET 38	DRAWING NUMBER 7033871	REVISION D	ECRN 715402
SHEETS 37, 38 and 40 Alternator wiring changes			NTS 38	NTS 38	NTS 38	NTS 38

Aux Engine JCB 55kW and 93kW 12 Volt - Sheet 39/64 Rev D

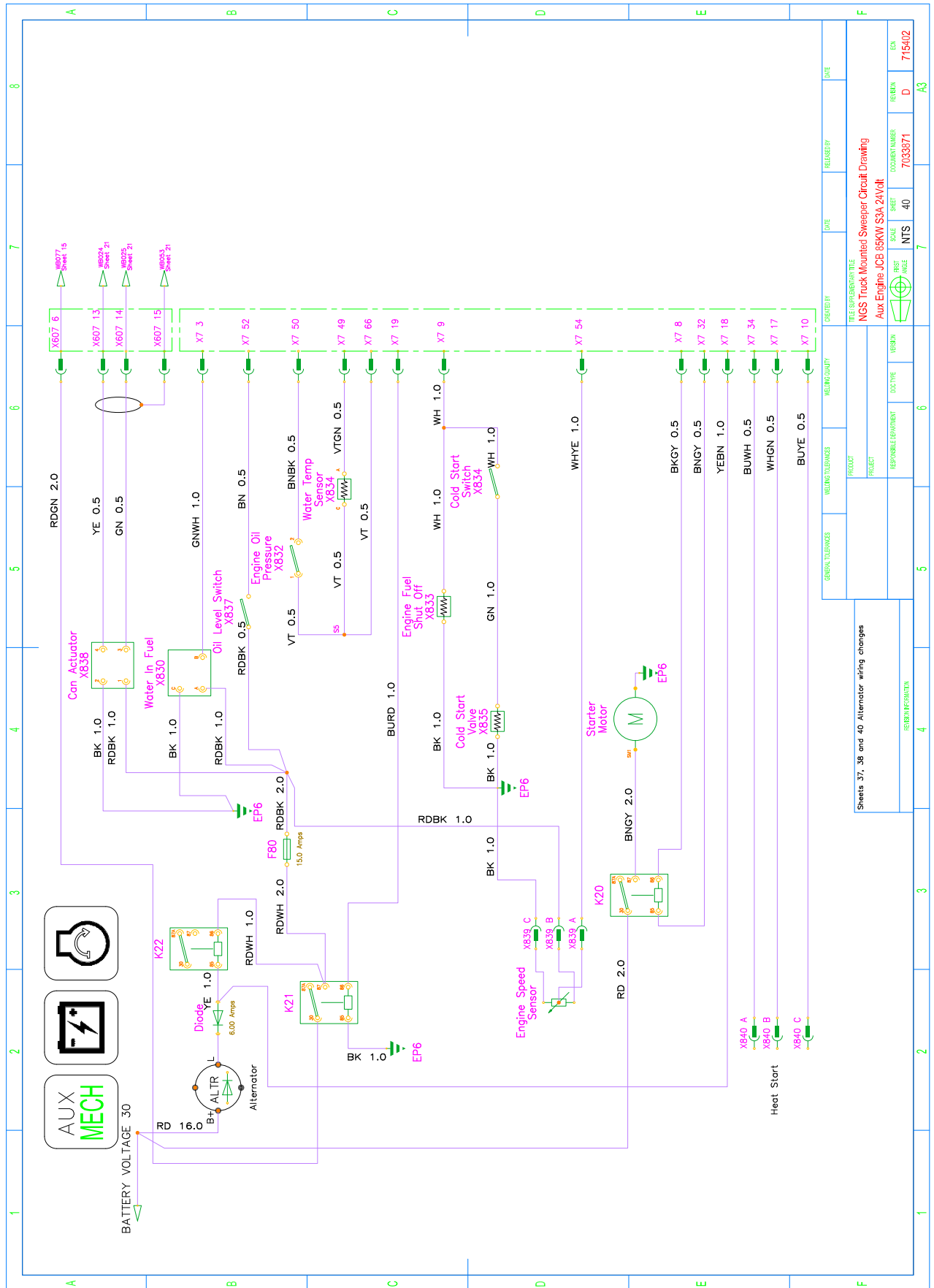


GENERAL TOLERANCES	RELIEF TOLERANCES	PRODUCT	REVISION	DATE	REVISION	DATE
		NGS Truck Mounted Sweeper Circuit Drawing	SCALE	SHEET	DOCUMENT NUMBER	EDN
		Aux Engine JCB 55kW and 93kW 12 Volt	NTS	39	7033871	715402
			FIRST ANGLE	7	D	

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Aux Engine JCB 85kW S3A 24 Volt - Sheet 40/64 Rev D

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GENERAL TELEGRAMS	WELDING TELEGRAMS	WELDING DIAGN	IDENTIFY	DATE	RELEASED BY	DATE
TELESUBMITTABLE			NGS Truck Mounted Sweeper Circuit Drawing			
PROJECT			Aux Engine JCB 85kW S3A 24Volt			
RESPONSIBLE DEPARTMENT			DOCTRY			
SERIAL POSITION			WORK			
SHEETS 37, 38 and 40 Alternator wiring changes			SCALE	SHEET	DATE	REV
SERIAL POSITION			NTS	40	7033371	D
			ANGLE	7		A3
						715402

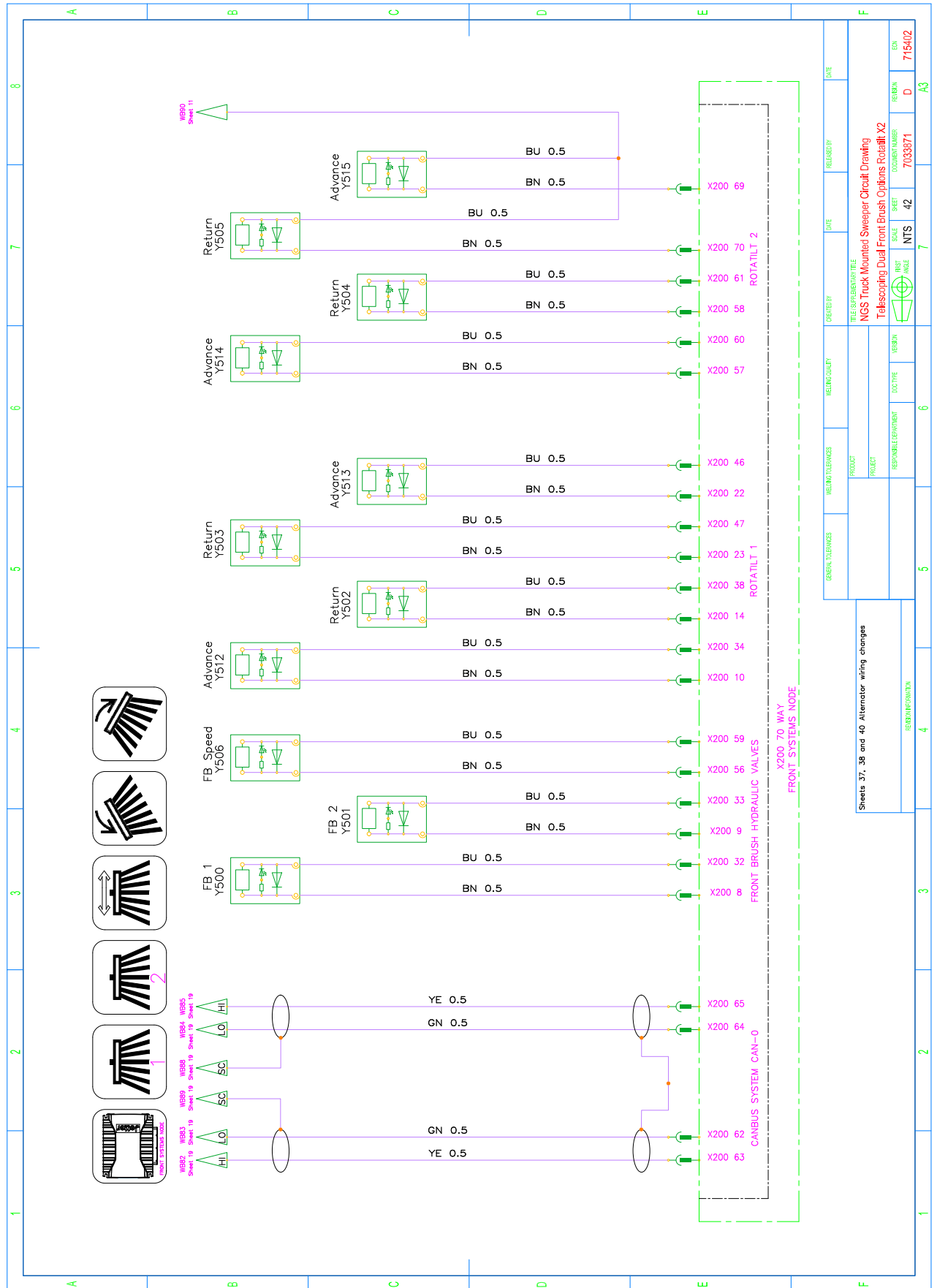
**Spare - Sheet 41/64 Rev D**

SPARE						GENERAL TOLERANCES WEIGHTS/TOLERANCES HELIX QUALITY CRYSTALLINITY DATE REVISION DATE	
						TITLE AND SUBJECT MATTER <b>NGS Truck Mounted Sweeper Circuit Drawing</b> Spare	
						SHEETS 37, 38 and 40 Alternator wiring changes REVISION INFORMATION	
						PROJECT RESPONSIBLE DEPARTMENT DOC TYPE VERSION	SCALE SHEET NTS 41 7
						DOCUMENT NUMBER 7033871	ECR 715402

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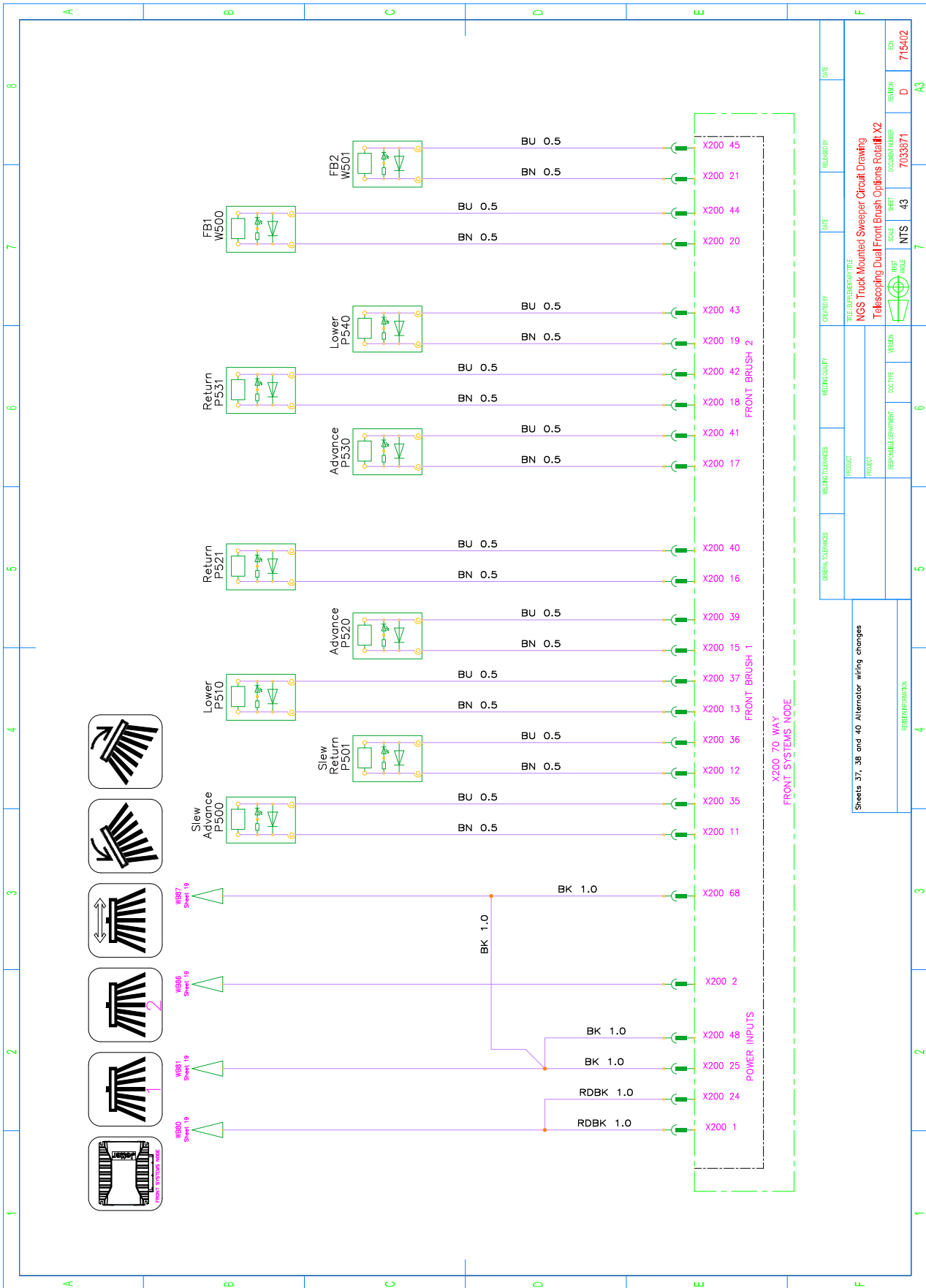
Telescopic Dual Front Brush Options Rotatilt x2 01 - Sheet 42/64 Rev D

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GENERAL TOLERANCES	MATERIAL TOLERANCES	FINISH QUALITY	CURRENCY	DATE	RELEASED BY	DATE
<p><b>NGS Truck Mounted Sweeper Circuit Drawing</b>  <b>Telescopic Dual Front Brush Options Rotatilt X2</b></p>						
<p>PROJECT: _____</p>		<p>SCALE: _____</p>		<p>SHEET: _____</p>		<p>EDN: 715402</p>
<p>RESPONSIBLE DEPARTMENT: _____</p>			<p>DOCTYPE: _____</p>		<p>REVISION: _____</p>	<p>REVISION: _____</p>
<p>REVISION INFORMATION</p>			<p>NTS: 42</p>		<p>7</p>	<p>A3</p>
<p>Sheets 37, 38 and 40 Alternator wiring changes</p>						

Telescopic Dual Front Brush Options Rotatilt x2 02 - Sheet 43/64 Rev D

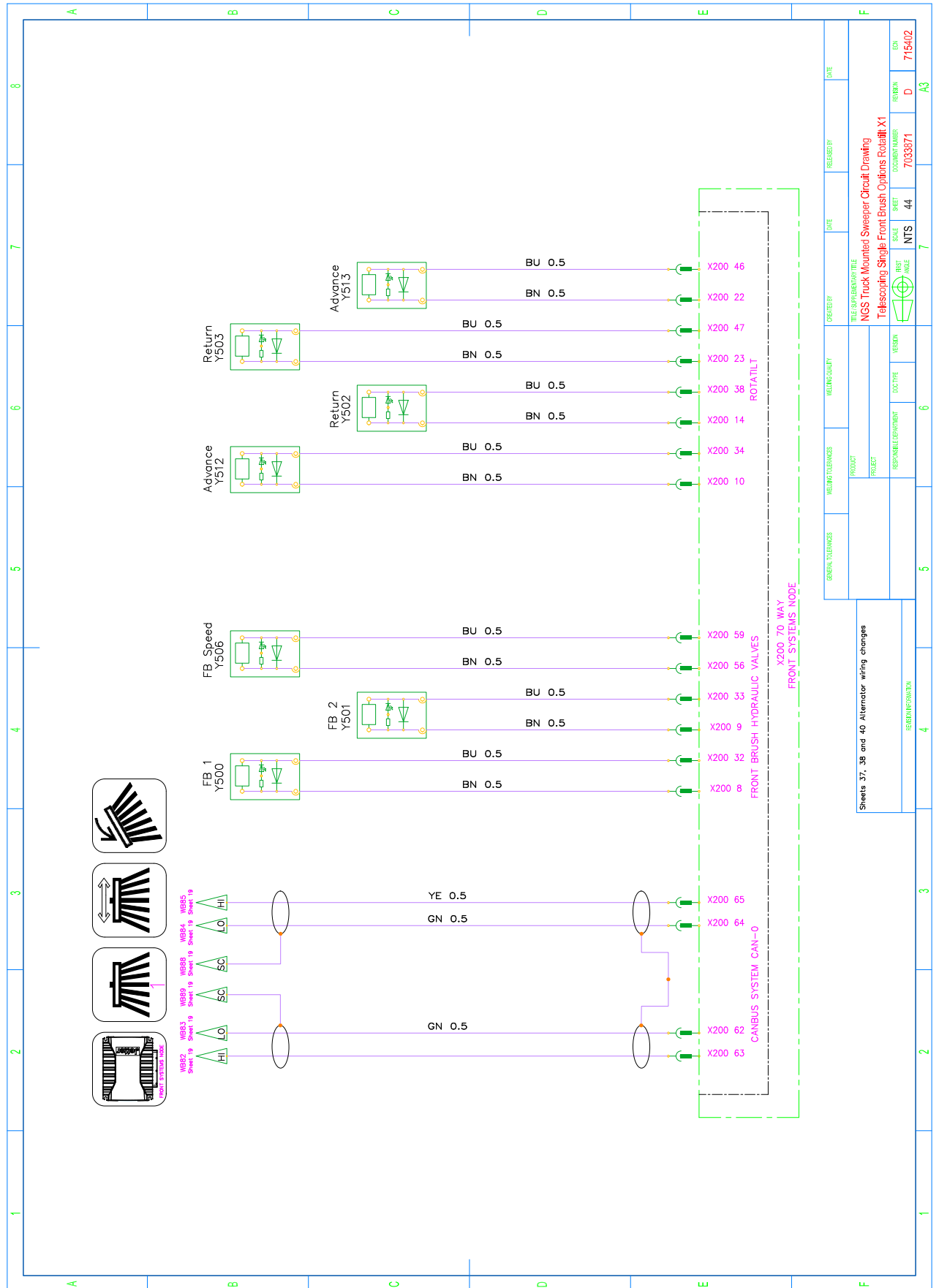


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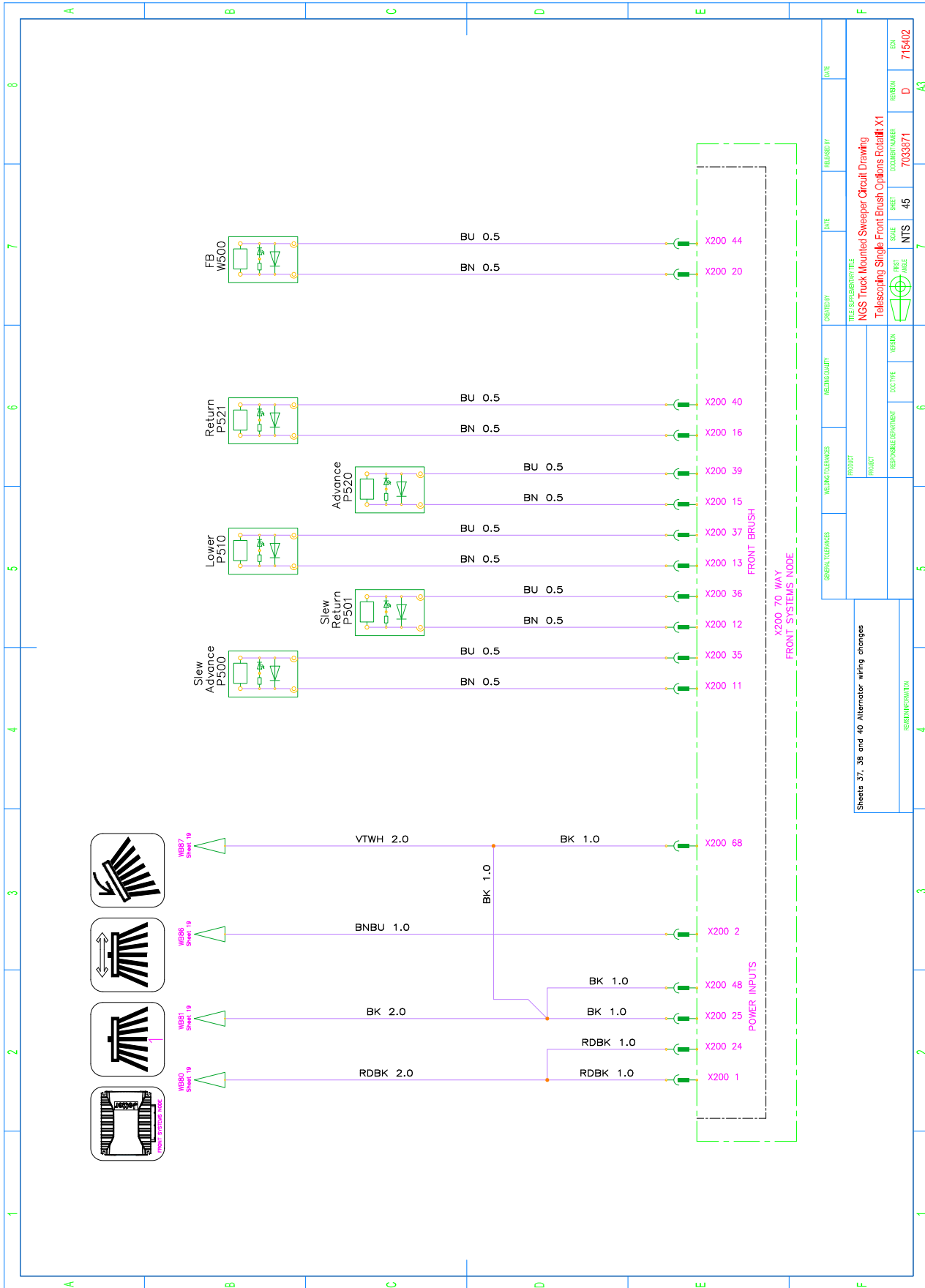


Telescopic Single Front Brush Options Rotatilt x1 01 - Sheet 44/64 Rev D

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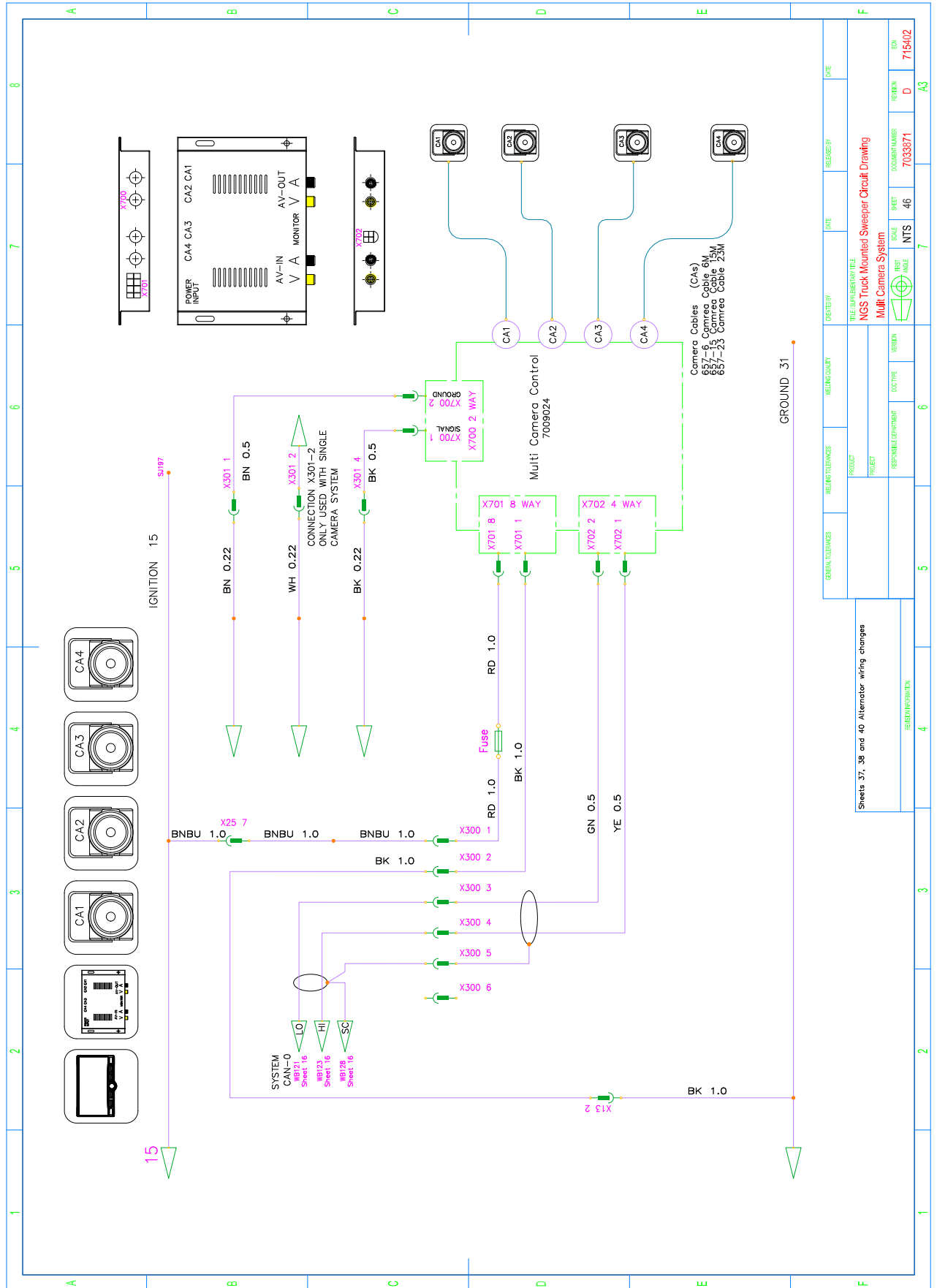
Telescopic Single Front Brush Options Rotatilt x1 02 - Sheet 45/64 Rev D



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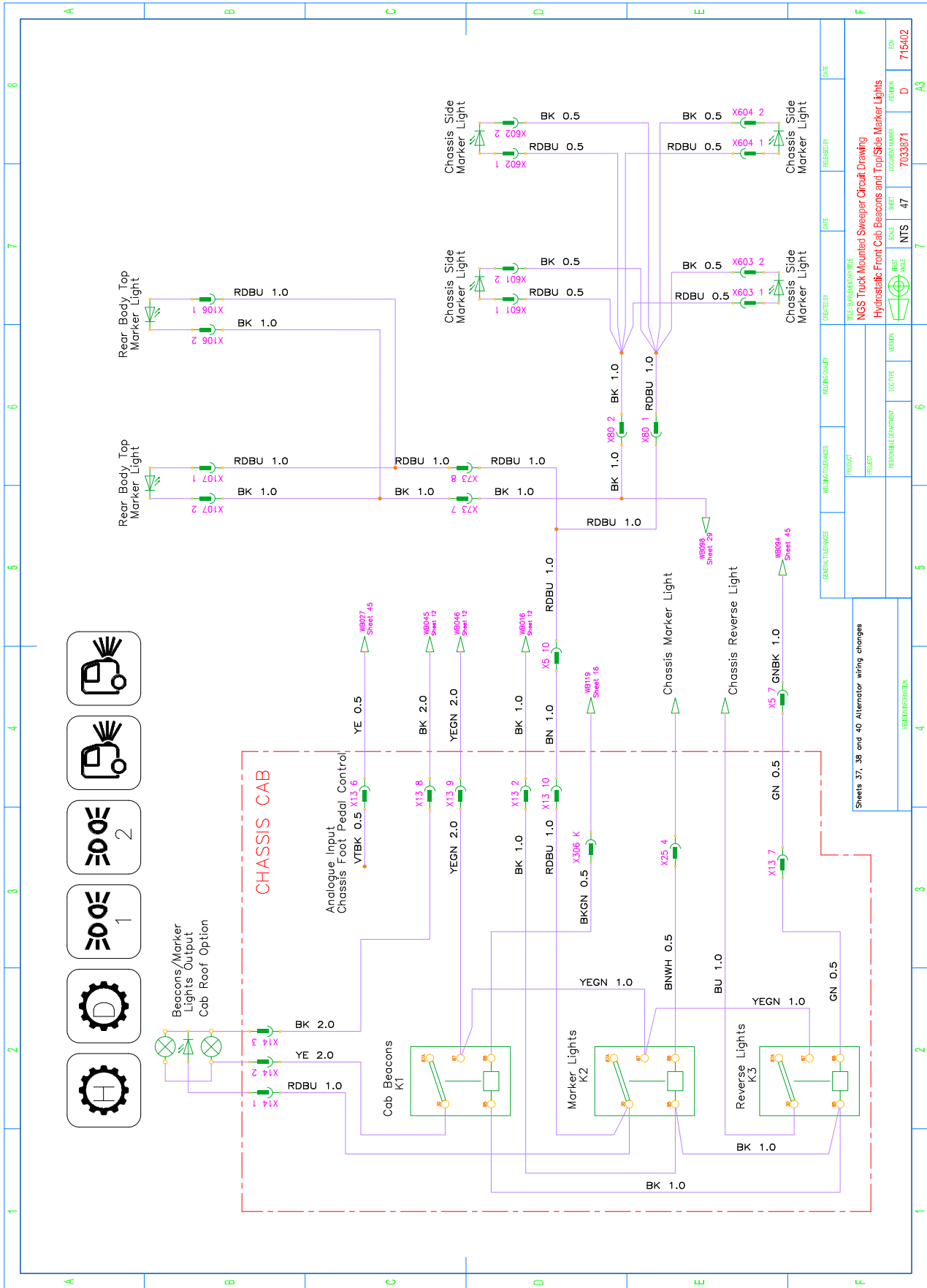
Multi Camera System - Sheet 46/64 Rev D



Sheets 37, 38 and 40 Alternator wiring changes

GENERAL TOLERANCES	RELIEF TOLERANCES	MATERIALS	FINISHES	PROTECT	PROJECT	RESPONSIBLE DEPARTMENT	DOCTRYE	VERSION	SCALE	NTS	SHEET	DOCUMENT NUMBER	REVISION	EDN
											46	7033871	D	715402

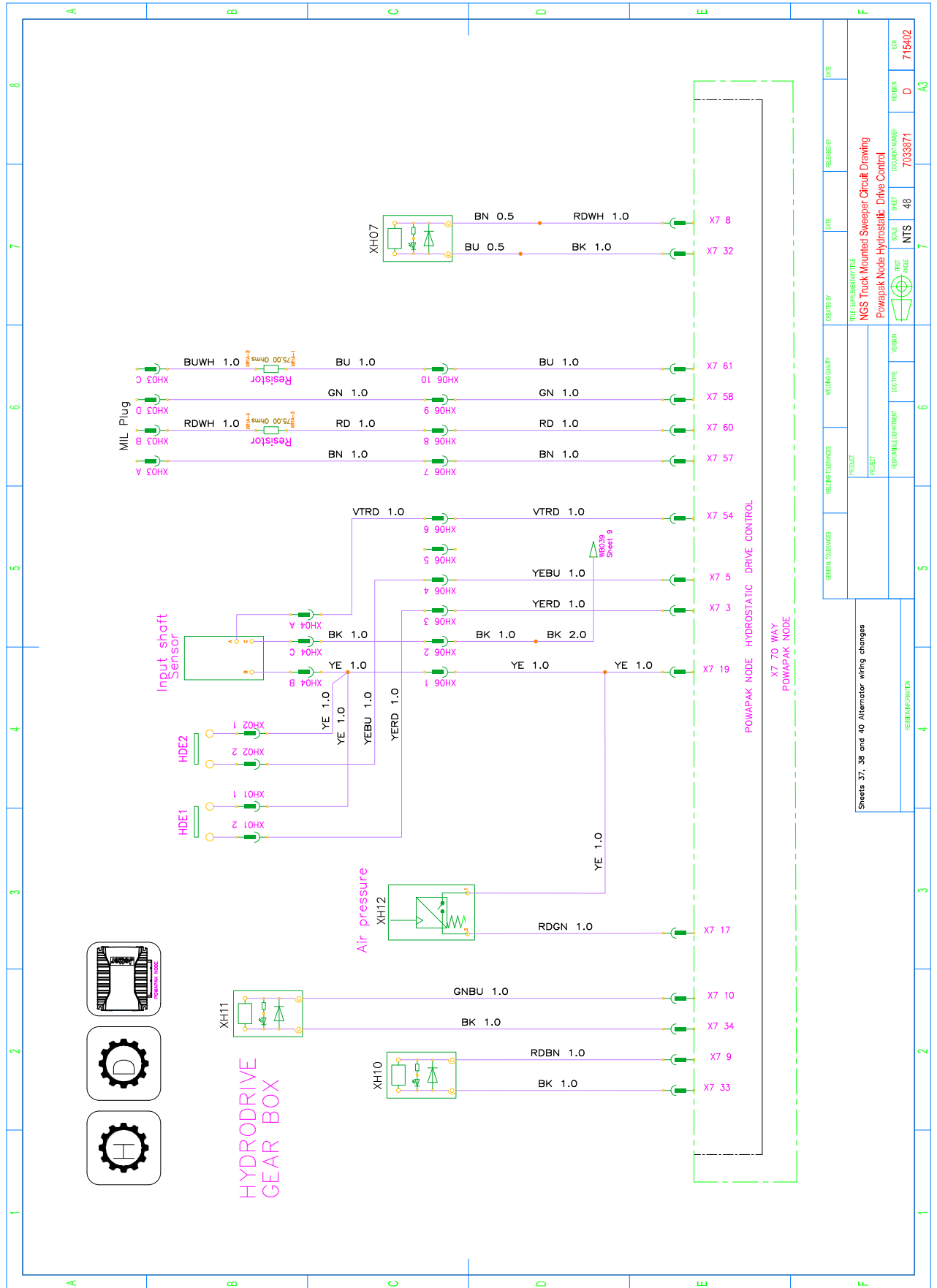
Hydrostatic Front Cab Beacons and Top/Side Marker Lights - Sheet 47/64 Rev D



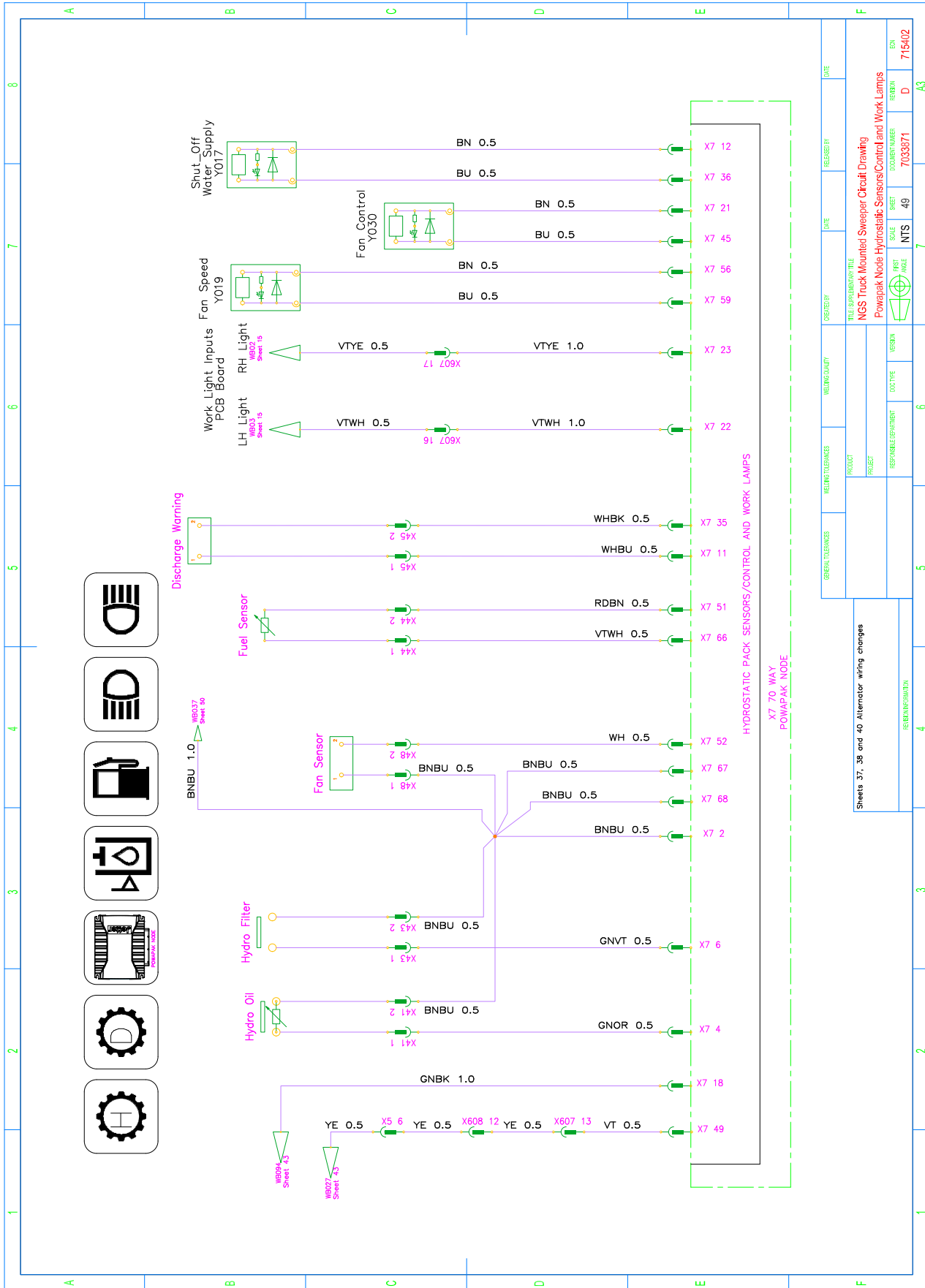
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Powapak Node Hydrostatic Drive Control - Sheet 48/64 Rev D

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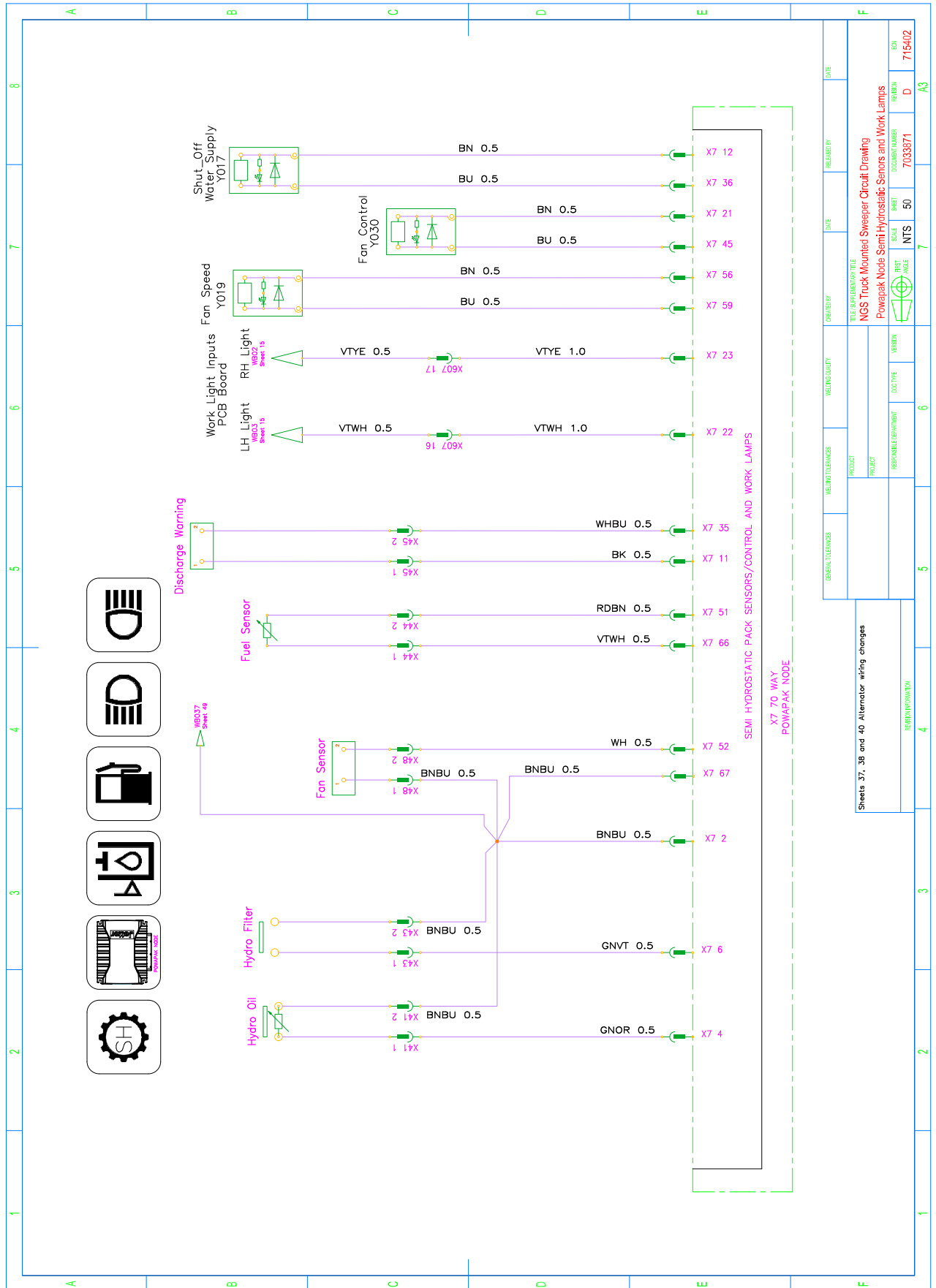
**Powapak Node Hydrostatic Sensors/Control and Work Lamps - Sheet 49/64 Rev D**



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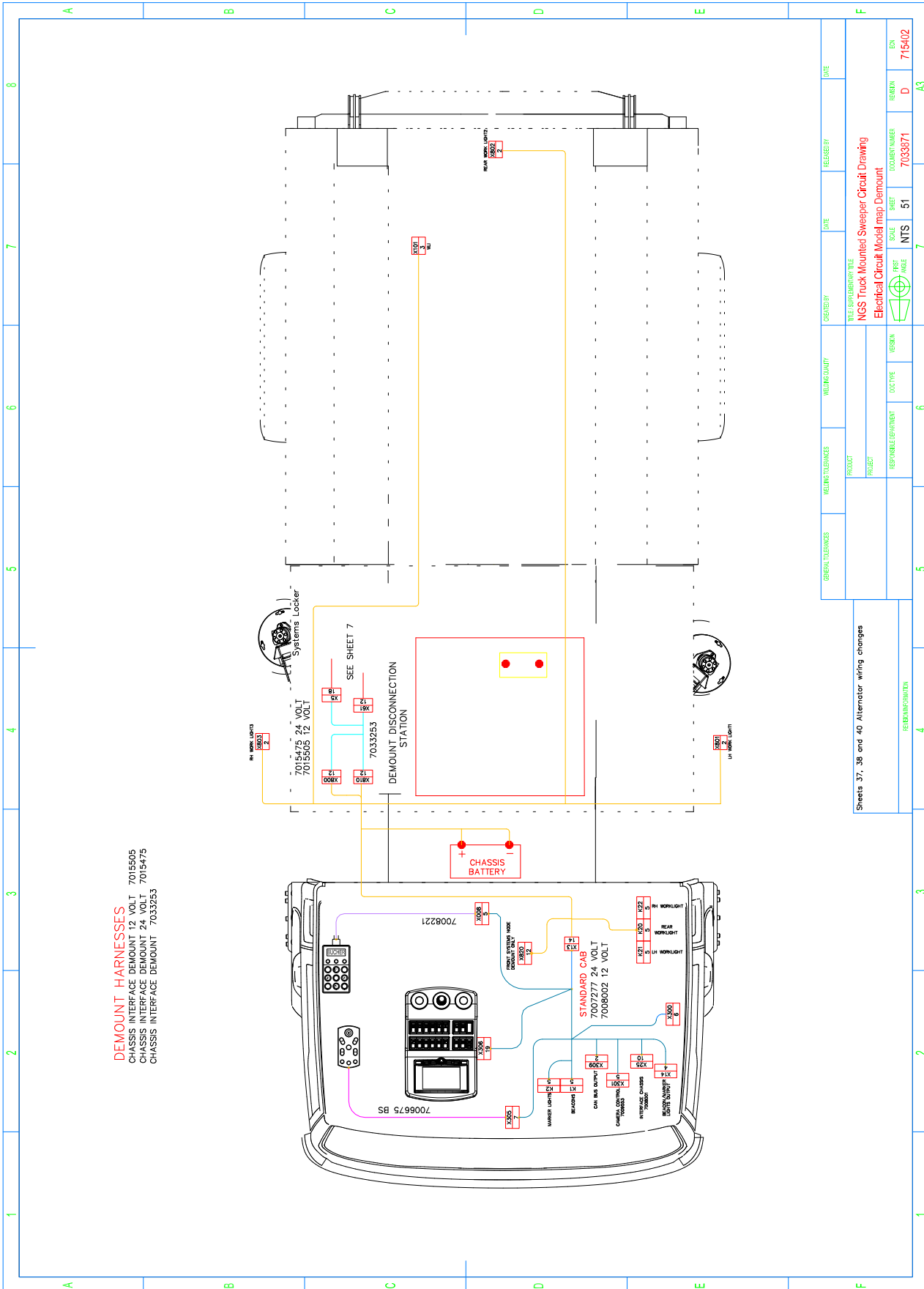
Powapak Node Semi Hydrostatic Sensors and Work Lamps - Sheet 50/64 Rev D

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GENERAL TOLERANCES	MATERIAL TOLERANCES	WELDING QUALITY	CREATED BY	DATE	RELEASED BY	DATE
PRODUCT			TITLE SUPERSCRIPTIVE			
PROJECT			NGS Truck Mounted Sweeper Circuit Drawing			
RESPONSIBLE DEPARTMENT			Powapak Node Semi Hydrostatic Sensors and Work Lamps			
REVISION			SCALE	SHEET	DOCUMENT NUMBER	EDN
REVISION INFORMATION			NTS	50	7033871	715402
			REST	ANGLE	D	A3

Electrical Circuit Model Map Demount - Sheet 51/64 Rev D



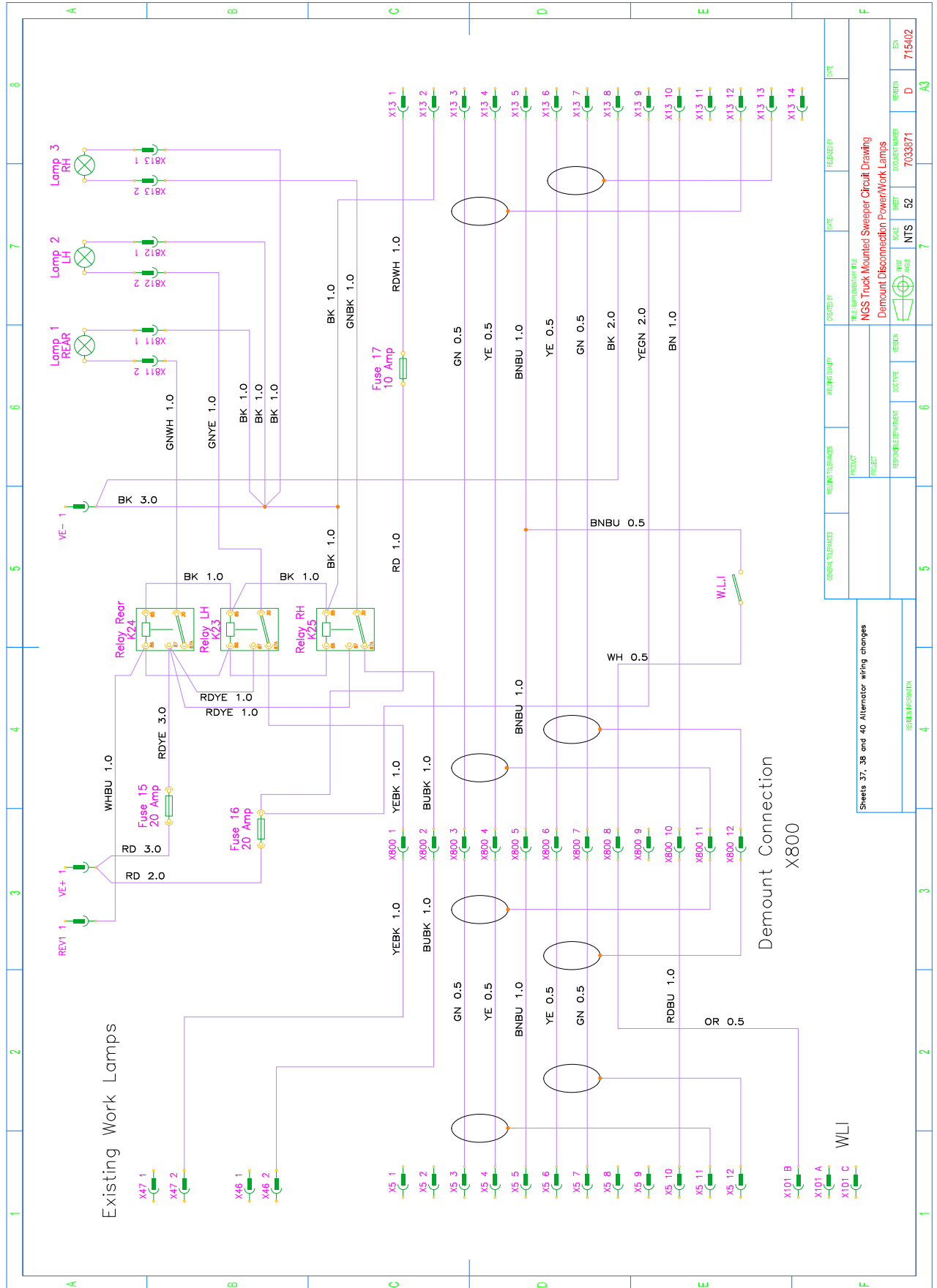
GENERALISSUES	MECHANICALISSUES	WELDINGQUALITY	SECRETARY	DATE	RELEASED BY	DATE
PRODUCT: NGS TRUCK MOUNTED SWEEPER PROJECT: NGS Truck Mounted Sweeper Circuit Drawing			DATE: 7/15/2023			
RESPONSIBLE DEPARTMENT: ELECTRICAL			DOCTYPER: NTS	SHEET: 51	DRAWING NUMBER: 7033871	REVISION: D
REVISION INFORMATION: SHEETS 37, 38 and 40 Alternator wiring changes			SCALE: NTS			
REVISION INFORMATION: SHEETS 37, 38 and 40 Alternator wiring changes			EGR: 715402			

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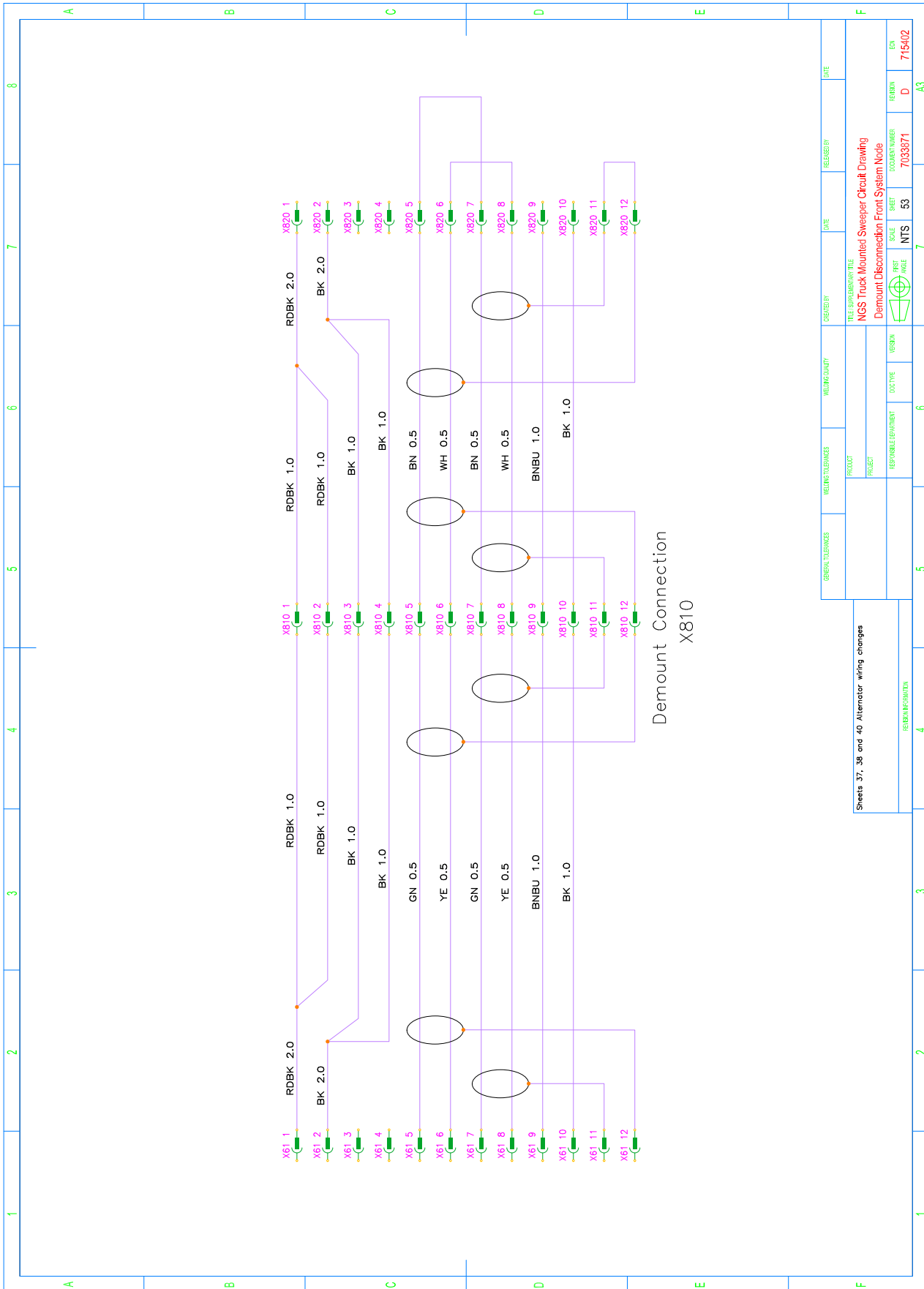


Demount Disconnection Power/Work Lamps - Sheet 52/64 Rev D

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Demount Disconnection Front System Node - Sheet 53/64 Rev D

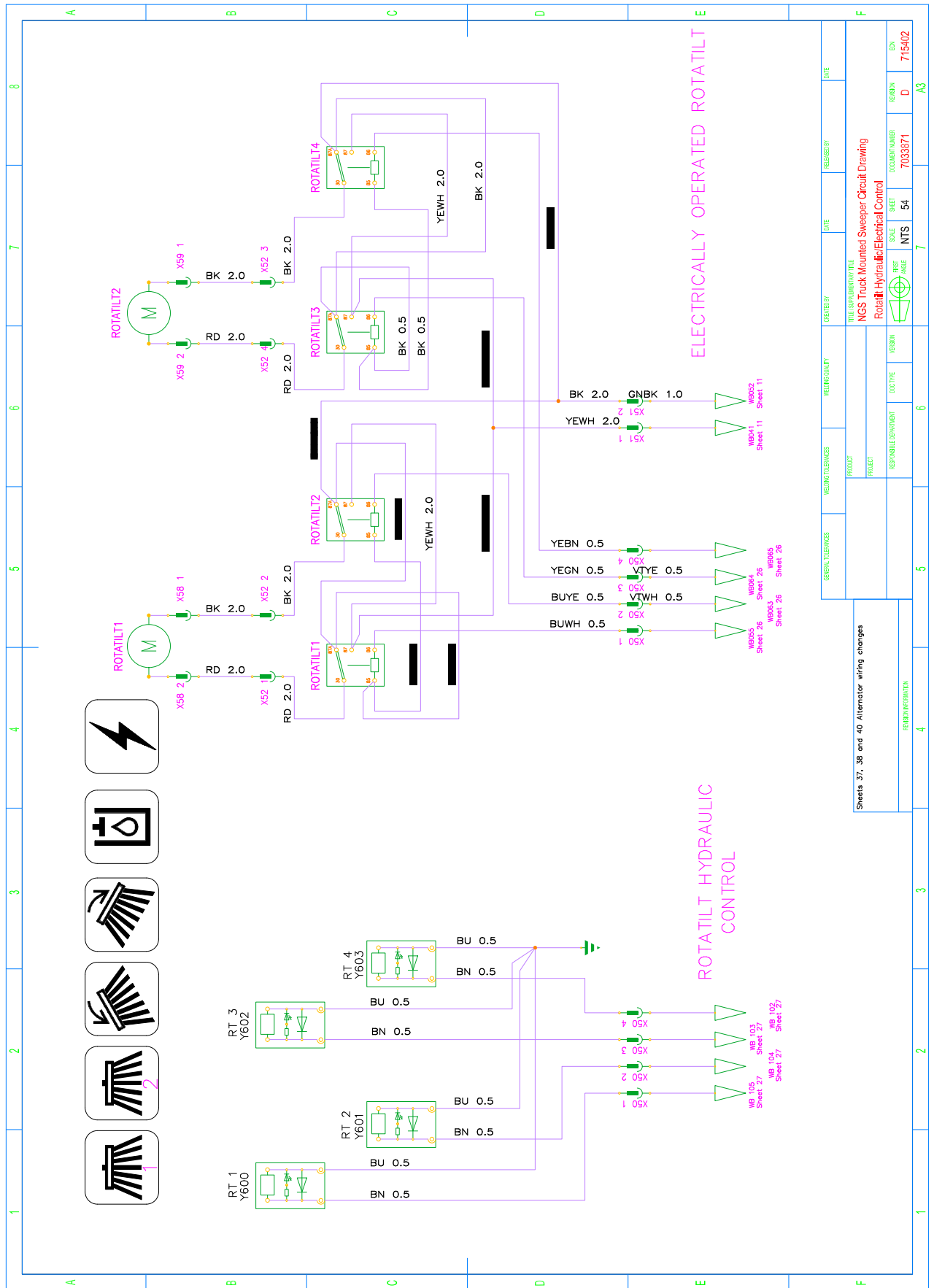


GENERAL TOLERANCES	MATING TOLERANCES	RELING TOLERANCES	CHECKED BY	DATE	RELEASED BY	DATE
PRODUCT		TITLE (SUPERSEDER TITLE)		NGS Truck Mounted Sweeper Circuit Drawing		
PROJECT		PROJECT		Demount Disconnection Front System Node		
RESPONSIBLE EQUIPMENT		OBJECTIVE		VERSION		
REVISION/REVISION		SCALE		SHEET		
		NTS		63		
		7		7033871		
		A3		D		
		715402		CN		

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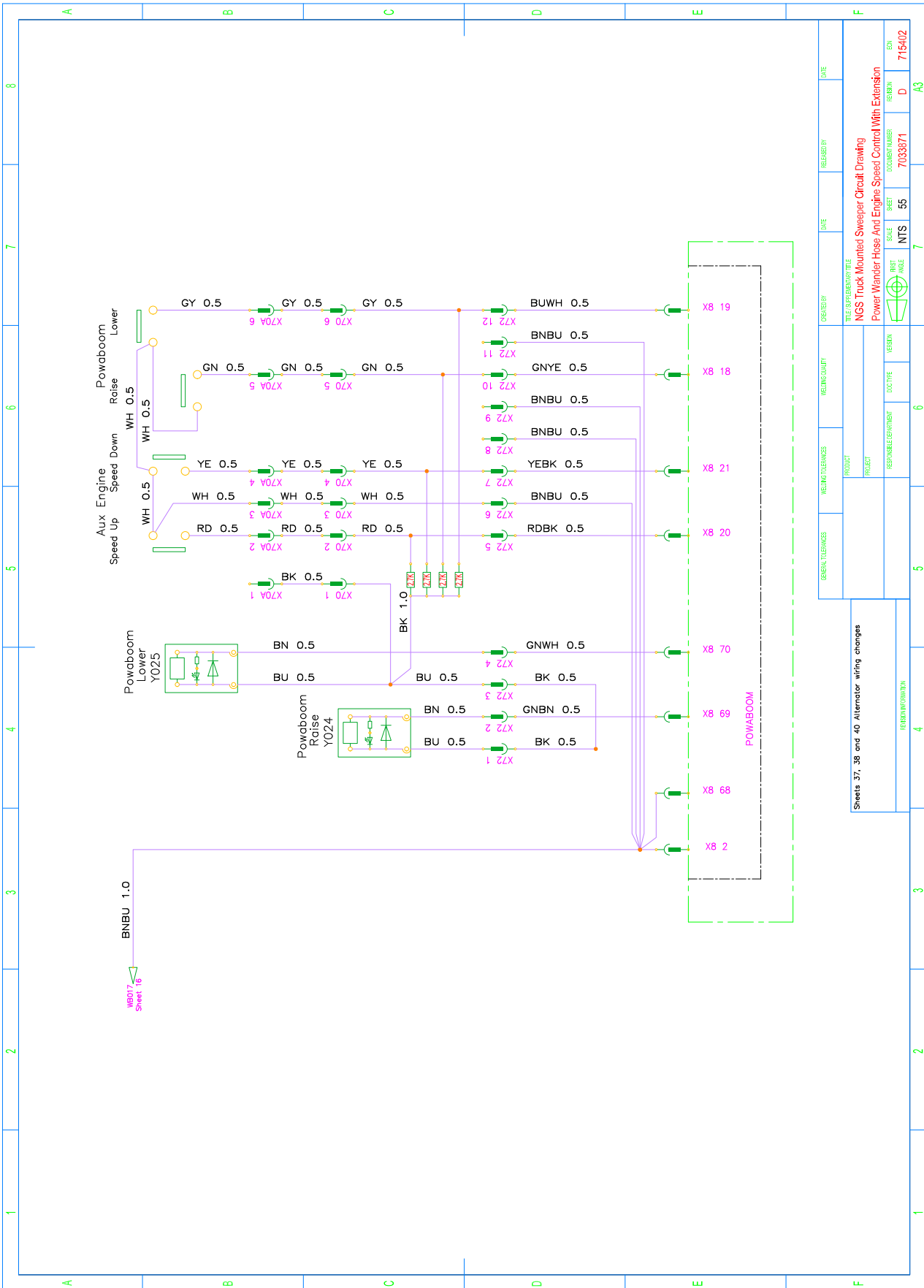
Rotatilt Hydraulic/Electrical Control - Sheet 54/64 Rev D

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GENERAL TOLERANCES	WELDING TOLERANCES	WELDING QUALITY	DESIGNED BY	DATE	RELEASED BY	DATE
TITLE SHEET/MAIN TITLE <b>NGS Truck Mounted Sweeper Circuit Drawing</b> PROJECT PROJECT RESPONSIBLE DEPARTMENT DOCTYPE VERSION SCALE SHEET NUMBER ANGLE REVISION EDN 715402						
SHEETS 37, 38 and 40 Alternator wiring changes REVISION/REPAIR/OK						

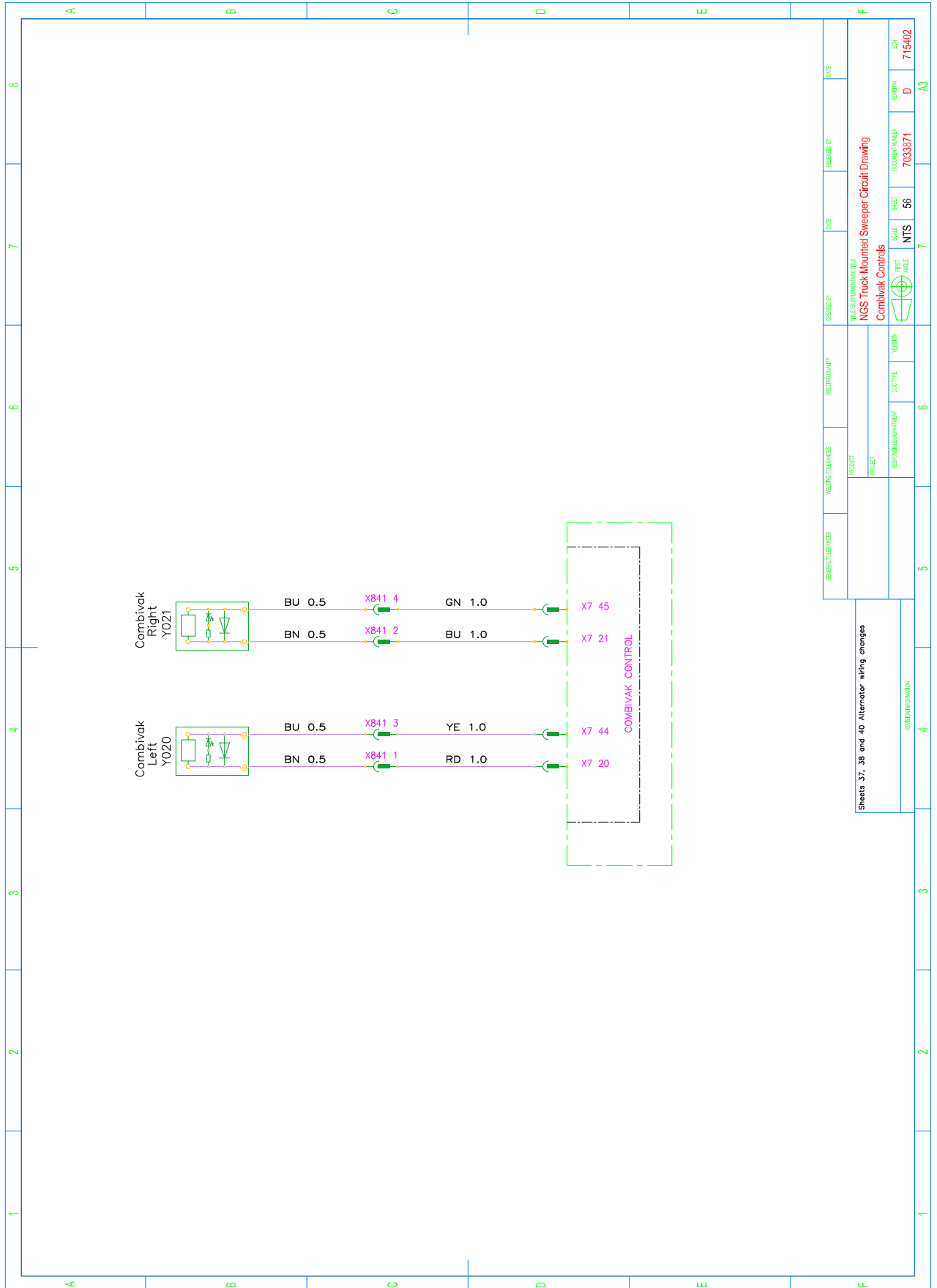
Power Wander Hose and Engine Speed Control with Extension - Sheet 55/64 Rev D



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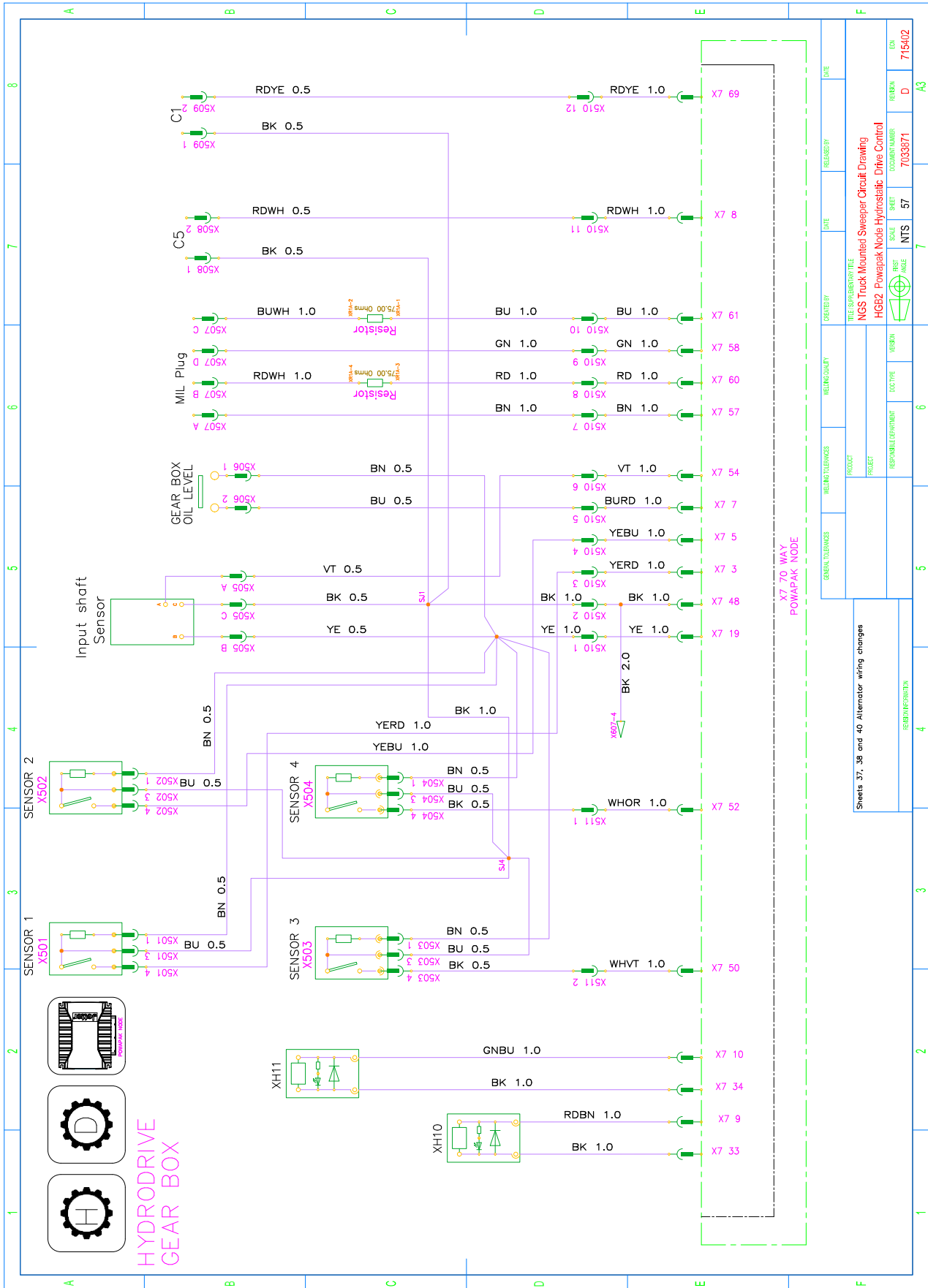
Combivak Controls - Sheet 56/64 Rev D

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GENERAL TOLERANCES	MELING TOLERANCES	WELDING QUALITY	CORROSION	DATE	RELEASED BY	DATE
<b>TITLE REPRESENTATIVE</b> NGS Truck Mounted Sweeper Circuit Drawing Combivak Controls						
SHEETS: 37, 38 and 40 Alternator wiring changes REFERENCE DRAWING		PRODUCT PROJECT	RESPONSIBLE DEPARTMENT PROJECT	DOCTYPE SHEET	SCALE FIRST ANGLE	DRAWING NUMBER 7033871
				NTS 7	56	715402
						6 7 A3

HGB2 Powapak Node Hydrostatic Drive Control - Sheet 57/64 Rev D



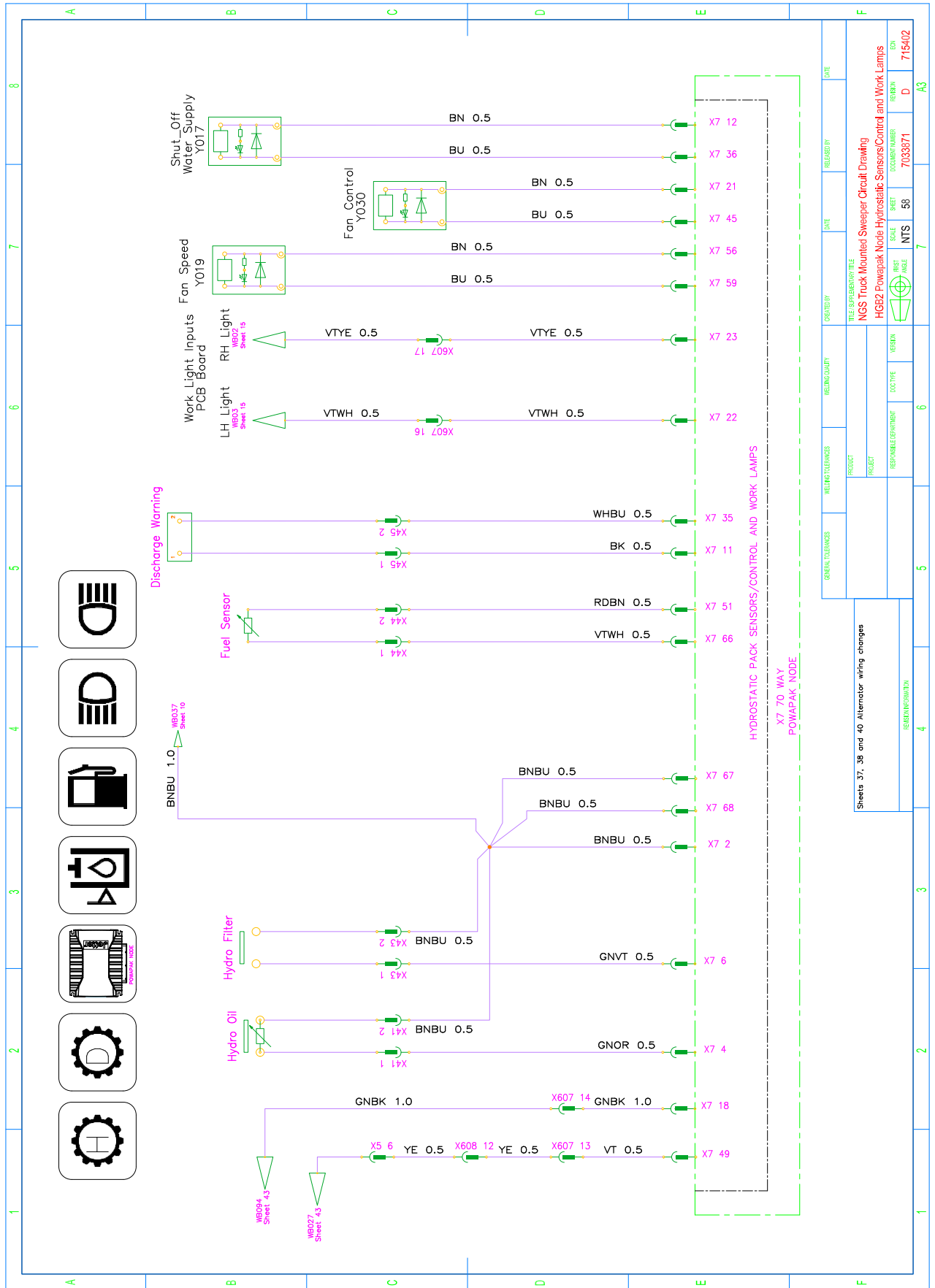
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PRODUCT	PROJECT	RESPONSIBLE PERSON	DOCTYPE	CREATED BY	RELEASED BY	DATE	DATE
TITLE: <b>NGS Truck Mounted Sweeper Circuit Drawing</b> PRODUCT: <b>HGB2 Powapak Node Hydrostatic Drive Control</b>				SHEET: <b>57</b> TOTAL SHEETS: <b>64</b>	DRAWING NUMBER: <b>7033971</b> REVISION: <b>D</b>	ISSUE NUMBER: <b>715402</b> DATE: <b>7/15/02</b>	DRAWN BY: <b>DN</b> CHECKED BY: <b>DN</b>

Sheets 37, 38 and 40 Alternator wiring changes

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HGB2 Powapak Node Hydrostatic Sensors/Control & Work Lamps- Sheet 58/64 Rev D

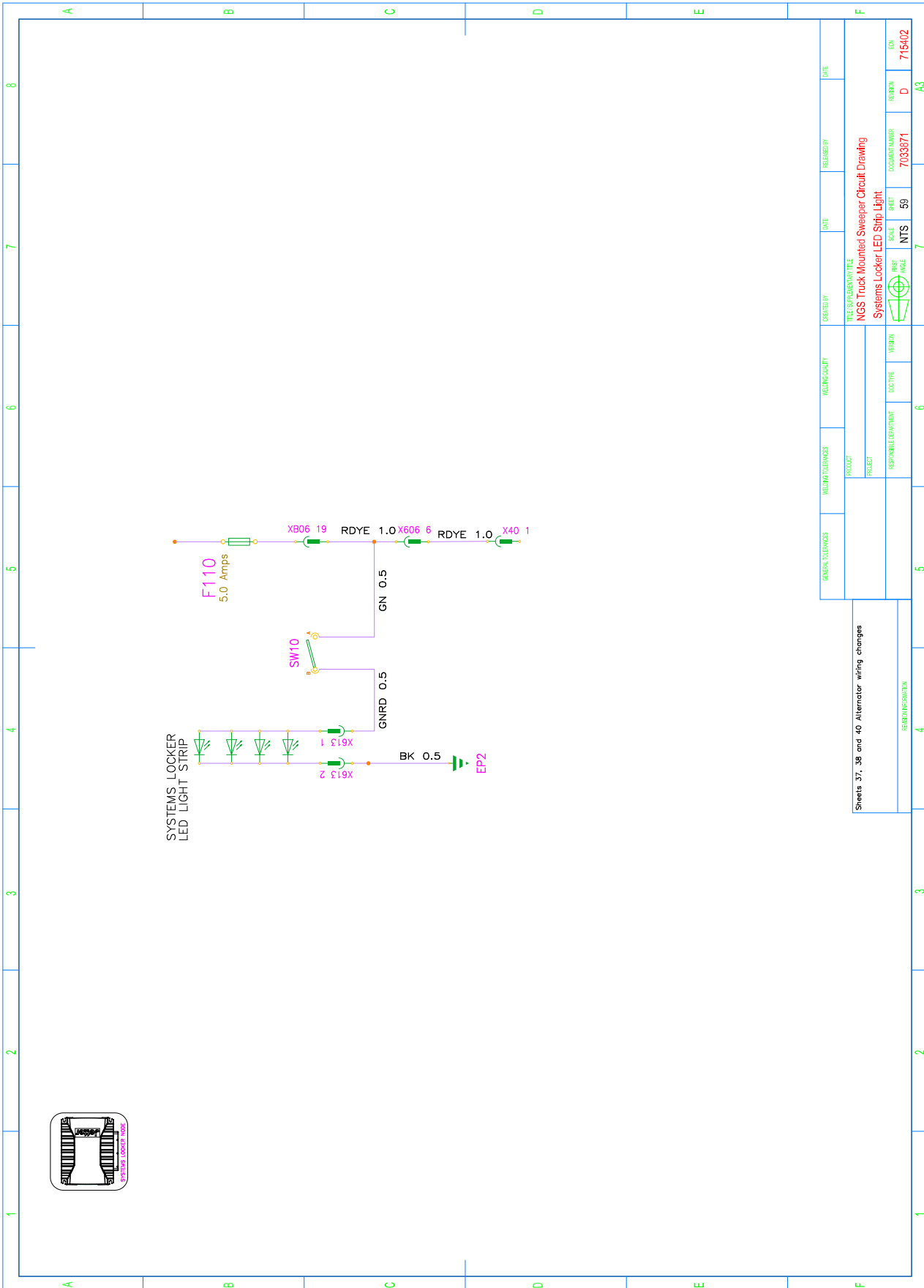
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GENERAL TOLERANCES	WELDING TOLERANCES	WELDING QUANTITY	FORMED BY	DATE	RELEASED BY	DATE
FILE REFERENCE/TITLE <b>NGS Truck Mounted Sweeper Circuit Drawing</b>						
PROJECT <b>HGB2 Powapak Node Hydrostatic Sensors/Control and Work Lamps</b>						
RESPONSIBLE ENGINEER	DOCTYPER	VERSION	SCALE	SHEET	DOCUMENT NUMBER	EDN
			NTS	58	7033871	D
						715402

Sheets 37, 38 and 40 Alternator wiring changes

**Systems Locker LED Strip Light - Sheet 59/64 Rev D**



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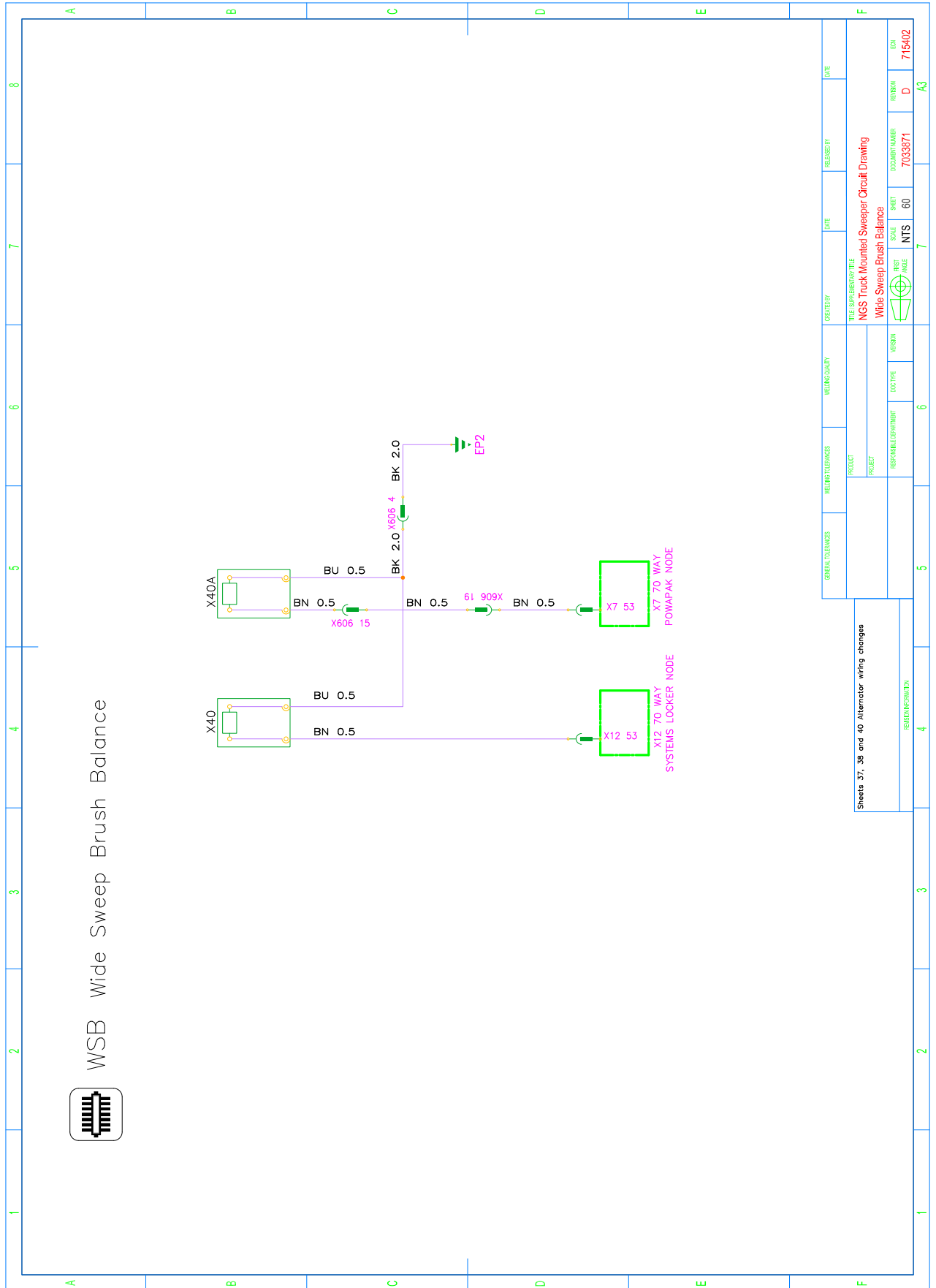


Wide Sweep Brush Balance - Sheet 60/64 Rev D

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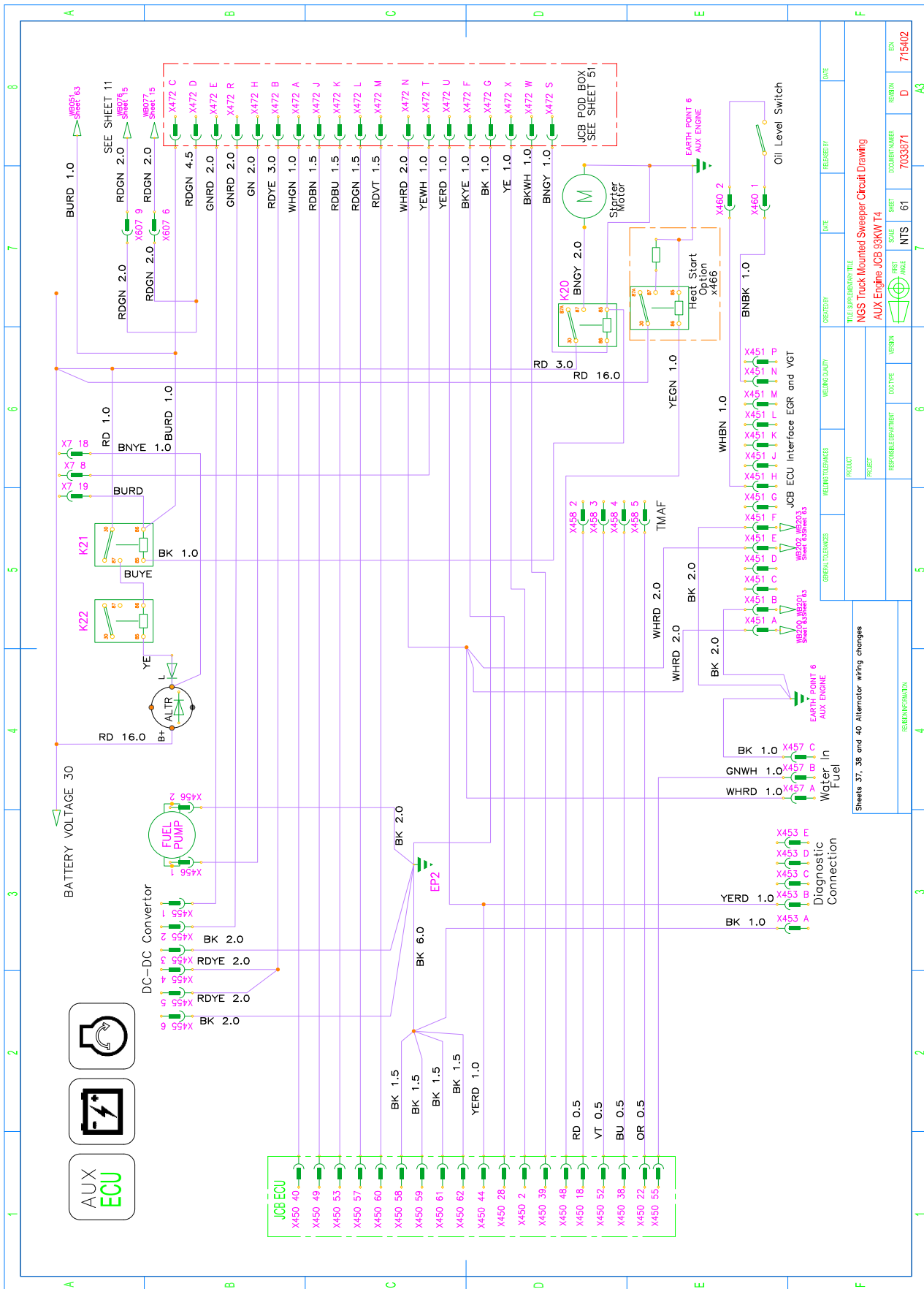
WSB Wide Sweep Brush Balance



GENERAL TOLERANCES	MATERIAL TOLERANCES	FINISHES	CREATED BY	DATE	REVISION	DATE
TITLE: <b>NGS Truck Mounted Sweeper Circuit Drawing</b> PROJECT: <b>Wide Sweep Brush Balance</b>						
RESPONSIBLE DEPARTMENT: <b>60</b>		SHEET: <b>60</b>		SCALE: <b>NTS</b>		SHEET: <b>715402</b>
RESPONSIBLE ENGINEER: <b>D</b>		DRAWN: <b>7033371</b>		CHECKED: <b>D</b>		REVISION: <b>D</b>
REVISION: <b>D</b>		DATE: <b>715402</b>		DRAWN: <b>D</b>		CHECKED: <b>D</b>

Sheets 37, 38 and 40 Alternator wiring changes

AUX Engine JCB 93kW T4 - Sheet 61/64 Rev D



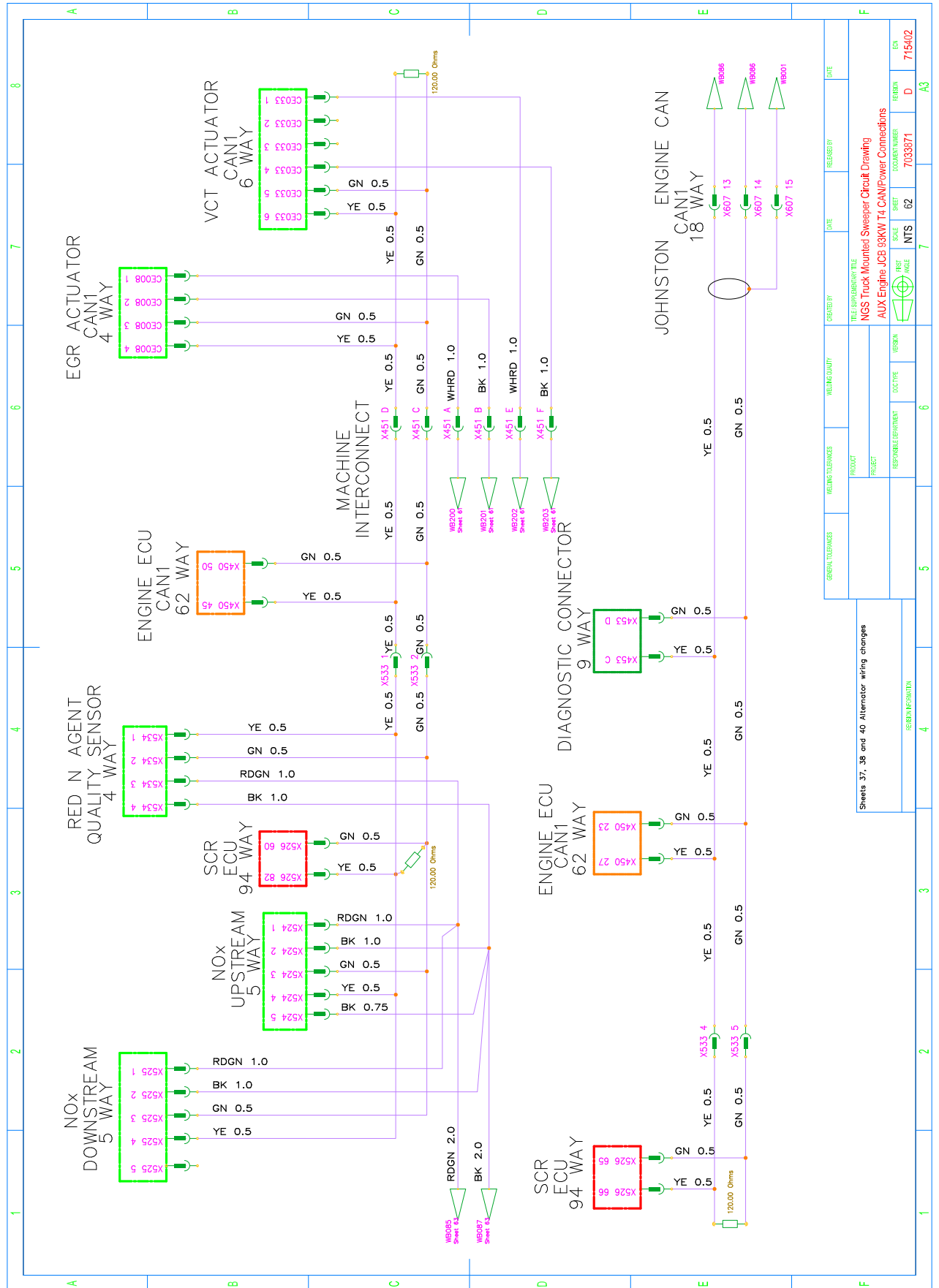
GENERAL TOLERANCES	MATING TOLERANCES	RELINQUISH	DATE	REVISION	DATE
GENERAL TOLERANCES	MATING TOLERANCES	RELINQUISH	DATE	REVISION	DATE
<p>FILE ORIGINATOR: NGS Truck Mounted Sweeper Circuit Drawing</p> <p>PROJECT: AUX Engine JCB 93KW T4</p> <p>RESPONSIBLE DEPARTMENT: COO TYPE: WSKM</p> <p>SCALE: NTS</p> <p>SHEET: 61</p> <p>WAGE: 7033371</p> <p>REVISION: D</p> <p>ENR: 7154/02</p>					

Sheets 37, 38 and 40 Alternator wiring changes

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AUX Engine JCB 93kW T4 CAN/Power Connections - Sheet 62/64 Rev D

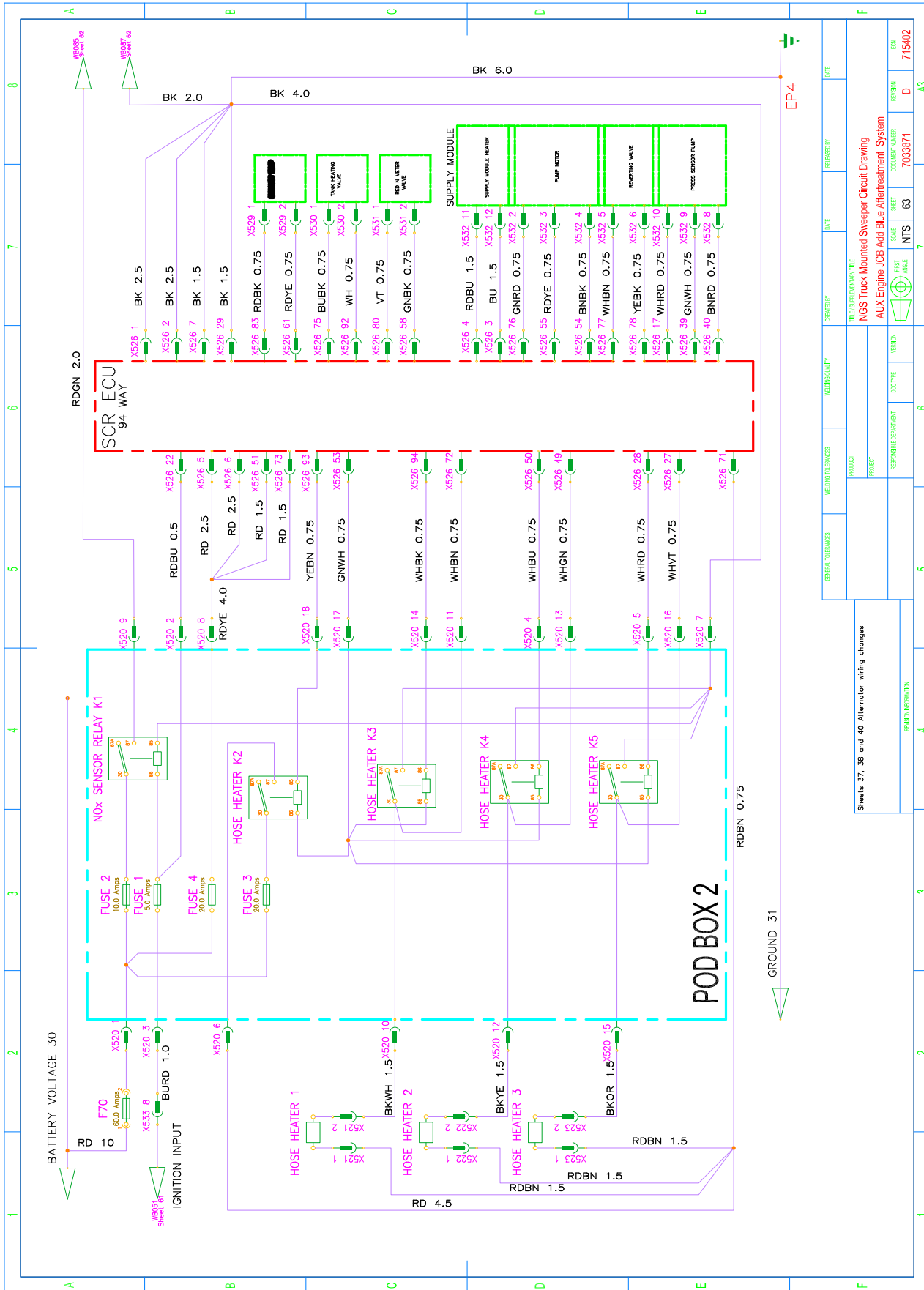
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GENERAL TOLERANCES	RELIEF TOLERANCES	FINISHING QUALITY	CREATED BY	DATE	RELEASED BY	DATE
TITLE SUBGROUP/ARTICLE <b>NGS Truck Mounted Sweeper Circuit Drawing</b>						
PROJECT <b>AUX Engine JCB 93KW T4 CAN/Power Connections</b>						
RESPONSIBLE REPRESENTATIVE	SCALE	SHEET	DOCUMENT NUMBER	REVISION	ECN	
	NTS	62	7033371	D	715402	

Sheets 37, 38 and 40 Alternator wiring changes

AUX Engine JCB AdBlue after treatment system - Sheet 63/64 Rev D



GENERAL TOLERANCES	MEASUREMENTS	RELIEF ANGLE	CREATED BY	DATE	REVISION
PRODUCT PROJECT			TITLE DESCRIPTION		
RESPONSIBLE DEPARTMENT			DOCUMENT NUMBER		
SCALE			SHEET		
ANGLE			NTS		
REVISION			7033371		
D			7154/02		

Sheets 37, 38 and 40 Alternator wiring changes

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Spare Options - Sheet 64/64 Rev D

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SPARE  
Options

GENERAL TOLERANCES	MATERIAL TOLERANCES	WEIGHT QUANTITY	CREATED BY	DATE	REVISION	DATE
PROJECT			TITLE / SUBJECT / PART TITLE			
PROJECT			NGS Truck Mounted Sweeper Circuit Drawing			
RESPONSIBLE DEPARTMENT			Spare			
RESPONSIBLE DEPARTMENT						
RESPONSIBLE DEPARTMENT			SCALE NTS			
RESPONSIBLE DEPARTMENT			SHEET 64			
RESPONSIBLE DEPARTMENT			DRAWING NUMBER 7033371			
RESPONSIBLE DEPARTMENT			REVISION D			
RESPONSIBLE DEPARTMENT			DATE 715402			

Sheets 37, 38 and 40 Alternator wiring changes  
 RESPONSIBILITY



## CHAPTER

## 4

**Water System****Table of Contents**

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Piping Diagram / Component Location	4 : 6
<b>Supawash Pump</b>	
Pump Repair	4 : 8
Seal and Valve Maintenance	4 : 9
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<b>Circuit Diagrams</b>	4 : 13

## WATER SYSTEM - INTRODUCTION

### General Description

The water systems can be categorised into three systems.

**Low pressure:-** For dust suppression and lubrication of consumable components.

**High pressure:- (Supawash)** For surface cleaning.

**Re-circulation:-** For reducing the overall usage of water and extended on station work time

### Low Pressure Water

Pressure for the water supply is provided by a twin diaphragm pump hydraulically driven from the auxiliary engine. Pressure regulation is by a relief valve situated at the rear of the machine. Filtration is by two filters, one mounted within the water tank and a second in-line type located at the right hand rear of the machine. An isolator valve is built into the in-line filter for ease of element servicing. All sweeping spray jets are controlled by simple solenoid valves, manifold mounted within the systems locker.

Control of the washdown hose and Wanderhose water injection is by manual valves at the rear of the machine subframe.

### Supawash

This optional equipment comprises a hydraulically driven high pressure water pump mounted within the subframe, and a hand lance with a 15 metre hose wound onto a recoiling reel.

Front and nozzle spraybars are available as additional options.

### Recirculating Water

This option enables the water held within the body to be drained to the suction nozzle, enabling it to be re-used for lubrication and dust suppression.

### Supawash Unloader Valve - Pressure Setting

1. Ensure that the hydraulic relief valve has been set as outlined in section 8.
2. Fit a hydraulic test gauge to the Supawash manifold (T13).
3. Disconnect the 3/8" bypass pipe at the unloader valve and plug the hose end.
4. Turn on the front spraybar tap.
5. Activate the Supawash and increase the engine speed to 2000 rpm. Check to see if any water is leaking from the bypass port on the unloader, if not loosen the retaining nut on the top of the unloader and unscrew anticlockwise until water dribbles from the bypass port. Gently turn the adjuster clockwise until water stops dribbling, then turn the adjuster 1/2 turn clockwise and lock off the retaining nut. The operational pressure at the manifold should be 100 bar nominal. If the pressure is higher check again for blocked jets. If the pump operates at a pressure in excess of 100 bar there is a problem that will effect the life of the pump and invalidate any warranty.  
**NB - Do not** turn off the front Supawash spraybar or water will be ejected from the bypass valve where the hose has been removed.
6. Stop the engine and reconnect the bypass hose.

### Circuit Pressures

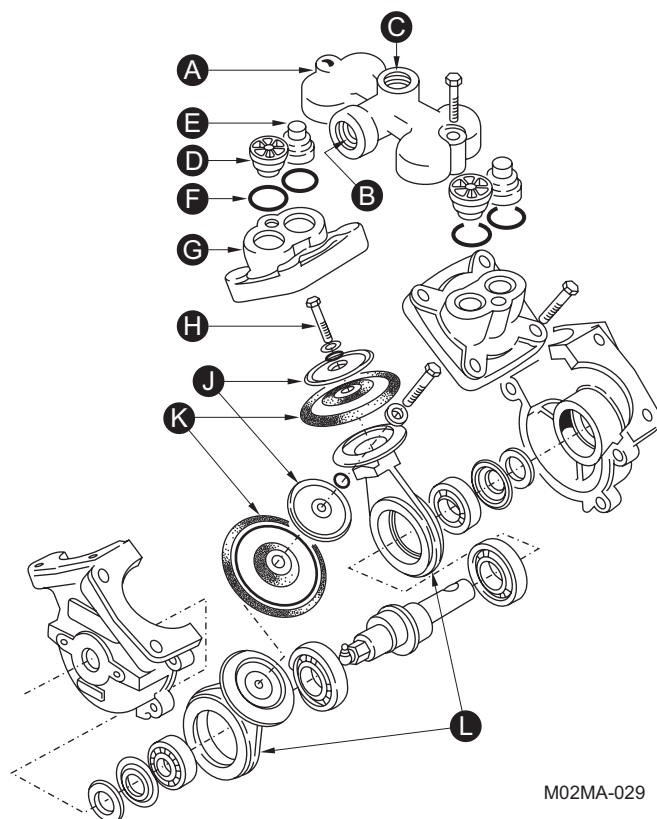
Two test points are provided for checking the water pressures.

Test Point No.	Function
W-1Z2	Dust Suppression Sweep System
W-1Z22	Supawash System



## COMPONENT MAINTENANCE AND SETTINGS

### Water Pump



#### KEY

A)	Manifold
B)	Suction Port
C)	Delivery Port
D)	Suction Valve
E)	Delivery Valve
F)	Valve Sealing Rings
G)	Pump Chamber
H)	Tension Pad Bolts
J)	Tension Pads
K)	Diaphragms
L)	Connecting Rods

M02MA-029

The assembly of the twin diaphragm pump is quite simple and straightforward, but attention to the under mentioned points will afford economy by prolonging the life of the pump and, more especially, the expendable components.

- 1 Diaphragms -**  
When replacing a diaphragm, turn the crankshaft until the relative connecting rod is at TDC so that when securing the diaphragm and the tension pad by means of the tension pad bolt, the periphery of the diaphragm is free of the crank case.  
Ensure that the tension pad is pulled down onto the connecting rod.
- 2 Pump Chambers -**  
Before fitting a pump chamber, turn the crankshaft until the relative diaphragm is at the centre of its stroke, i.e. so that the periphery of the diaphragm is just resting on the face of the crankcase. Place the pump chamber in position, place the bolts and nuts in position and tighten 'finger tight'. Tighten down, but make sure that the pump chamber is pulled down square so that the lower face of the chamber is correctly located against the crankcase.
- 3 Manifolds and Valves -**  
Fit the valve sealing rings onto the valve seat. Place the delivery valve (stem upwards) over the delivery orifice of the pump chamber and push the sealing ring down so that it is flush with the pump chamber. Fit the suction valves in a similar manner, but with stem downwards. Place the manifold over the valves and see that it sits square. If the manifold does not sit square, then either the valves or the sealing rings are not correctly located. Place the securing bolts in position and pull down squarely.

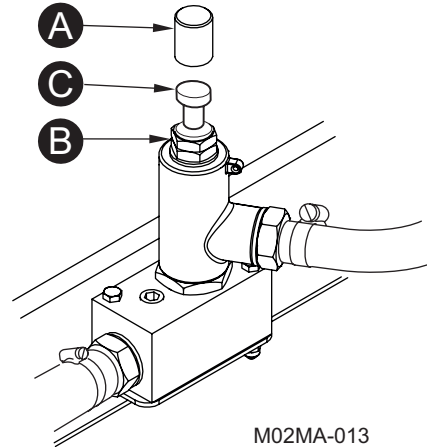
It is important that these instructions are carried out, especially with regard to the fitting of the manifolds, to ensure a satisfactory seal at the valve sealing rings. Unless these instructions are followed, leakage will be experienced at the joint between the manifold and the pump chambers. On dismantling a pump for examination, if the valve sealing rings have taken on a permanent set to their location (roughly triangular in cross section), they should be replaced.

### Relief Valve

This valve is factory set and should not normally be touched, but should it be necessary to make adjustments, the pressure is set as follows.

#### Pressure Setting

Remove the cover (A) and loosen adjuster locknut (B). Connect a pressure gauge to the test point located in the systems locker. With the auxiliary engine running at low idle speed (750/800), and all water sprays switched off, turn adjuster screw (C) until gauge reads 3.5 bar (50 psi). Tighten locknut and replace cover.

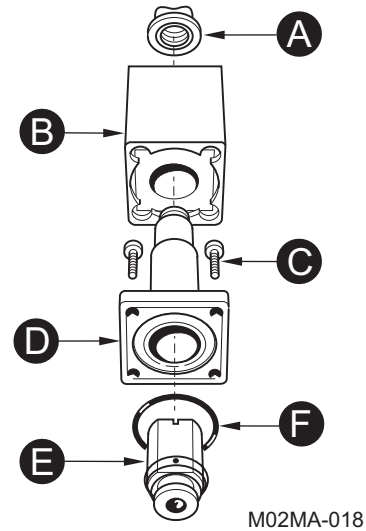


### Solenoid Valves

Solenoid valves control the water spray jets and are located in the systems locker.

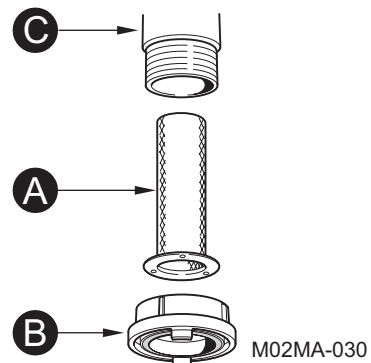
The valve is easily dismantled for inspection or cleaning by unscrewing the retaining cap (A) through the coil (B).

To access the armature, unscrew the four retaining screws (C) and remove the armature cover (D). The armature (E) can be removed. When refitting parts ensure the 'O' ring (F) is in good condition and located correctly.



### Hydrant Filter

Periodically the hydrant filter (A) should be cleaned, or replaced if damaged. To gain access to the filter, unscrew the hydrant coupling (B) and withdraw the filter from its housing (C).



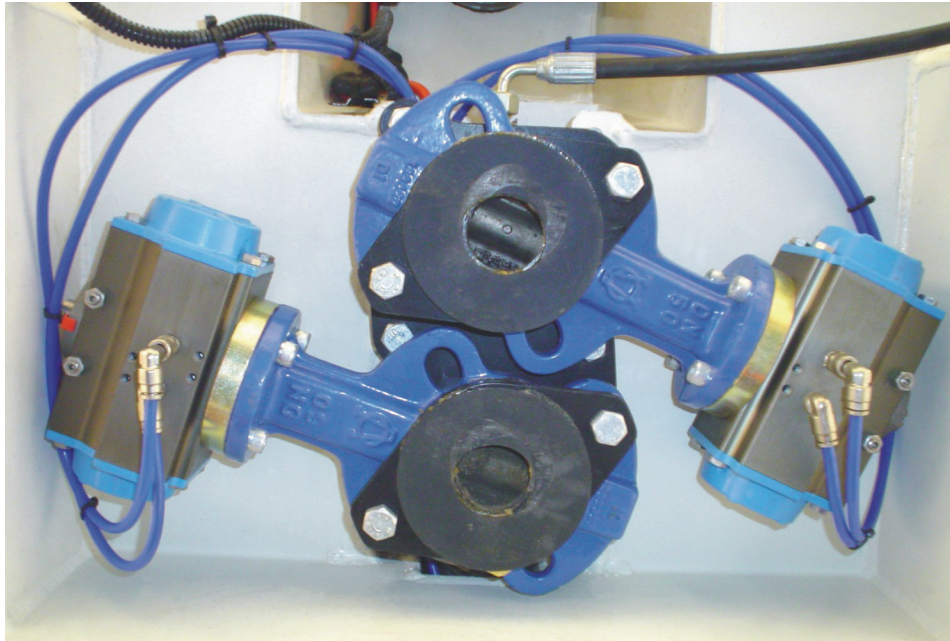
### Recirculation Valves



#### Safety Notice



The shut off valve must be used when servicing any item on the air system

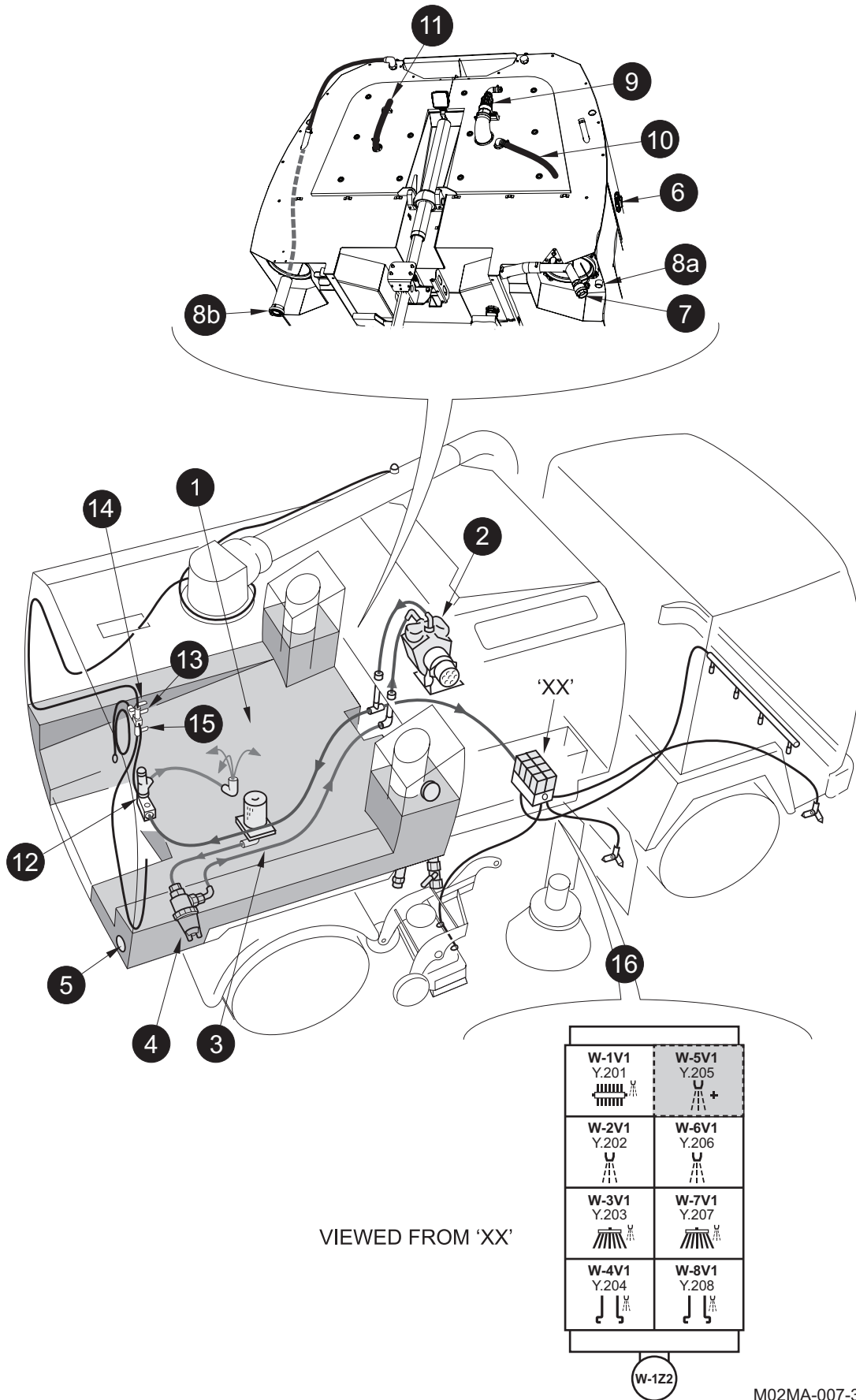


M02MA-048

There is no routine maintenance required on these valves.

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Piping Diagram / Component Location



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M02MA-007-3

## Component Key

1	Water tank
2	Water pump - output 28 l/m
3	Water tank primary filter
4	Suction filter
5	Tank flushing ports
6	Tank filler port - hosepipe
7	Tank drain/flushing valve
8a	Hydrant filler port for water tank
8b	* Hydrant filler port for Recirc water
9	'Type A' anti syphon water break
10	Cowl overflow
11	Breather
12	Relief valve
13	Washdown hose
14	* Wanderhose valve
15	* Littasnatch valve
16	Water valve manifold - see table below

\* Optional

	1	2
VALVE	SINGLE	DUAL
W-1V1	Wide Sweep Brush	Wide Sweep Brush
W-2V1	Gutter Spray	LH Gutter Spray
W-3V1	Channel Brush	LH Channel Brush
W-4V1	Nozzle	LH Nozzle
W-5V1*	Additional Water	Additional Water
W-6V1	<i>Not Fitted</i>	RH Gutter Spray
W-7V1	<i>Not Fitted</i>	RH Channel Brush
W-8V1	<i>Not Fitted</i>	RH Nozzle
W-1Z2	Test Point	Test Point

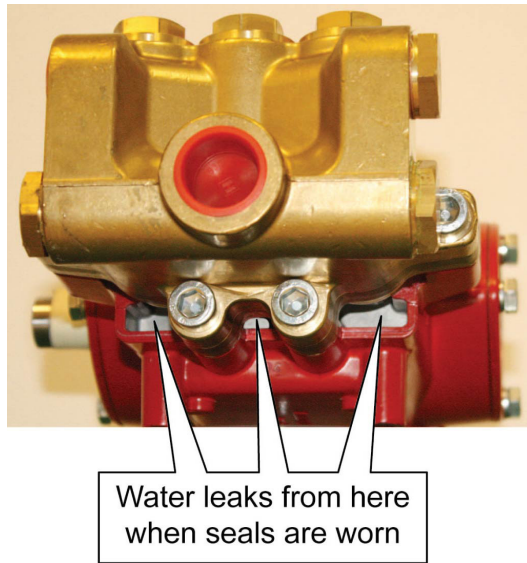
## SUPAWASH PUMP

### Pump Repair

Water pumps by their very nature are subject to erosion and wear from the process of pumping water. The life of the pump will depend on the quality of the water being used. The more particles that are in suspension in the water the sooner the seals and valves in the pump will wear and require replacing and are therefore considered as consumable items.

The main components in the pump that will require servicing are the suction and discharge valves and the seals on the plunger pipes.

A pump working correctly will normally not have any water leaks. If the plunger seals wear water will leak from the underside of the pump as shown below.



A drip ever 5 -10 seconds is an indication that the seals need replacing in the very near future.

A continuous drip from underneath the pump shows the seals are severely worn and require urgent and prompt replacement. Shown by the arrows in the above picture.

If a steady stream of water leaking from the pump is observed the pump should NOT be used. Should the pump be used in this condition water will be drawn back into the crankcase by the motion of the plungers. This water ingress into the crankcase will cause a catastrophic failure of the pump.





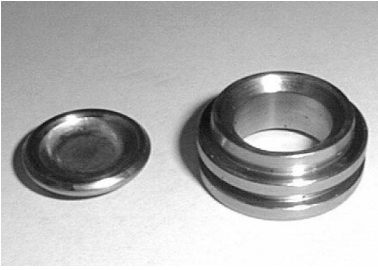
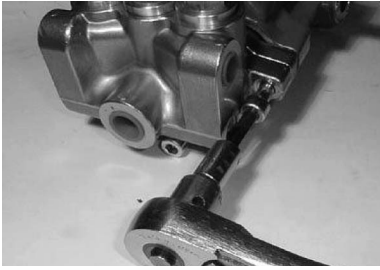

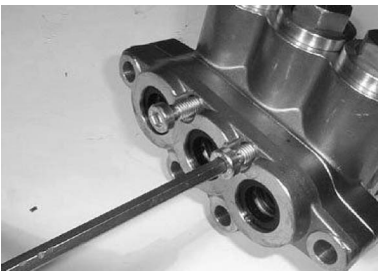
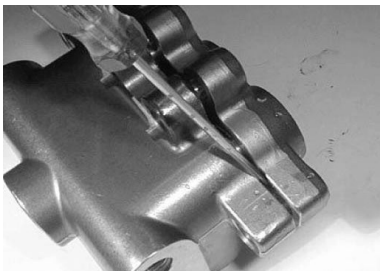
When the suction and discharge valves wear the out put of the pump will be reduced and this will be noticed as reduced output from the spray jets.

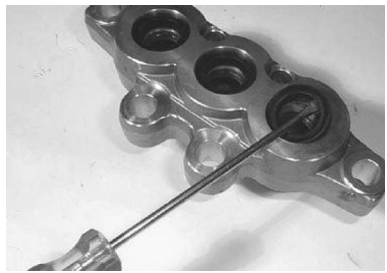








**Seal and Valve Maintenance Instructions**

**P22/34-100 Johnston Water Pump 700803**

The following shows the overhaul procedure for the valves and plunger seals



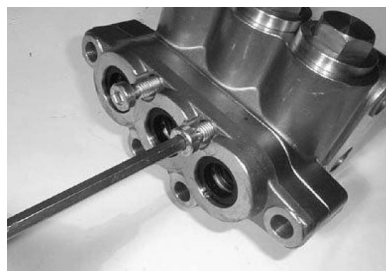



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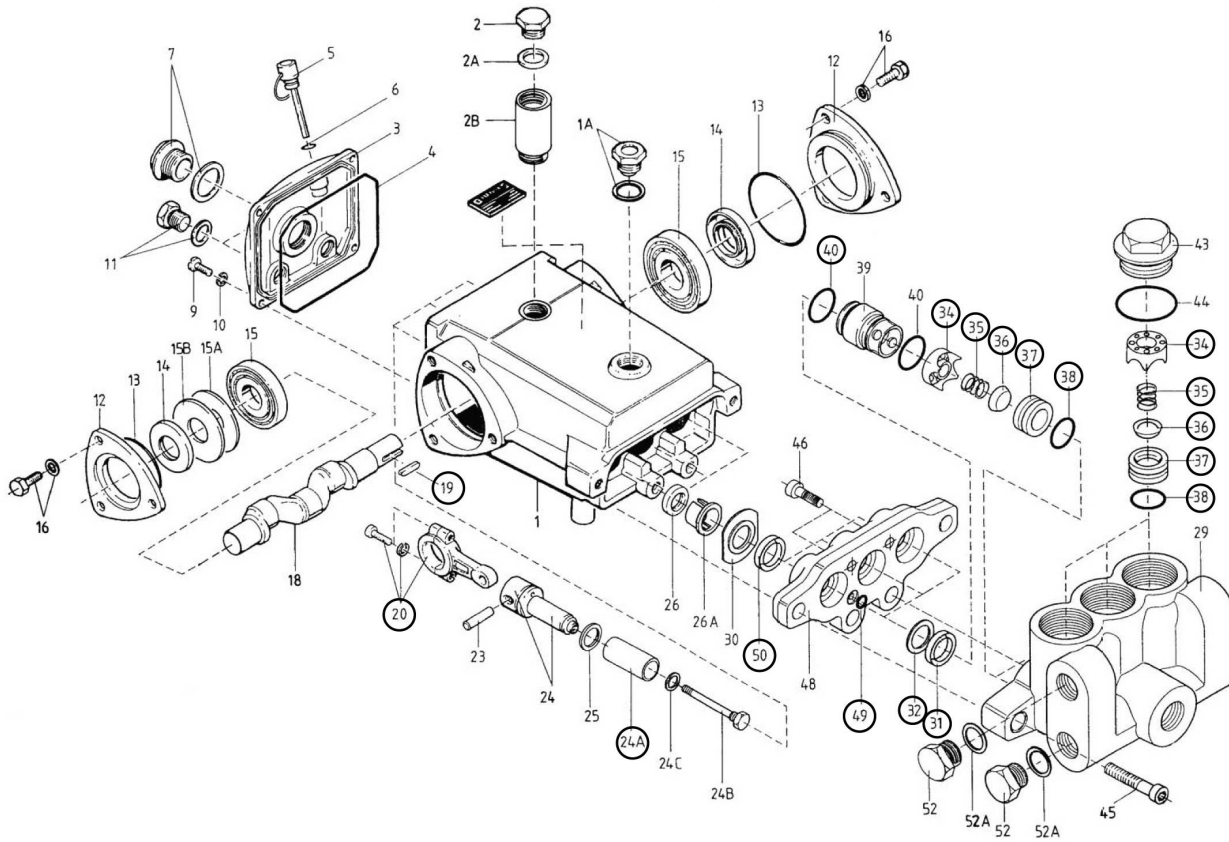
		
<p>1. With a 22mm socket, remove the three discharge valve plugs (43) from the top of the manifold.</p>	<p>2. With a pair of needle nose pliers remove the spring tension cap (34), spring (35) and plate (36)</p>	
		
<p>3. Use a valve extractor tool (99.061) to remove the valve seats (37)</p>	<p>4. Inspect the valve seat (37) and valve seat (36) for signs of wear or cavitation and replace as necessary.</p>	<p>5. Using an 8mm Allen key remove the inner hexagon screws (45)</p>
		
<p>6. With a rubber mallet tap the back of the valve casing (29) and pull the valve casing (29) off the plungers (24a).</p>	<p>7. Using a 6mm Allen key remove the two inner hexagon screws (46).</p>	<p>8. Separate the intermediate casing (48) from the valve casing (29)</p>

		
<p>9. Remove and inspect the low pressure seal (50) and replace if necessary.</p>	<p>10. Turn over intermediate casting (48) Remove and inspect the high pressure seal (31) and the support ring (32) replace if necessary.</p>	<p>11. Remove the seal case (39) from the valve casing (29) and inspect both O Rings (40) for wear.</p>
		
<p>12. Using needle nose pliers, remove the spring tensioning caps (34), valve spring (35), valve plate (36) from the valve casing (29) Using a valve extractor (99.061) to remove the valve seat (37) from the valve casing (29).</p>	<p>13. Inspect the valve seat (37) and valve seat (36) for signs of wear or cavitation and replace as necessary.</p>	<p>14. Install the inlet valve assembly (34 – 38) back into the valve casing. Ensure the “fingers” of the spring tensioning cap (34) DO NOT obstruct the cross bore in the valve casing (29).</p>
		
<p>15. Install the seal case (39) with O Rings (40) into the valve casing (29)</p>	<p>16. Install the support ring (32) and the high pressure seal (31) into the intermediate plate (48)</p>	<p>17. Lubricate the low pressure seal (50) and install into the intermediate casing (48).</p>



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<p>18. Replace the three spacer sleeves (26a) over the plunger (24a) with the flanged side toward the valve casing (29)</p>	<p>19. Install the pressure rings (30) over the plungers (24a). Make sure that the small o ring (49) is in place in the intermediate casing (49)</p>	<p>20. Secure the intermediate casing (48) to the valve casing (29) with the inner hexagon screws (46). Torque to 12 NM.</p>
		
<p>21. Place the valve casing (29) over the plungers (24a). Secure with inner hexagon screws (45) Torque evenly to 45 NM</p>	<p>22. Install the high pressure valve assemblies with o rings (34 – 38) Ensuring the fingers of the spring tensioning cap (34) DO NOT obstruct the cross bore in the head (29).</p>	<p>23. Replace the high pressure plugs (43) and torque to 70 NM.</p>

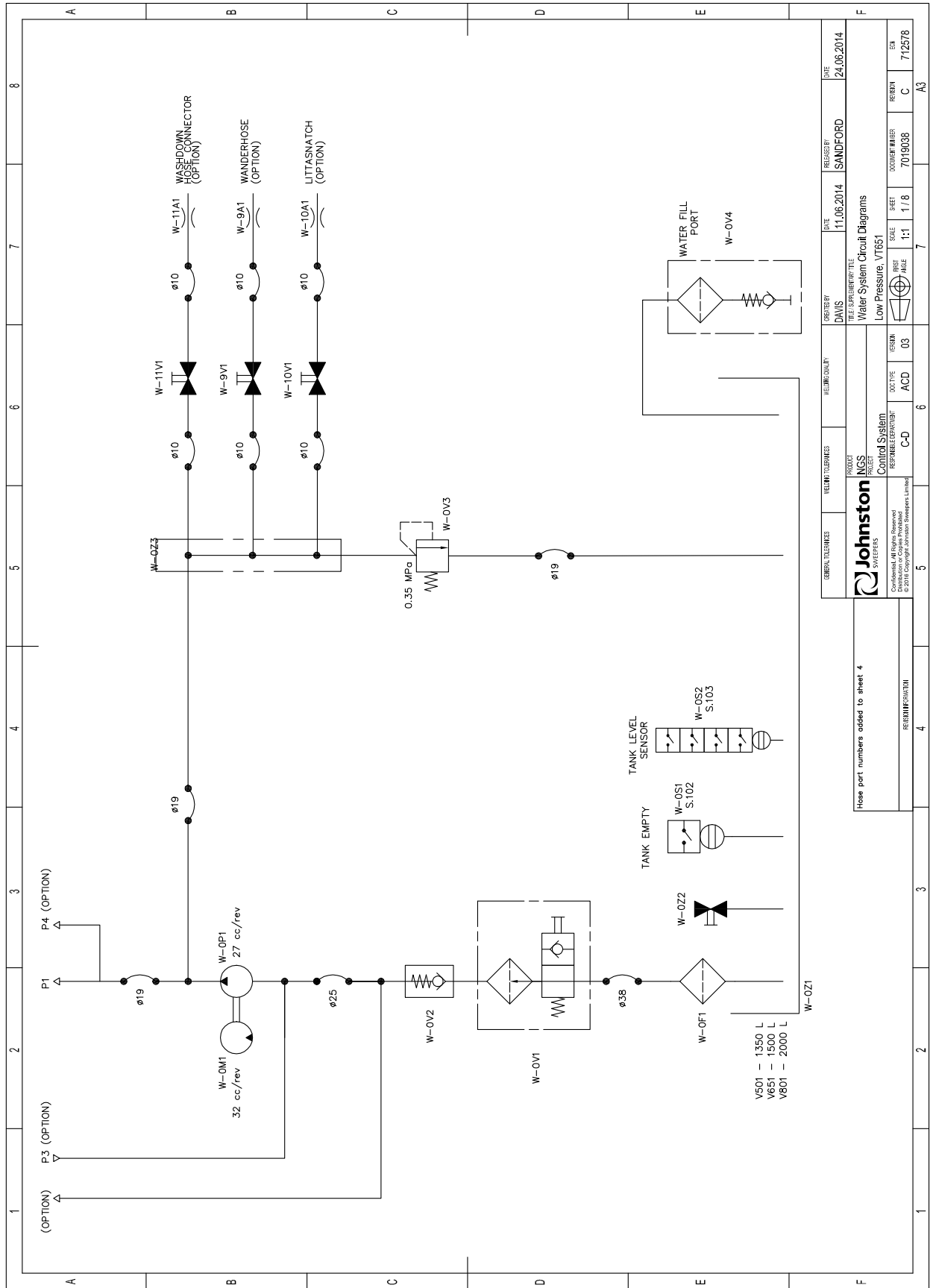
**Exploded View of Pump**


Item Number	Quantity	Part Number	Description
19	1	283701-19	Woodruff Key
20	3	283701-20	Connecting Rod
24A	3	283701-24A	Ceramic Liner
31,32,40,49,50	1 Kit	283701-500	Plunger Seal kit - for 3 plungers
34,35,36,37,38	1 Kit	283701-501	Valve Kit - for the 6 valves

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Low Pressure Water System - Sheet 1/8 Rev C

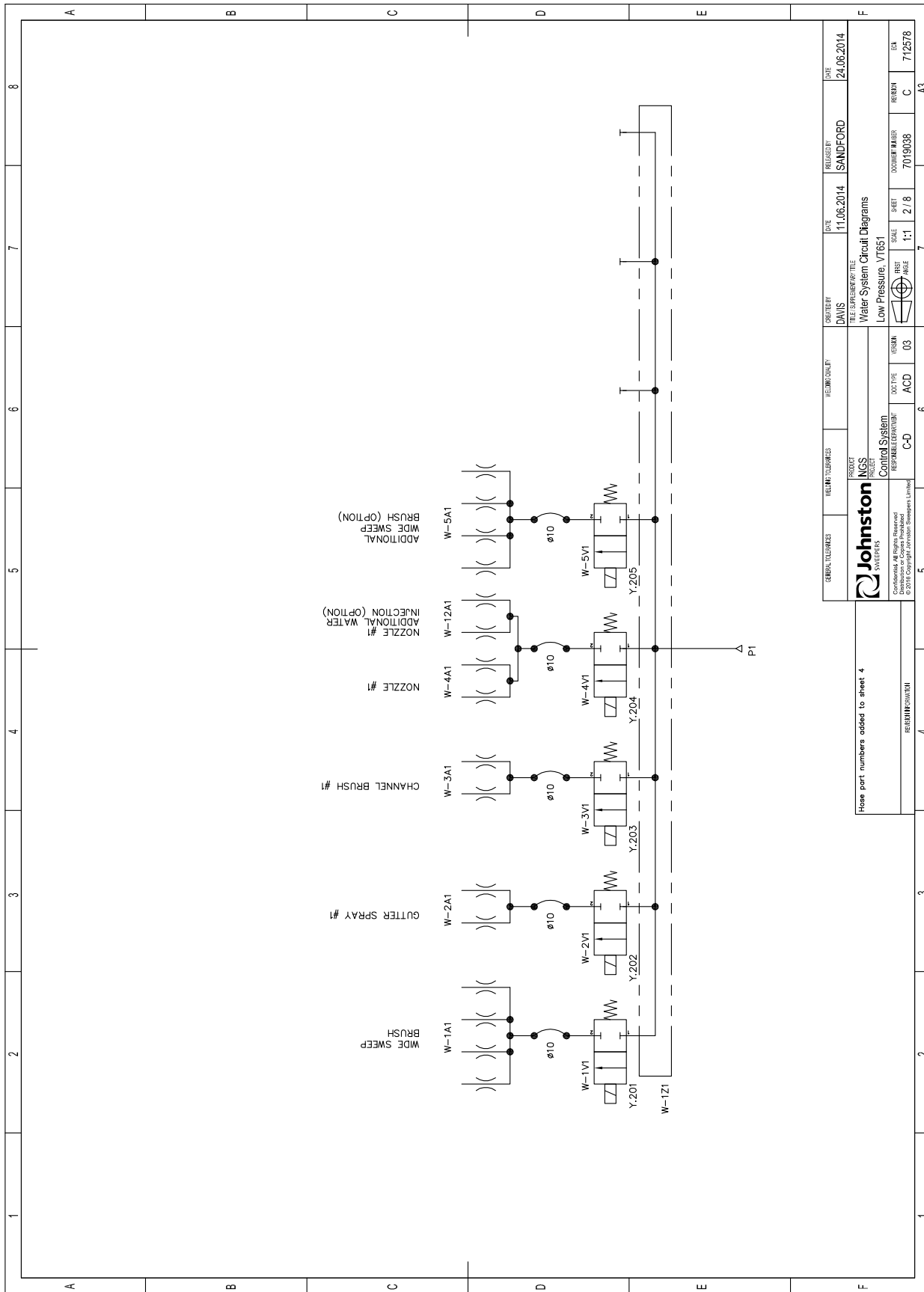
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			DAVIS	11.06.2014
PRODUCT	TITLE / REFERENCE TITLE	REVISION	REVISION	DATE
NGS Control System	Water System Circuit Diagrams	03	C	24.06.2014
REVISION	SCALE	SHEET	OF SHEETS	EN
	1:1	1/8	7019038	7/2578

These part numbers added to sheet 4

Low Pressure Water System - Sheet 2/8 Rev C

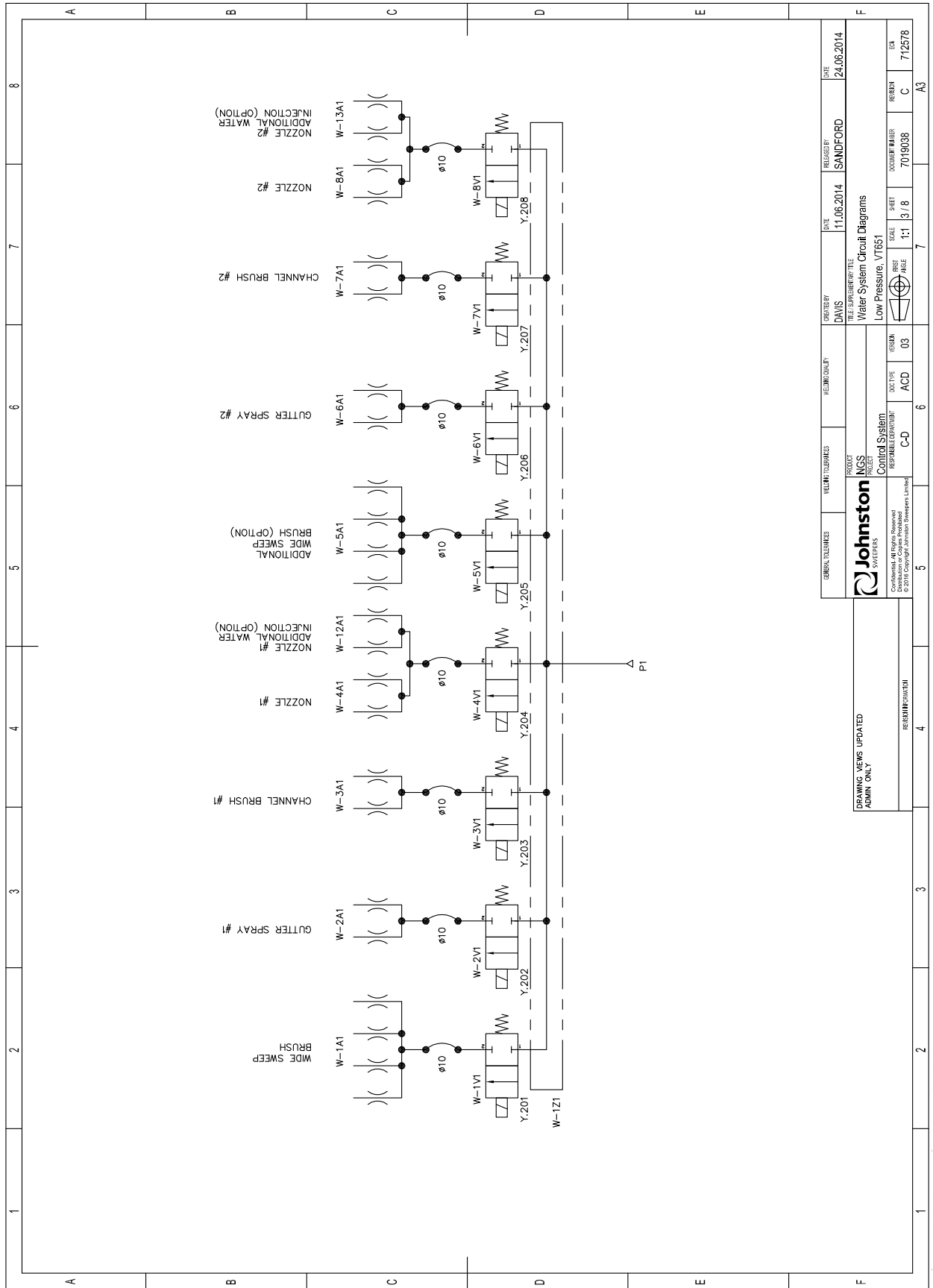


GENERAL SERVICES	TELEPHONE NUMBERS	REG. NO.	DATE	RELEASED BY	DATE
			11.06.2014	SANDFORD	24.06.2014
<b>Johnston</b> NGS CONTROL SYSTEMS WATER SYSTEMS SWEEPERS					
PRODUCT TITLE: WATER SYSTEM TITLE Water System Circuit Diagrams Low Pressure, VT651					
REVISION	DESCRIPTION	DATE	BY	DATE	BY
03	ACC				
02	ACC				
01	ACC				
HOSE PART NUMBERS ADDED TO SHEET 4 REVISION(S)					
SCALE: 1:1 SHEET: 2/8 DRAWING NUMBER: 7019038 REVISION: C ECA: 712578					

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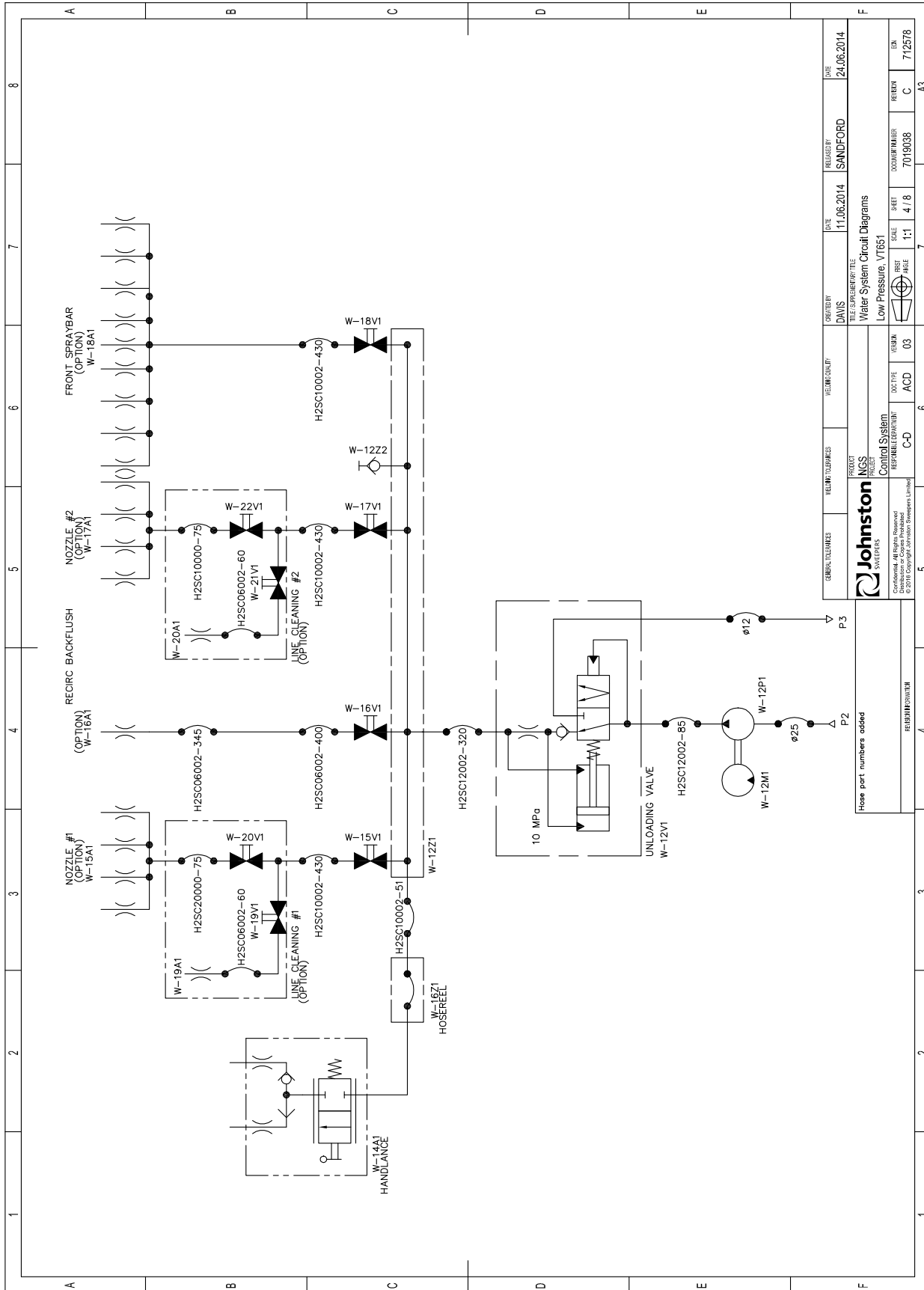
Low Pressure Water System - Sheet 3/8 Rev C

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DESIGNING VIEWS UPDATED ADMIN ONLY	PRODUCT NGS Water System Circuit Diagrams	DATE	11.06.2014	RELEASED BY SANDFORD
	CONTROL SYSTEM RESPONSIBILITY	DATE	11/3/8	ISSUE NO
	SCALE	1:1	3/8	7019038
	WEEK	11	3/8	712578
	REVISION	C		

Low Pressure Water System - Sheet 4/8 Rev C



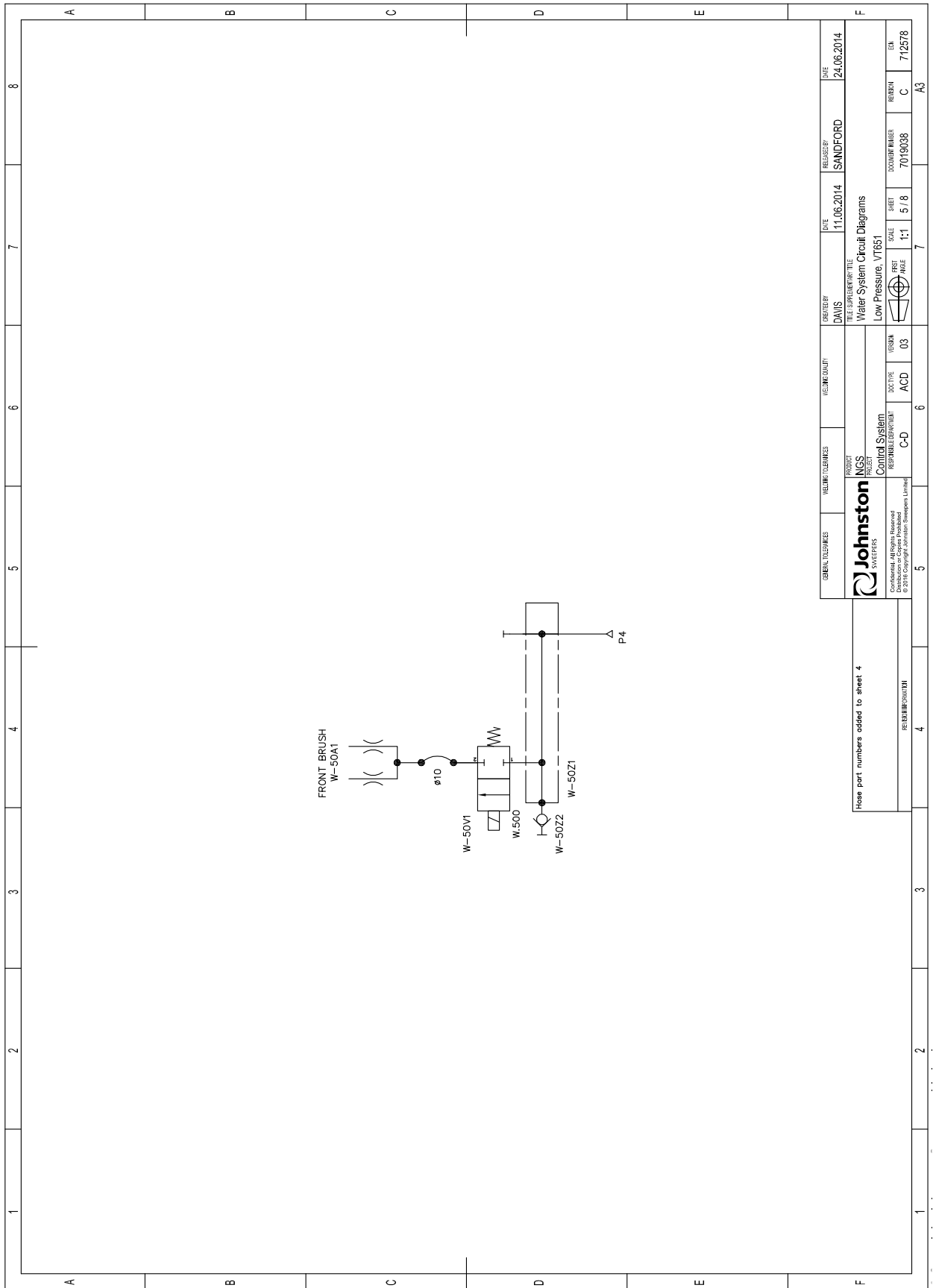
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PRODUCT	RELAY/VALVES	RELIGIORITY	DATE	RELEASED BY
Johnston Control System			11.06.2014	SANDFORD
TITLE: SUBPART FILE				
Water System Circuit Diagrams				
Low Pressure, V7651				
REVISION	YEAR	DESCRIPTION	DATE	BY
C-0	03		11/18	C
7019038	7/12/578			

Hose part numbers added	
P2	
P3	

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Low Pressure Water System - Sheet 5/8 Rev C

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GENERAL SERVICES	WELLING / CLERMONT	REGISTRATION	DRAWN BY	DATE	RELEASED BY	DATE
<b>Johnston</b> SWEEPERS	NCS PROJECTS		DNIS	11.06.2014	SANDFORD	24.06.2014
PROJECT TITLE			Low Pressure Water System Circuit Diagrams			
RESponsible DEPARTMENT			C-D			
DOCTYPER			ACD			
SCALE			1:1			
SHEET			5 / 8			
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REVISION			C			
EM			712578			

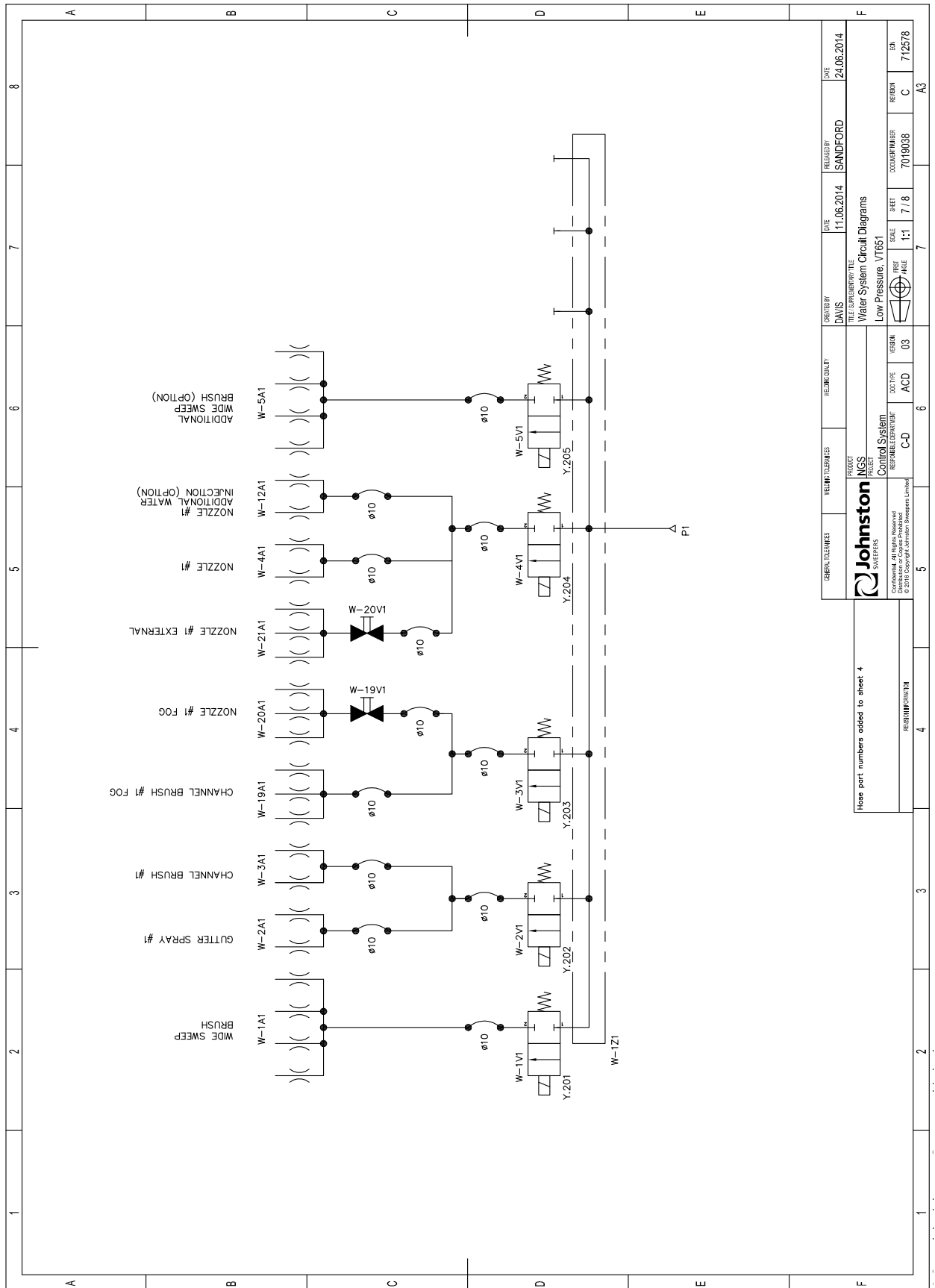
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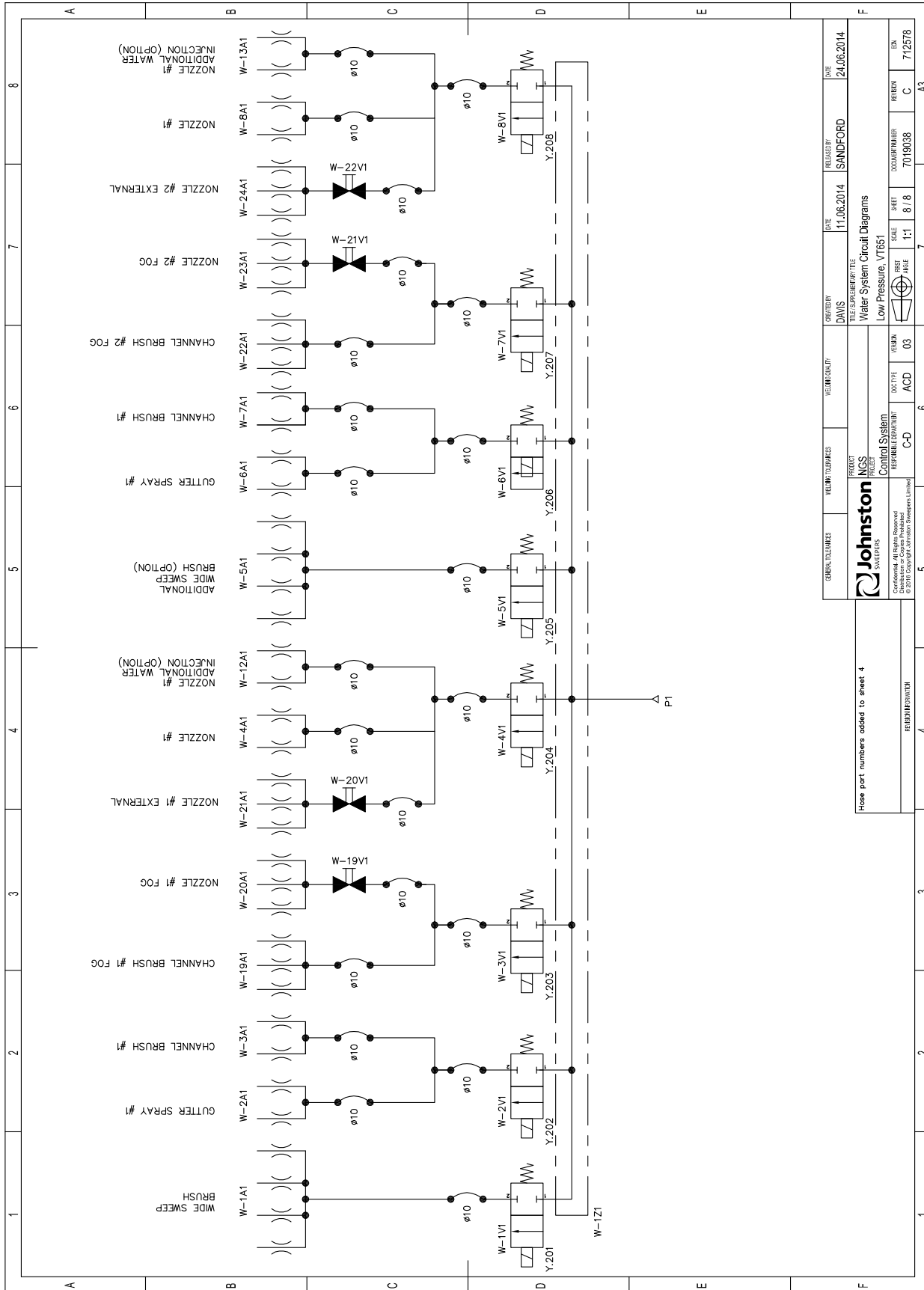


Low Pressure Water System - Sheet 7/8 Rev C

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Low Pressure Water System - Sheet 8/8 Rev C



GENERAL DELIMITERS	REVISIONS	RELIABILITY	DATE
			24.06.2014
GENERAL DELIMITERS	REVISIONS	DATE	RELEASED BY
		11.06.2014	SANDFORD
CREDITED BY: DAVIS TITLE: SUBPART TITLE Water System Circuit Diagrams PRODUCT: NGS Control System Low Pressure, V7651 REVISIONS: C-0 DOC P/E: ACC YEAR: 03 SHEET: 8/8 SIZE: A3 DRAWING NO: 7019038 REVISION: C DATE: 7/25/78			

Hose part numbers added to sheet 4

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**CHAPTER**

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**5****Pneumatic System****Table of Contents**

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## PNEUMATIC SYSTEM - INTRODUCTION

### General Description

The air supply for the pneumatic system is taken from the vehicle braking system via a safety regulating valve that ensures the braking system receives priority in the event of a failure to the sweeper air system. A filter regulator unit with integral shut off/drain facility and low air pressure warning buzzers are located within the systems locker, as are the electrical solenoid control valves for operation of channel brush/nozzle and wide sweep brush, and intake duct flap. Wide sweep brush balance adjustment is provided by electronic proportional pressure regulators.



### Safety Precautions



**Before servicing any components on this system, the air supply should be shut off by means of the shut off valve mounted on top of the filter regulator unit. This not only severs the pneumatic supply, it also exhausts the air from the system causing the nozzle and wide sweep brush to lower. Wait approximately 15 seconds to allow air to completely exhaust before carrying out any work. The shut off valve does not drain air from the vehicle braking system.**

### Circuit Pressures

The system pressure is pre-set at 8.0 bar (115 PSI).

The pressure in the Powathrust system is preset at 3.5 bar.

The pressure in the Powascrub system (option) is preset at 2 bar.

- 1 First ensure truck air system is up to pressure and sweepgear is lifted.
- 2 If pressure is incorrect, adjustment is carried out by turning the regulator control on the filter regulator unit.

#### Note:

Provided in the systems locker is an air charge point via an airline push in connector supplied with the sweeper.

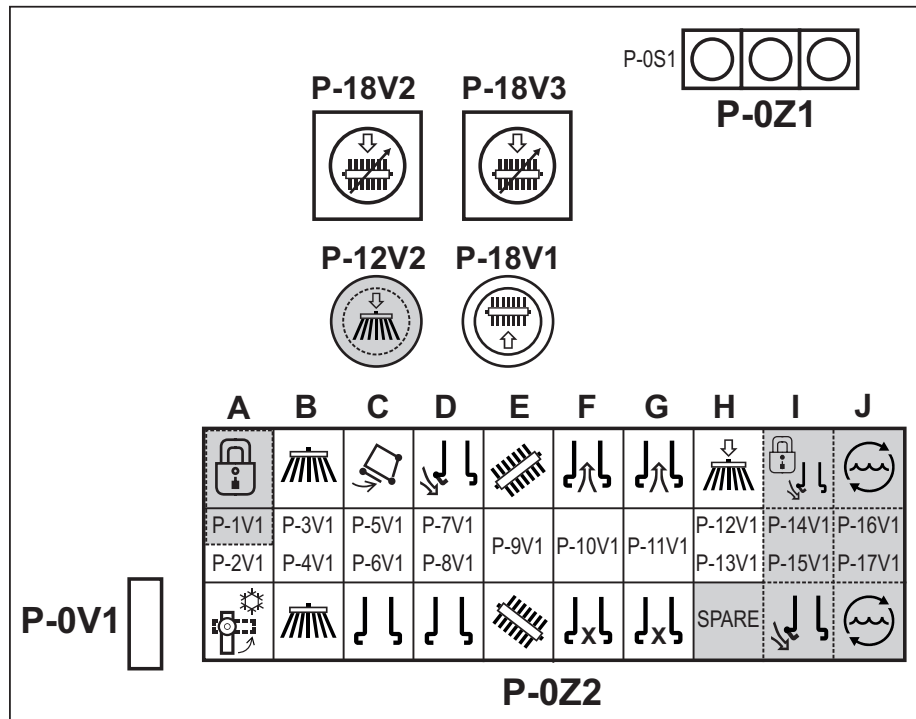
### Pneumatic Pipe Colours

A system of colour coding has been introduced to assist pipe identification and fault finding. The following colours have been adopted.

- R** = Red - Permanent/supply
- U** = Blue - Switched supply via valve or tap
- B** = Black - Permanent vent/exhaust line

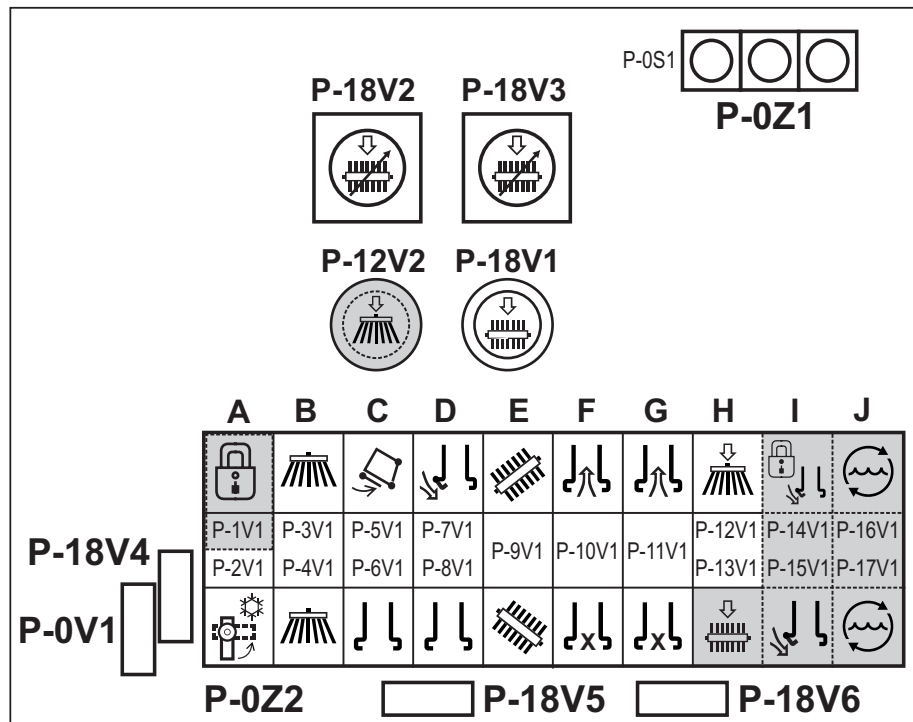
Valve Identification/Location

MKI WSB Control



M02MA-009-3

MKII WSB Control



M02MA-009-4

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## COMPONENT REMOVAL

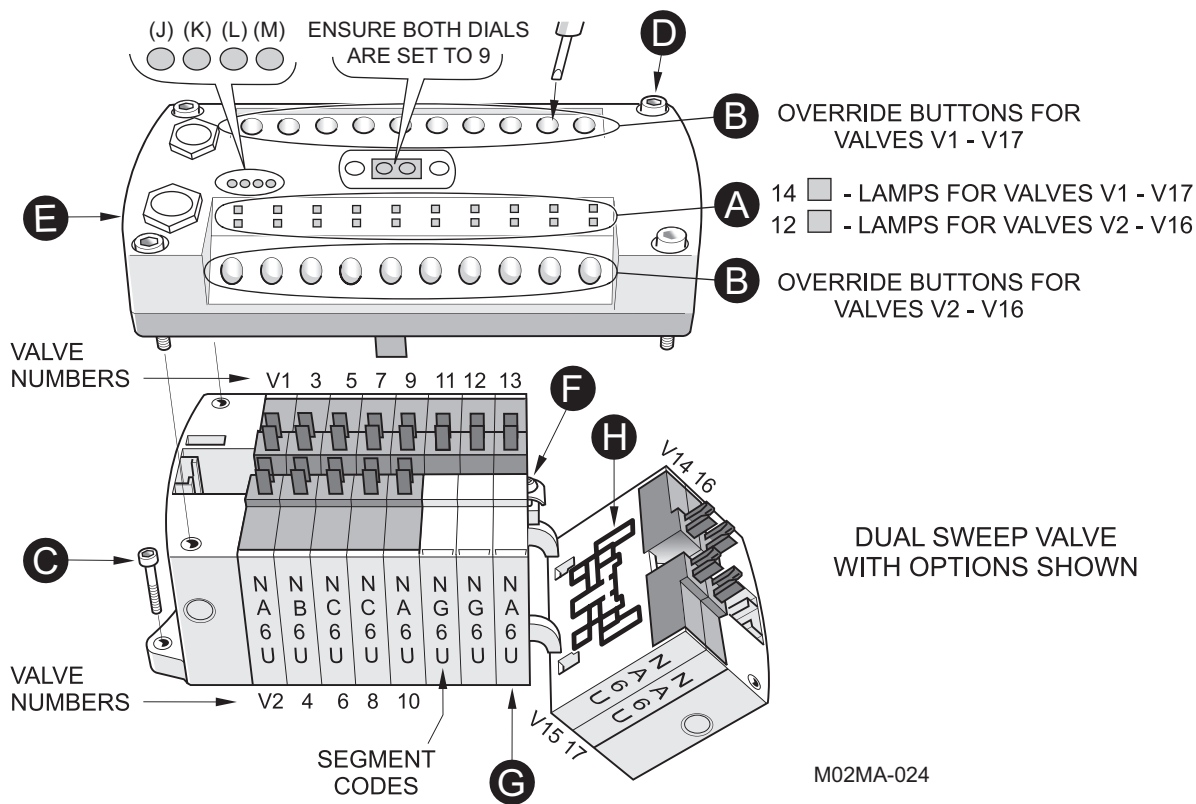
### Air Filtration and Regulator (FR)

A filter regulator unit, located in the systems locker on the left hand side of the body, filters the air for the sweeper section of the pneumatic system to prolong the life of the components served by it.

Before carrying out any major work on the unit, other than that described in the Routine Maintenance Section of the Operator's Guide, it will be necessary to remove it from the locker by first draining the vehicle air system, then disconnecting the supply pipes and releasing the fixing bolts.

### Pneumatic Valve Island

The pneumatic valve island is a modular unit comprising various valve segments. Each valve segment has an indicator light that illuminates when energised (A) and a manual override button (B) for ports 2 or 4 on each segment



Each segment is identified by a unique code, they are not all the same - see page 5:6 for identification and functionality.

To replace a valve segment -

- 1) Isolate the vehicles electrical supply.
- 2) Disconnect the two electrical connectors.
- 3) Remove the 4 fixing screws (C).
- 4) Remove the 4 socket head screws (D).
- 5) Remove the valve cover containing the valve operating coils (E).
- 6) Unscrew (F) each side of the segment to be replaced.
- 7) Fold open the segment (G) and replace ensuring the rubber gasket (H) is in position.
- 8) Tighten screws (F).
- 9) Replace top cover (E).
- 10) Replace screws (D).
- 11) Re-connect the electrical connectors

**Indicator Status**

- (J) - Error LED (Red)                      This LED indicates the status of the CAN physical and indicates errors due to missing CAN messages (SYNC, GUARD or HEARTBEAT).
  
- (K) - Run LED (Red/Green)                This LED indicates the status of the CANopen network state machine.
  
- (L) - 5v (Green)                              This LED will only be energised when the Network power is connected to the Network connector, indicating that the logic circuit of the module is powered.
  
- (M) - 24v (Green)                            This LED will only be energised when chassis voltage is applied to the valve power terminal of the power supply connector.

**Indicator status during powering up and commissioning**

Condition	24v	5v	Error LED	Run LED
Power up	On	On	Single flash	Single flash green/red
Auto baud rate detection active	On	On	Flickering	Flickering green
Changing of address during commissioning	On	On	Flickering	Flickering green
Device in a pre-operation state	On	On	Off	Blinking green
Device in a stopped state	On	On	Off	Single flash green
Device in an operation state	On	On	Off	On green

**Indicator status during CAN message errors**

Condition	24v	5v	Error LED	Run LED
Too many error frames received	On	On	Single flash	Dependent on device state
Heartbeat event has occurred	On	On	Double flash	Dependent on device state
A sync message has not been received	On	On	Triple flash	Dependent on device state
Bus off	On	On	On	Dependent on device state

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**Pneumatic Valve Island - Modus Operandi**

Single Sweep Function					
Segment	24v	12v	Valve	MKI WSB Control	MKII WSB Control
1	NA6U	TA6U	P-1V1 [Port 4 / LED 14]	Unlock [Autoloc Option] (NC)	
			P-2V1 [Port 2 / LED 12]	Water Purge (NC)	
2	NB6U	TB6U	P-3V1 [Port 4 / LED 14]	Channel Brush Lower (NO)	
			P-4V1 [Port 2 / LED 12]	Plugged	
3	NC6U	TC6U	P-5V1 [Port 4 / LED 14]	Body Prop Release (NC)	
			P-6V1 [Port 2 / LED 12]	Nozzle Lower (NO)	
4	NC6U	TC6U	P-7V1 [Port 4 / LED 14]	Nozzle Maxigap Open (NC)	
			P-8V1 [Port 2 / LED 12]	Plugged	
5	Blank	Blank			
6	NG6U	TG6U	P-10V1 [Port 4 / LED 14]	Intake Flap - Full Bore (NC)	
			[Port 2]	Intake Flap - Annulus (NO)	
7	Blank	Blank			
8	NA6U	TA6U	P-12V1 [Port 4 / LED 14]	Powathrust (NC)	
			P-13V1 [Port 2 / LED 12]	<b>Plugged</b>	<b>Powascrub</b>
9	NA6U	TA6U	P-14V1 [Port 4 / LED 14]	Varagap Unlock (NC)	
			P-15V1 [Port 2 / LED 12]	Varagap Close (NC)	
10	NA6U	TA6U	P-16V1 [Port 4 / LED 14]	Water Recirculation (NC)	
			P-17V1 [Port 2 / LED 12]	Plugged	

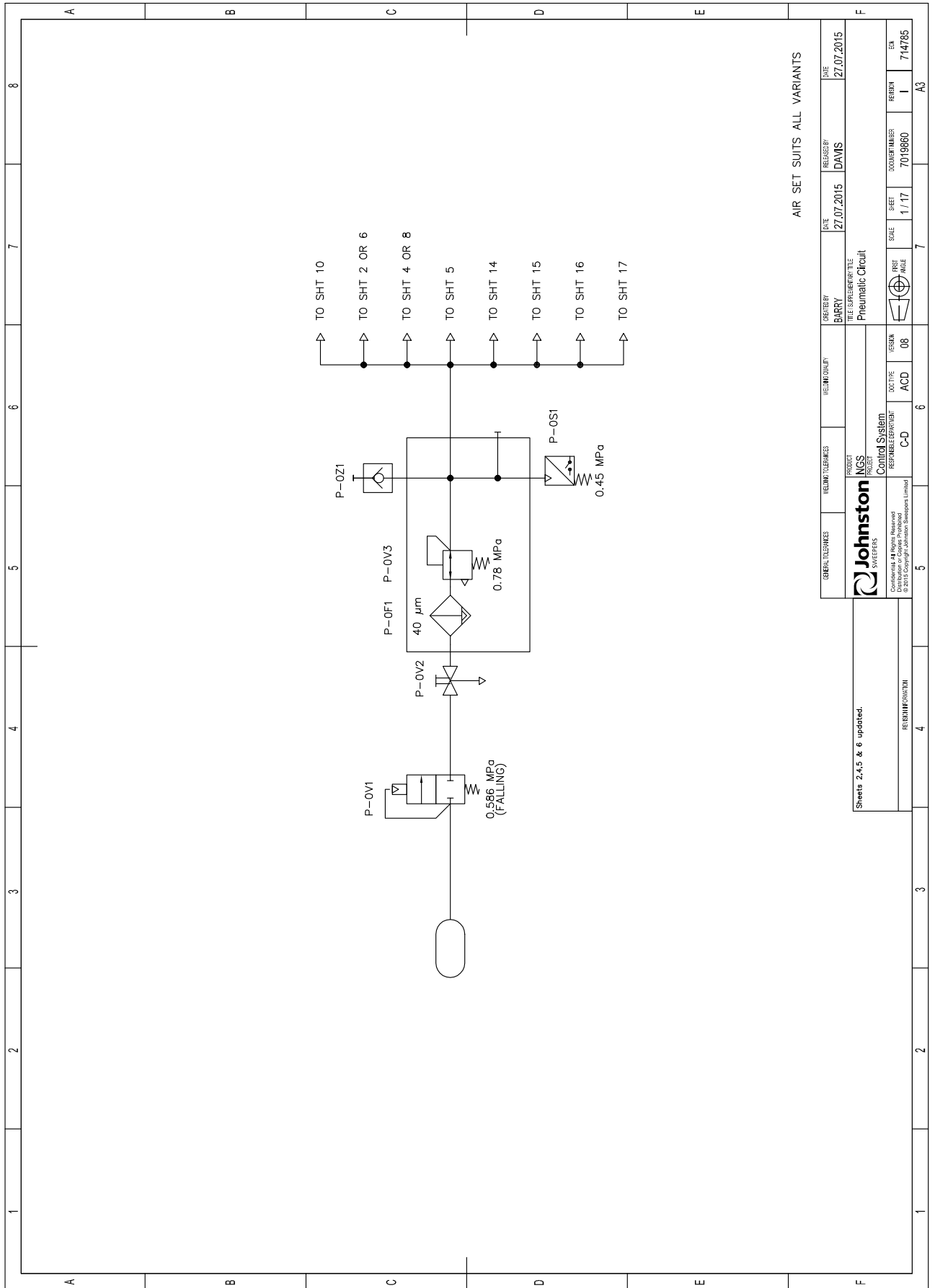
Dual Sweep Function					
Segment	24v	12v	Valve	Function	
1	NA6U	TA6U	P-1V1 [Port 4 / LED 14]	Unlock [Autoloc Option] (NC)	
			P-2V1 [Port 2 / LED 12]	Water Purge (NC)	
2	NB6U	TB6U	P-3V1 [Port 4 / LED 14]	Channel Brush LH Lower (NO)	
			P-4V1 [Port 2 / LED 12]	Channel Brush RH Lower (NO)	
3	NC6U	TC6U	P-5V1 [Port 4 / LED 14]	Body Prop Release (NC)	
			P-6V1 [Port 2 / LED 12]	Nozzle Lower LH (NO)	
4	NC6U	TC6U	P-7V1 [Port 4 / LED 14]	Nozzle Maxigap Open (NC)	
			P-8V1 [Port 2 / LED 12]	Nozzle Lower RH (NO)	
5	NA6U	TA6U	P-9V1 [Port 4 / LED 14]	Wide Sweep Brush Slew Left (NC)	
			[Port 2 / LED 12]	Wide Sweep Brush Slew Right (NC)	
6	NG6U	TG6U	P-10V1 [Port 4 / LED 14]	Intake Flap LH - Full Bore (NC)	
			[Port 2 / LED 12]	Intake Flap LH - Annulus (NO)	
7	NG6U	TG6U	P-11V1 [Port 4 / LED 14]	Intake Flap RH - Full Bore (NC)	
			[Port 2 / LED 12]	Intake Flap RH - Annulus (NO)	
8	NA6U	TA6U	P-12V1 [Port 4 / LED 14]	Powathrust (NC)	
			P-13V1 [Port 2 / LED 12]	<b>Plugged</b>	<b>Powascrub</b>
9	NA6U	TA6U	P-14V1 [Port 4 / LED 14]	Varagap Unlock (NC)	
			P-15V1 [Port 2 / LED 12]	Varagap Close (NC)	
10	NA6U	TA6U	P-16V1 [Port 4 / LED 14]	Water Recirculation LH (NC)	
			P-17V1 [Port 2 / LED 12]	Water Recirculation RH (NC)	

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Air Set Suits All Variants - Sheet 1/17 Rev I

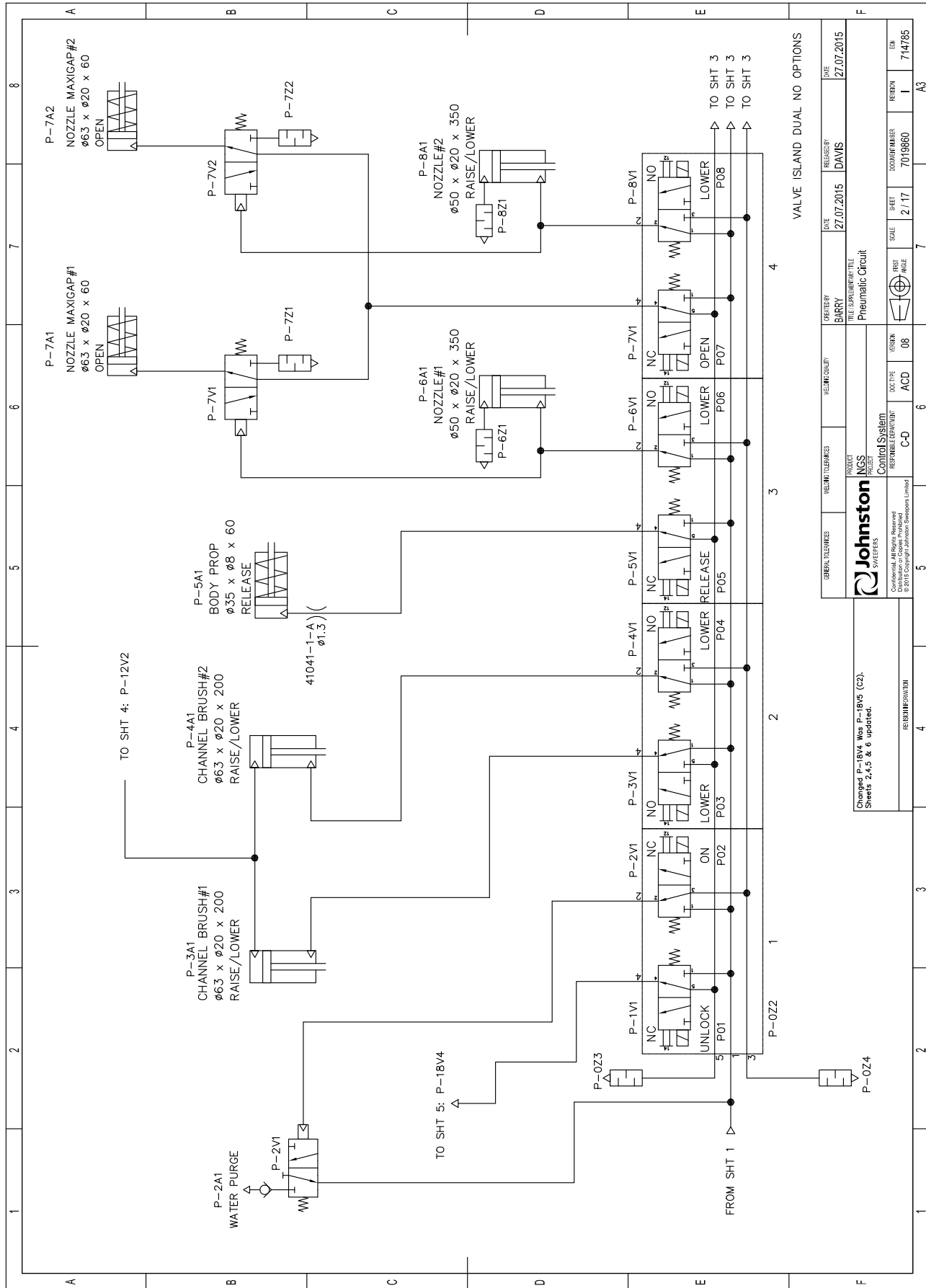


AIR SET SUITS ALL VARIANTS

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DESIGNED BY	BARRY	RELEASED BY	DAMIS	SCALE	1/17	REVISION	1
TITLE	Pneumatic Circuit						
PRODUCT	Confined Space SWEEEPERS						
REGISTRATION NUMBER	C-D	DOCTYLE	ACD	08	7019860	714785	
COMPONENTS	Johnston Sweepers Limited Confined Space SWEEEPERS Distribution of Confined Space SWEEEPERS © 2015 Copyright Johnston Sweepers Limited						

Sheets 2,4,5 & 6 updated.  
PERMITTED/NOT

Valve Island Dual - No Options 01 - Sheet 2/17 Rev I

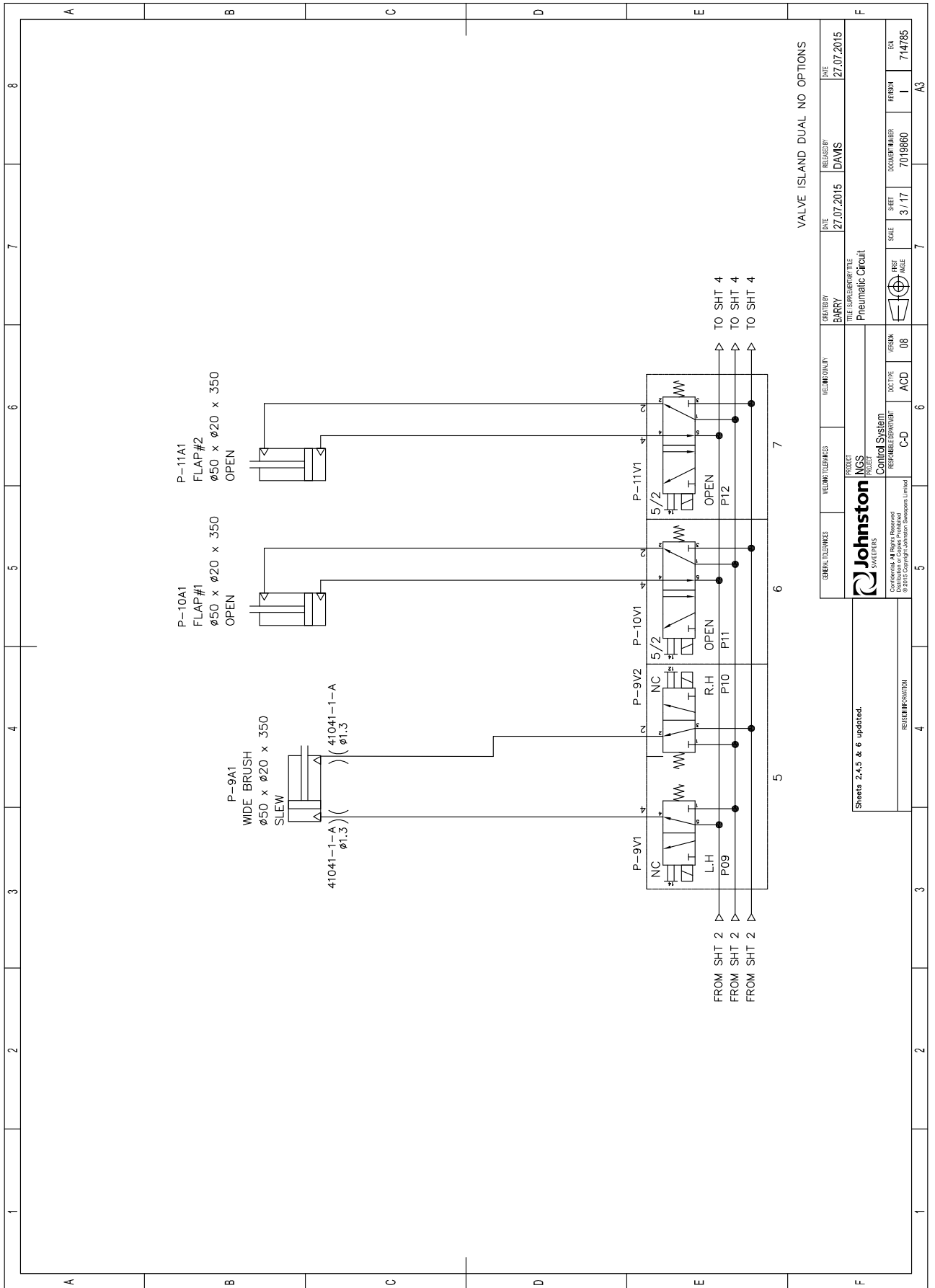


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PROJECT		TITLE (SUBPART/TITLE)			
Johnston		Pneumatic Circuit			
RESponsible		Control System			
CONFIDENTIAL: All Rights Reserved	© 2015 Copyright Johnston Sweepers Limited	DOC TYPE	VERSION	SHEET	DOOR/FRAME NUMBER
		C-D	ACD 08	2 / 17	7019860
		REVISION	SCALE	SHEET	DOOR/FRAME NUMBER
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Valve Island Dual - No Options 02 - Sheet 3/17 Rev I

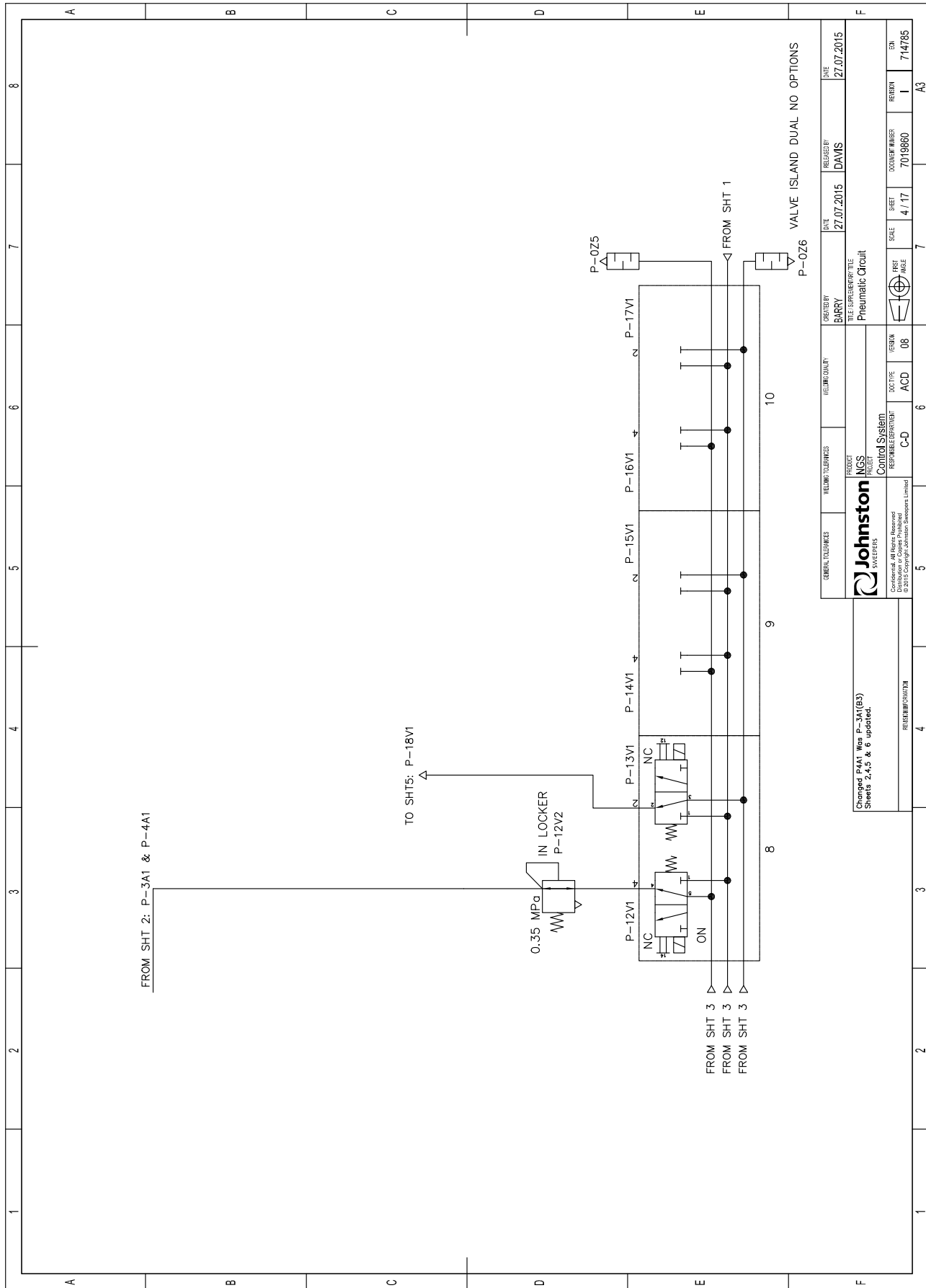
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VALVE ISLAND DUAL NO OPTIONS

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PROJECT		TITLE/SUPPLEMENT/TITLE			
Johnston MGS Sweepers		Pneumatic Circuit			
PRODUCT		PROJECT			
Control System		Control System			
RESPONSIBILITY		SCALE			
C-D	ACC	3/17	7019860	I	714785
REVISIONS	DESCRIPTION	DATE	BY	APP'D	ENR

Valve Island Dual - No Options 03 - Sheet 4/17 Rev I

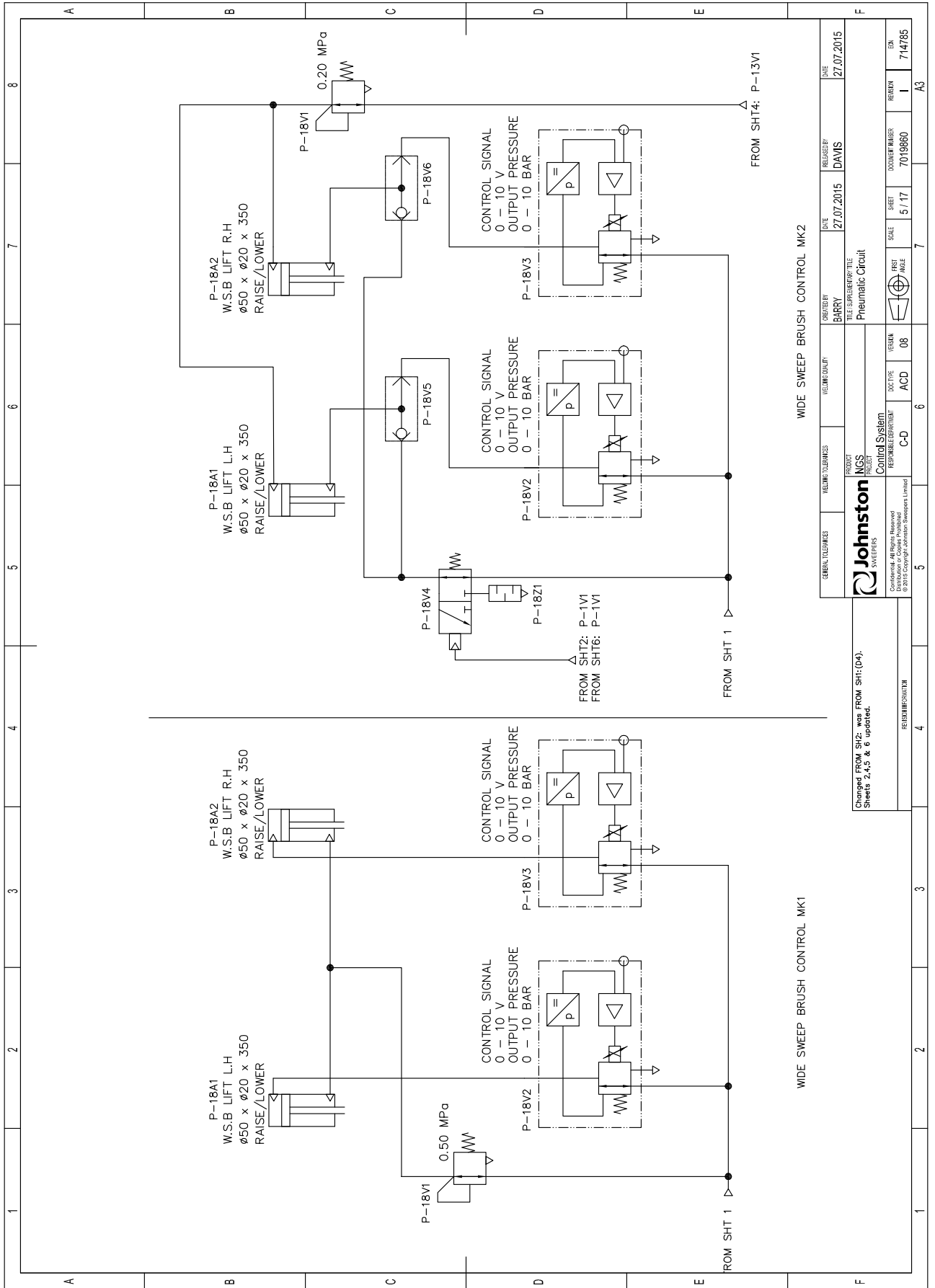


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 PRODUCT: NGS PROJECT: Control System RESPONSIBLE DEPARTMENT: C-D DOC TYPE: ACC VERION: 08			TITLE: SUPPLEMENTARY TITLE Pneumatic Circuit			
Changed P-4A1 Was P-3A1(B3) Sheets 2,4,5 & 6 updated.			FIRST ISSUE 4 / 17	SHEET 4 / 17	DRAWING NUMBER 7018660	REVISION I
RETURNED TO JOHNSTON SWEEPERS LTD © 2015 Copyright Johnston Sweepers Limited			DRAWING NUMBER 714785			

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Wide Sweep Brush Control MK2 - Sheet 5/17 Rev I

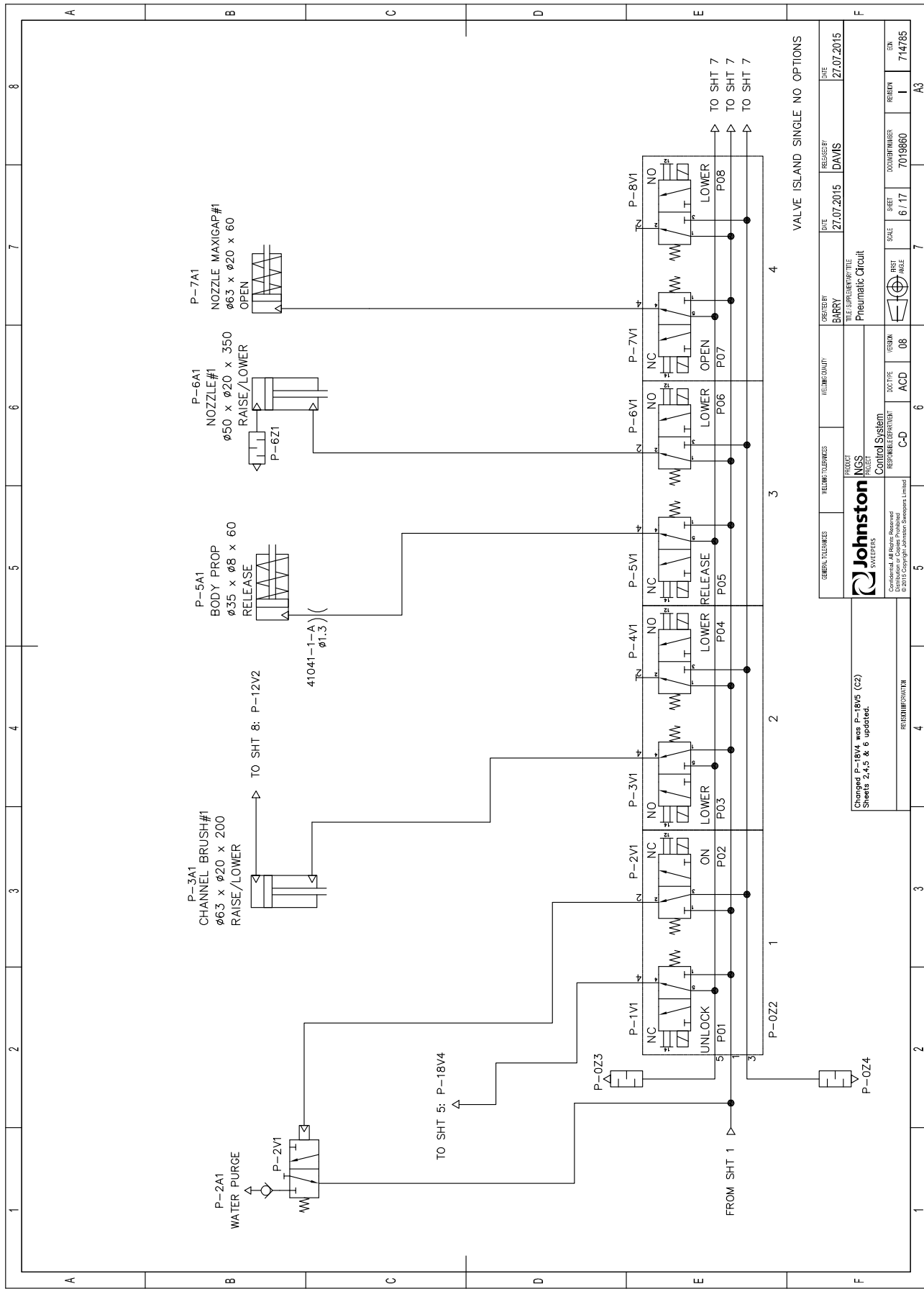
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PRODUCT			TITLE/SUBJECT/PARTICLE			
MGS			Pneumatic Circuit			
Control System			REVISION NUMBER			
C-D			7019860			
REVISION			SCALE			
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C-D			7			
REVISION			DRAWN			
08			I			
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 Sheets 2,4,5 & 6 updated.

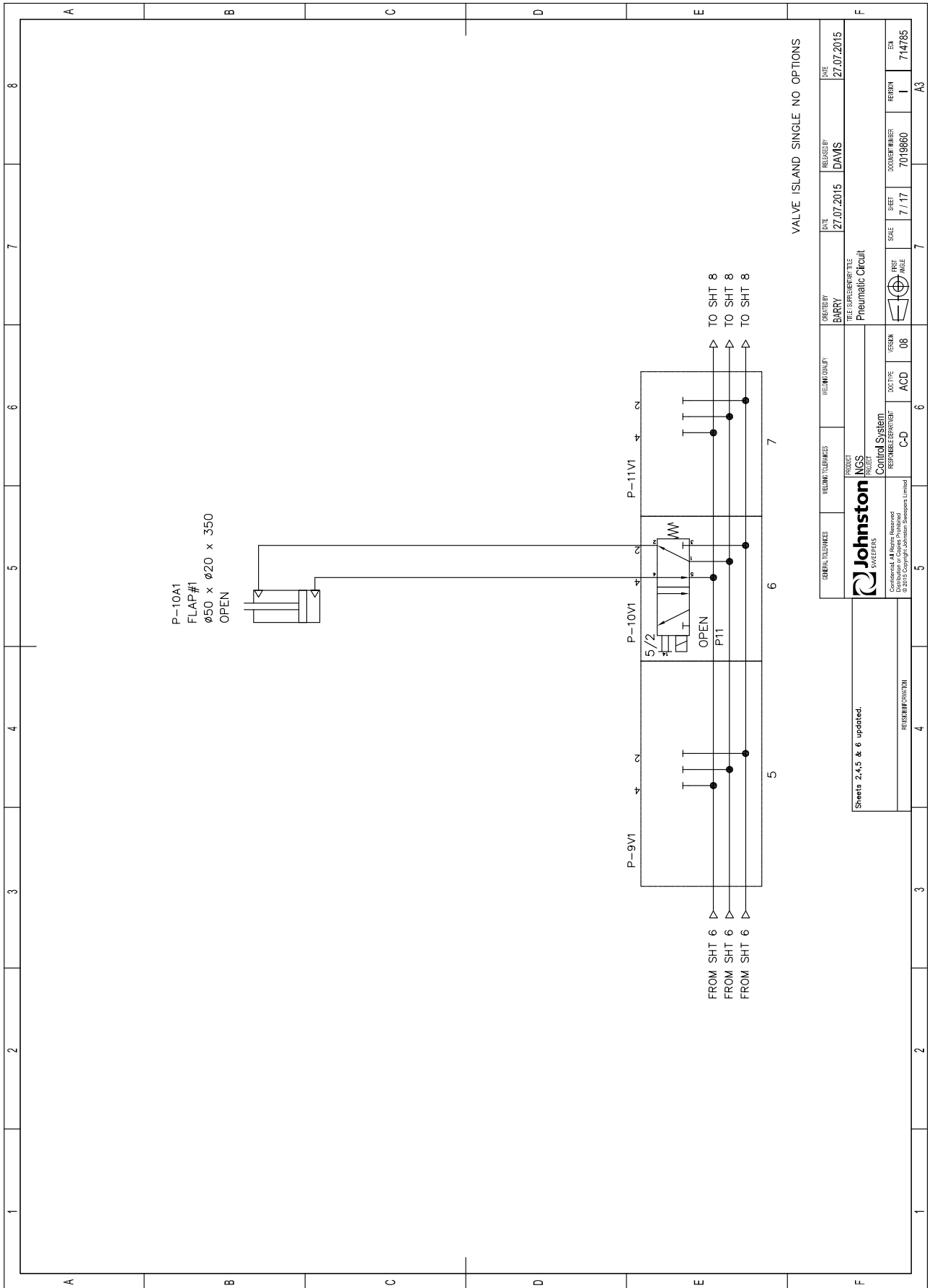
Valve Island Single - No Options 01 - Sheet 6/17 Rev I



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Valve Island Single - No Options 02 - Sheet 7/17 Rev I

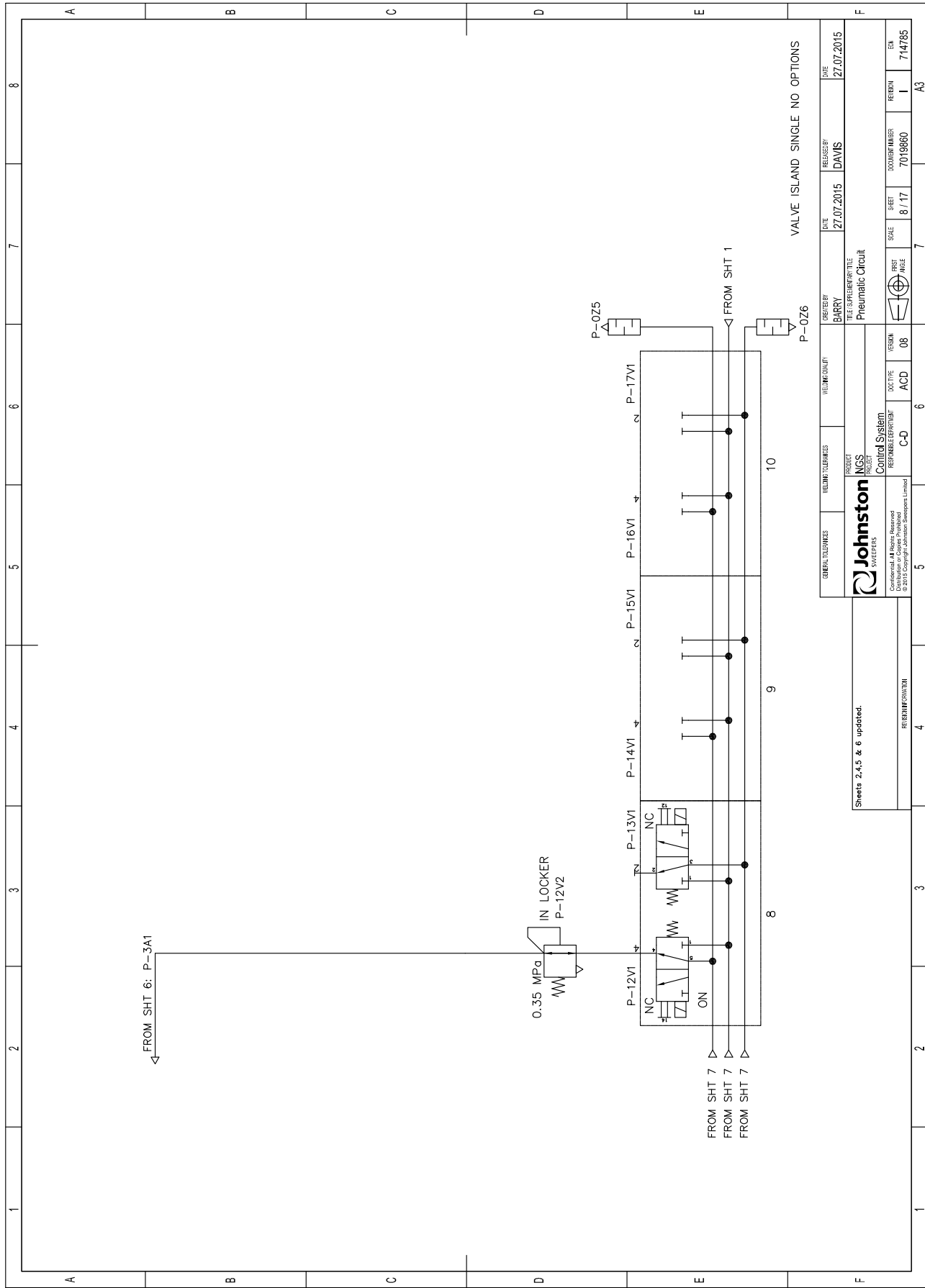
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PROJECT		TITLE/SUPPLEMENT/TITLE			
MCS		Pneumatic Circuit			
PROJECT		CONTROL SYSTEM			
C-D		C-D			
DOCTORS		ACC			
VERSION		08			
DRAWING NUMBER		SCALE		SHEET	
7019860		7/17		1	
REVISION		DRAWN		EN	
I		714785		A3	

Sheets 2,4,5 & 6 updated.

Valve Island Single - No Options 03 - Sheet 8/17 Rev I



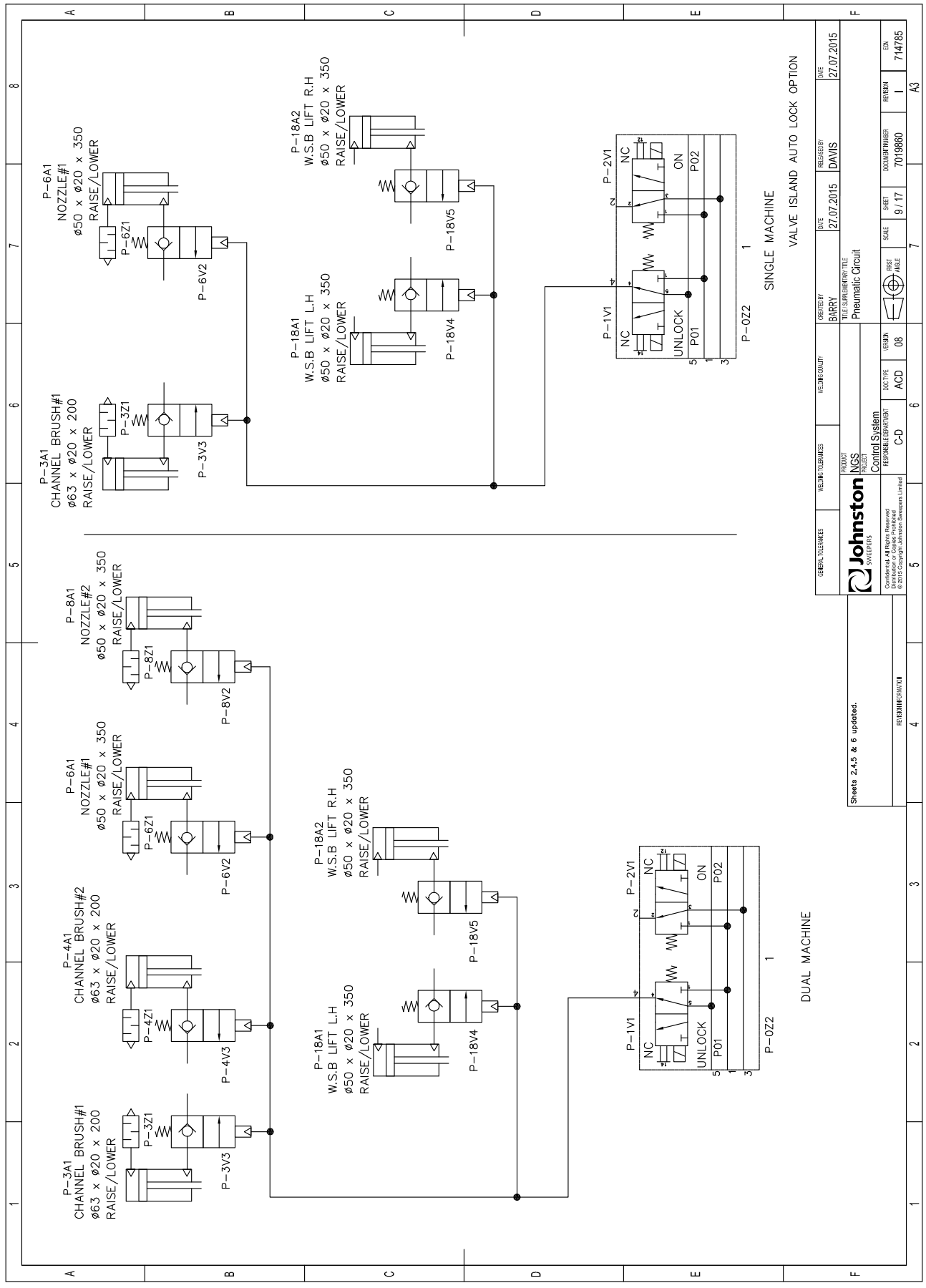
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			TITLE / SUBPART TITLE Pneumatic Circuit			
PRODUCT NGS Control System			SHEET 8 / 17			
RESPONSIBLE DEPARTMENT C-D			SCALE 1:1			
SHEETS 2,4,5 & 6 updated.			DOOR NUMBER 7019860			
REFERENCE DOCUMENT			REGION I			
			ESK 714785			

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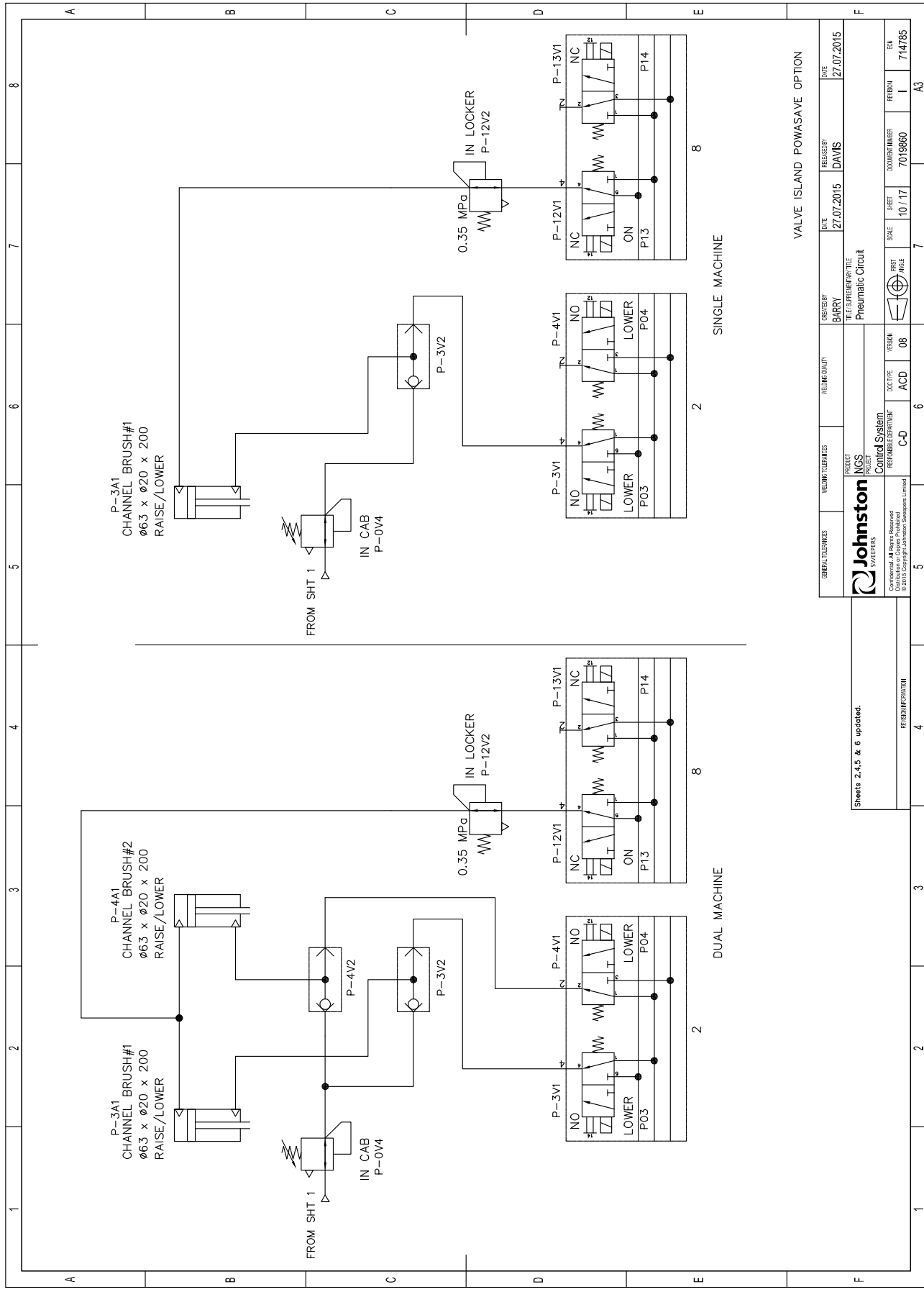
Valve Island Auto Lock Option - Sheet 9/17 Rev I

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GENERAL TELEPHONE	TELEPHONE NUMBERS	REVISION/QUANTITY	DESIGNED BY	DATE	REVISION/DATE
			BARRY	27.07.2015	DAVIS
<b>Johnston</b> SWEEPERS Confidential. All Rights Reserved. Distribution or Copying Prohibited. © 2015 Copyright Johnston Sweepers Limited.		PRODUCT MGS Control System RESPIRATOR DISTRIBUTION	TITLE/SUBTITLE Pneumatic Circuit	DATE 27.07.2015	REVISION I 7/14/85
Sheets 2,4,5 & 6 updated.		C-D ACD 08	SCALE 9/17	SHEET 7	DRAWING NUMBER 7019860
REVISION/QUANTITY		C-D ACD 08	SCALE 9/17	SHEET 7	DRAWING NUMBER 7019860

Valve Island Powasave Option - Sheet 10/17 Rev I



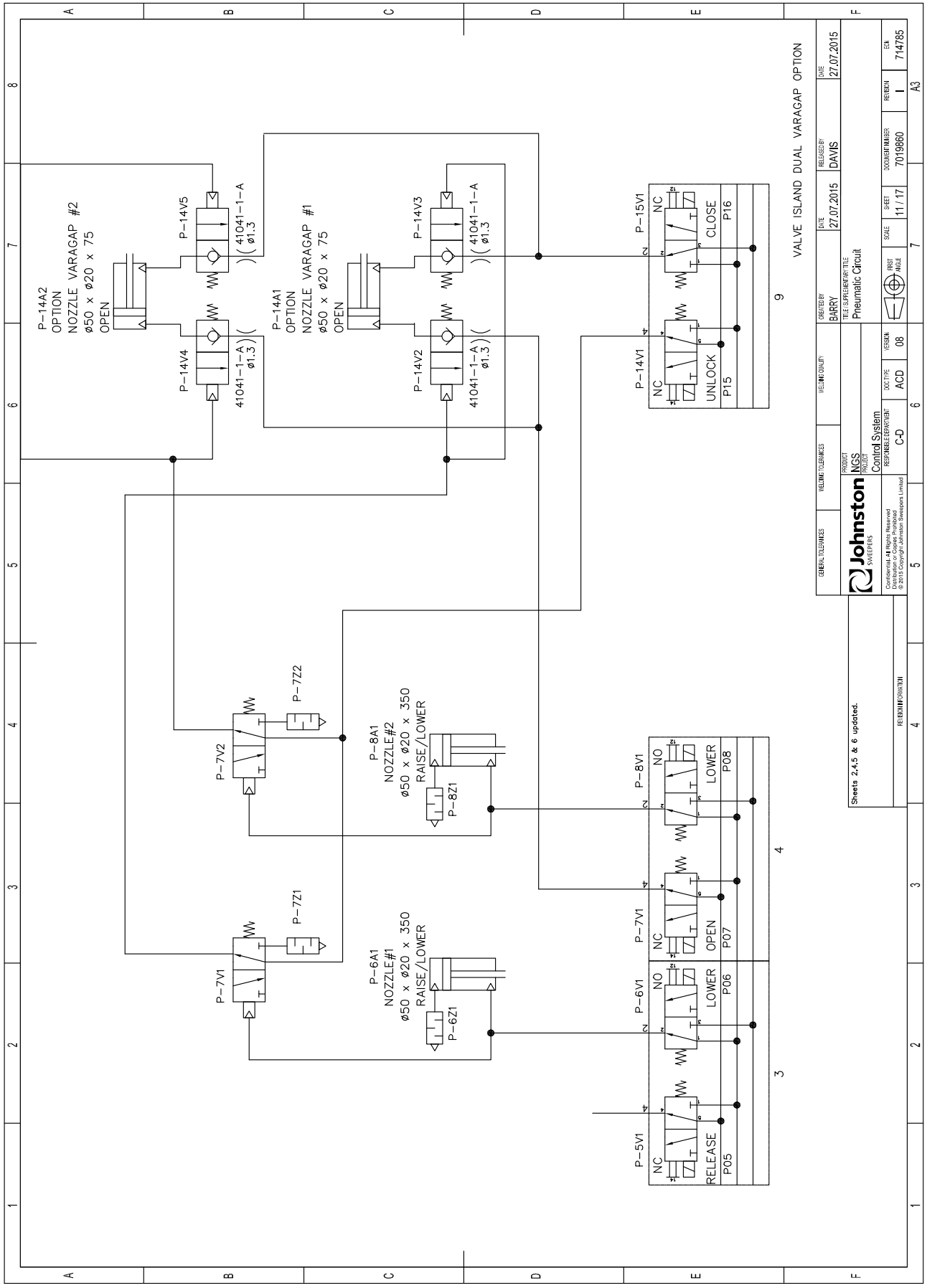
VALVE ISLAND POWASAVE OPTION

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			TITLE & REFERENCE TITLE Pneumatic Circuit			
PRODUCT Control System			VERSNO	SHEET	DOOR/FURNUMBER	REVISION
RESPONSIBLE DEPARTMENT C-D			ACC	10 / 17	7019860	I
SHEETS 2,4,5 & 6 updated.			REVISION	EN	714785	A3

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Valve Island Dual Varagap Option - Sheet 11/17 Rev I

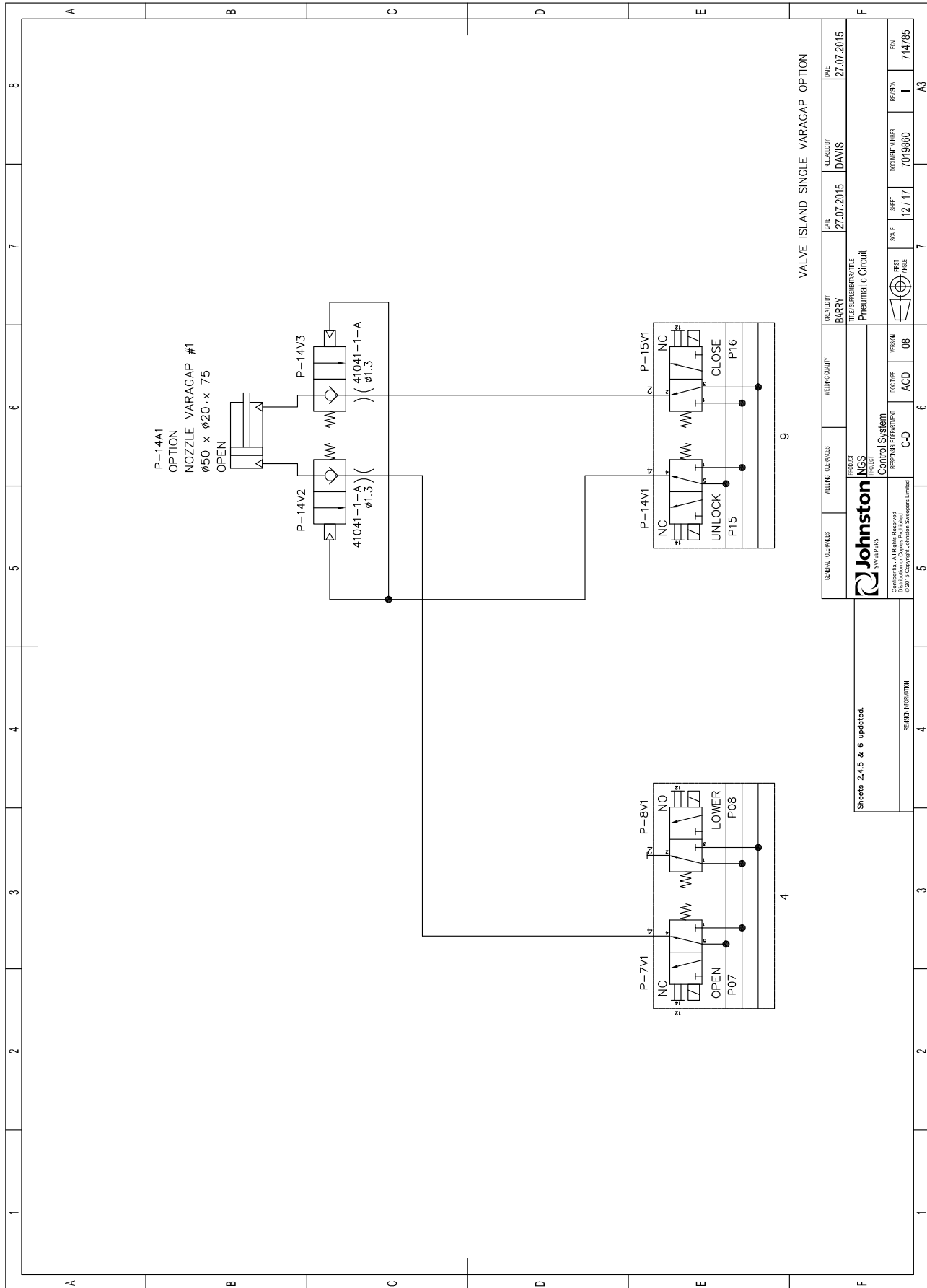
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GENERAL COMMENTS	REVISIONS	REVISIONS	REVISIONS	REVISIONS	REVISIONS	REVISIONS	REVISIONS
		PRODUCT MGS Control System RESERVE AIRPORT	TITLE Pneumatic Circuit	DRAWN BY ACB	CHECKED BY ACB	DESIGNED BY BARRY	REVISIONS DATE 27/07/2015 REVISION I DATE 27/07/2015
Confidential. All Rights Reserved. Don't make or Copy. Prohibited. © 2015 Johnston Sweepers Limited		DOCUMENT NUMBER 7019860	SHEET NUMBER 11/17	SCALE 1:1	DRAWN BY I	CHECKED BY I	DATE 7/4/85

Sheets 2,4,5 & 6 updated.

Valve Island Single Varagap Option - Sheet 12/17 Rev I



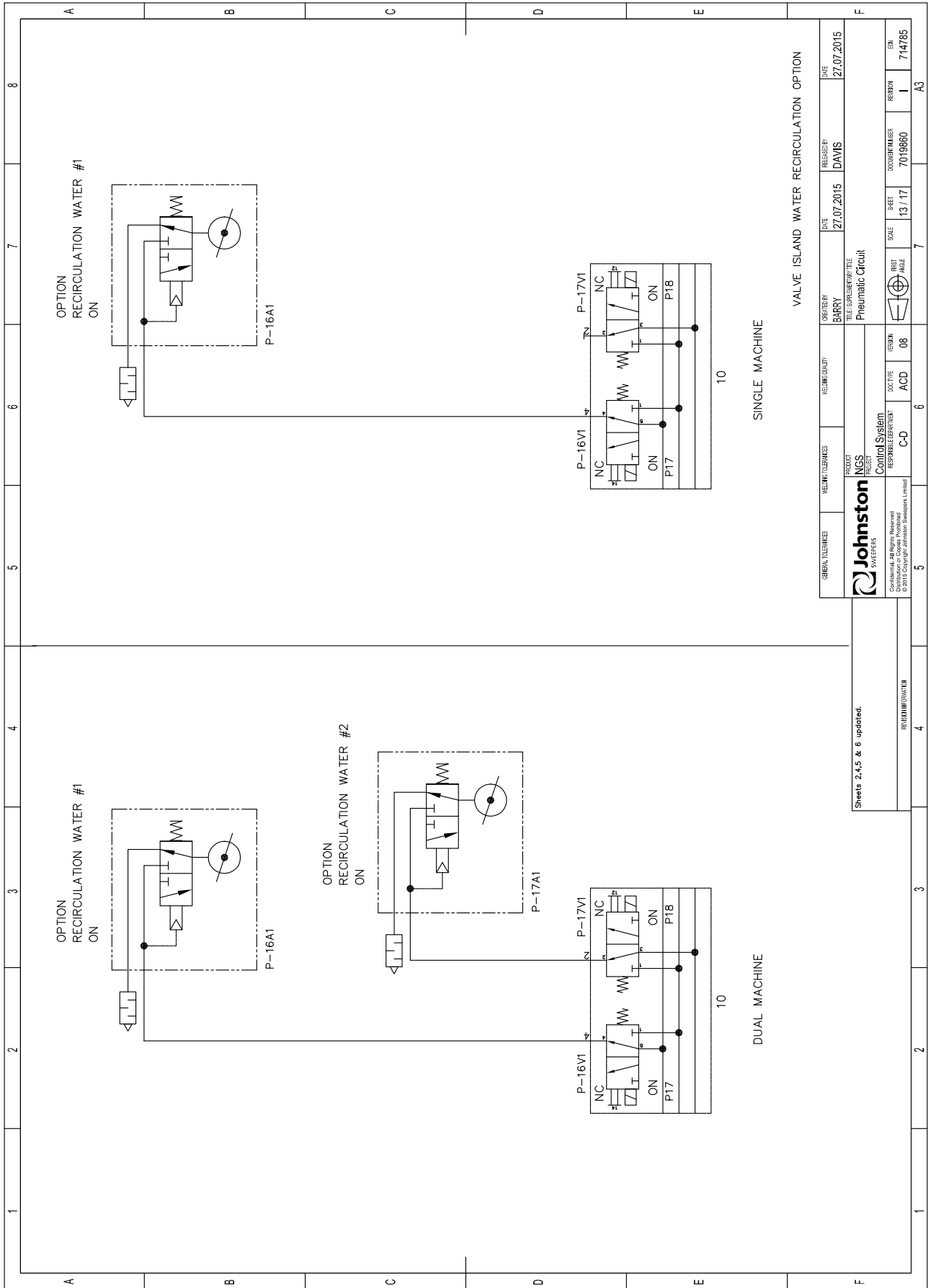
VALVE ISLAND SINGLE VARAGAP OPTION

GENERAL TOLERANCES	WELDING TOLERANCES	WELDING QUALITY	DESIGNER	DATE	RELEASED BY	DATE
			BARRY	27.07.2015	DAVIS	27.07.2015
 Confidential. All Rights Reserved © 2015 Copyright Johnston Sweepers Limited			TITLE: SUPPLEMENT TITLE Pneumatic Circuit			
SHEETS 2,4,5 & 6 updated.			PRODUCT: NGS PROJECT: Control System RESPONSIBLE PART: C-D DOC TYPE: ACC VERSION: 08			
REVISION NUMBER	SHEET	SCALE	FIRST MADE	REVISION	DATE	EN
7019960	12 / 17	I	7019960	I	71/4785	A3

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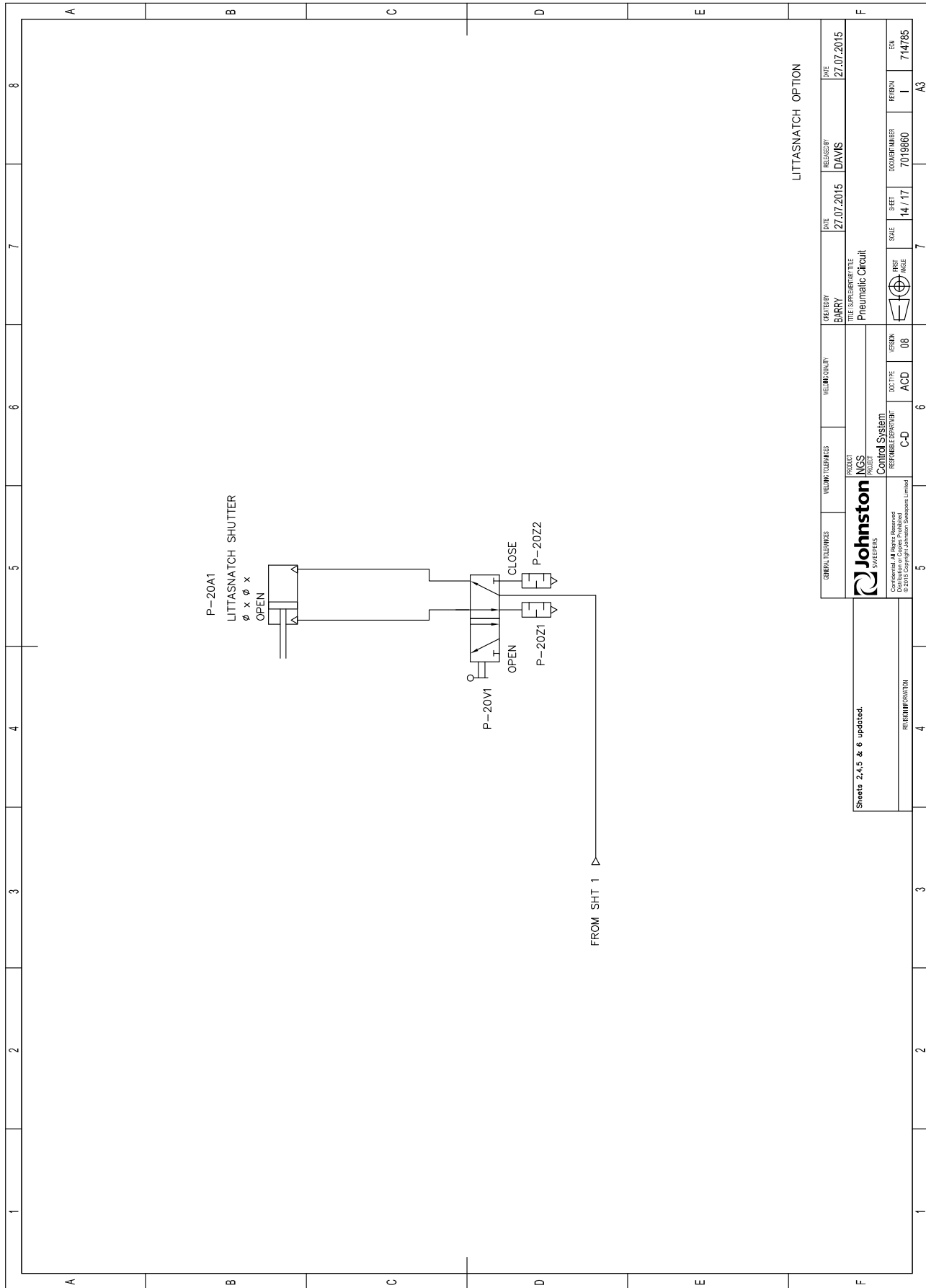
Valve Island Water Recirculation Option - Sheet 13/17 Rev I

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VALVE ISLAND WATER RECIRCULATION OPTION

GENERAL TOLERANCES	VALVE TOLERANCES	RELIEF VALVE	DESIGNER	DATE	REVISOR	DATE
			BARRY	27.07.2015	DAVIS	27.07.2015
PRODUCT TITLE: SUBCIRCUIT TITLE Pneumatic Circuit						
PRODUCT NAME: CONTROL SYSTEM RESPIRATOR UNIT						
SHEETS 2,4,5 & 6 updated.		C-D	ACD	08	13 / 17	7019860
JOHNSTON SWEEPERS Confidential Air Rights Reserved Distributor or Copies Provided © 2015 Copyright Johnston Sweepers Limited		5	6	7	I	714785
REVISIONS 4		A3				

**Littasnatch Option - Sheet 14/17 Rev I**


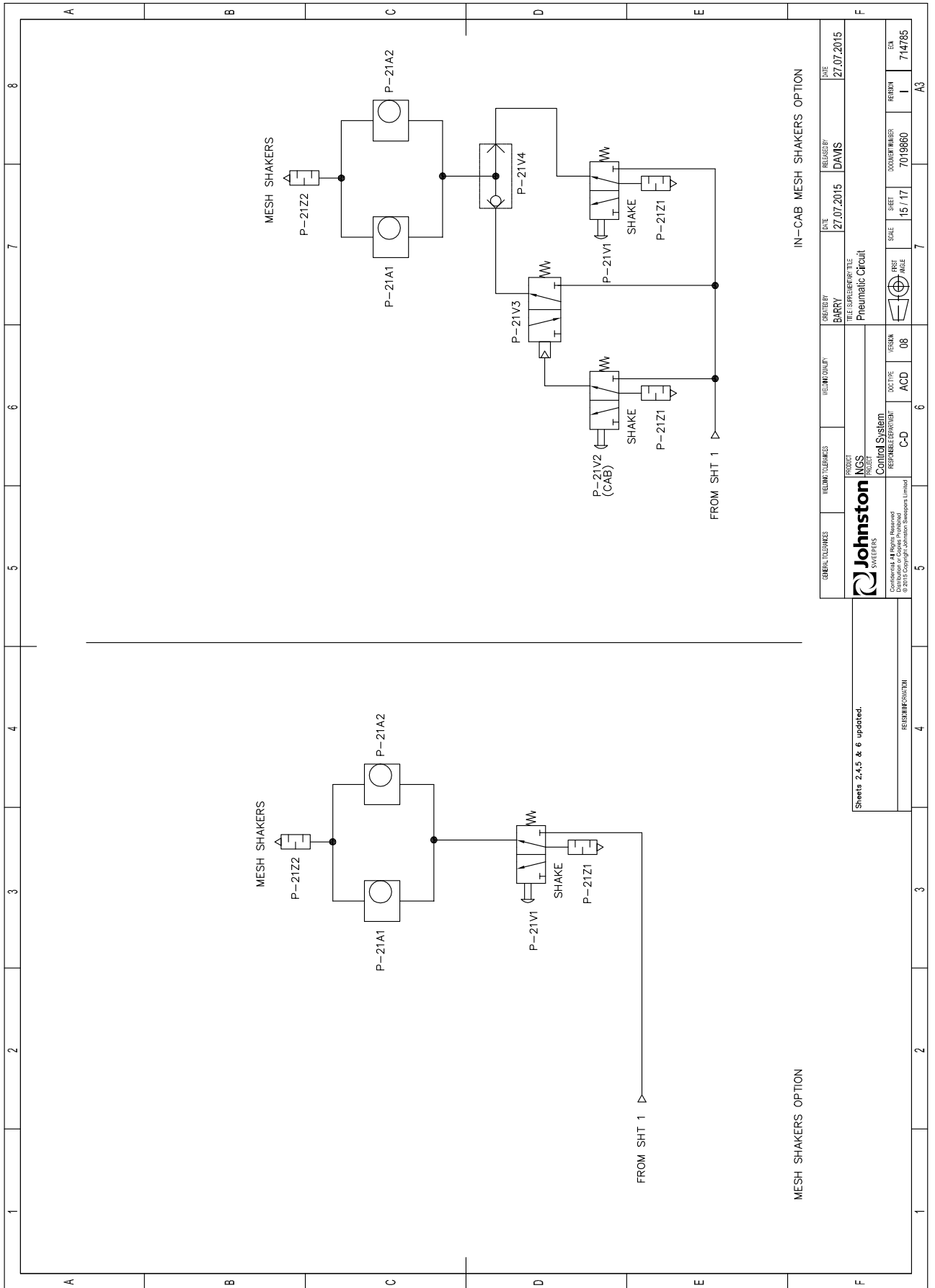
LITTASNATCH OPTION

GENERAL TOLERANCES	WELDING TOLERANCES	WELDING QUALITY	CREATED BY BARRY	DATE 27.07.2015	RELEASED BY DAVIS	DATE 27.07.2015
 NGS CONTROL SYSTEMS RESPONSIBLE DEPARTMENT C-D			TITLE & REFERENCE TITLE Pneumatic Circuit		SHEET 14 / 17	DRAWING NUMBER 7019860
Sheets 2,4,5 & 6 updated. REFERENCE DRAWING			PRODUCT Control System	VERSION 08	FIRST ANGLE	REGION I
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In-Cab Mesh Shakers Option - Sheet 15/17 Rev I

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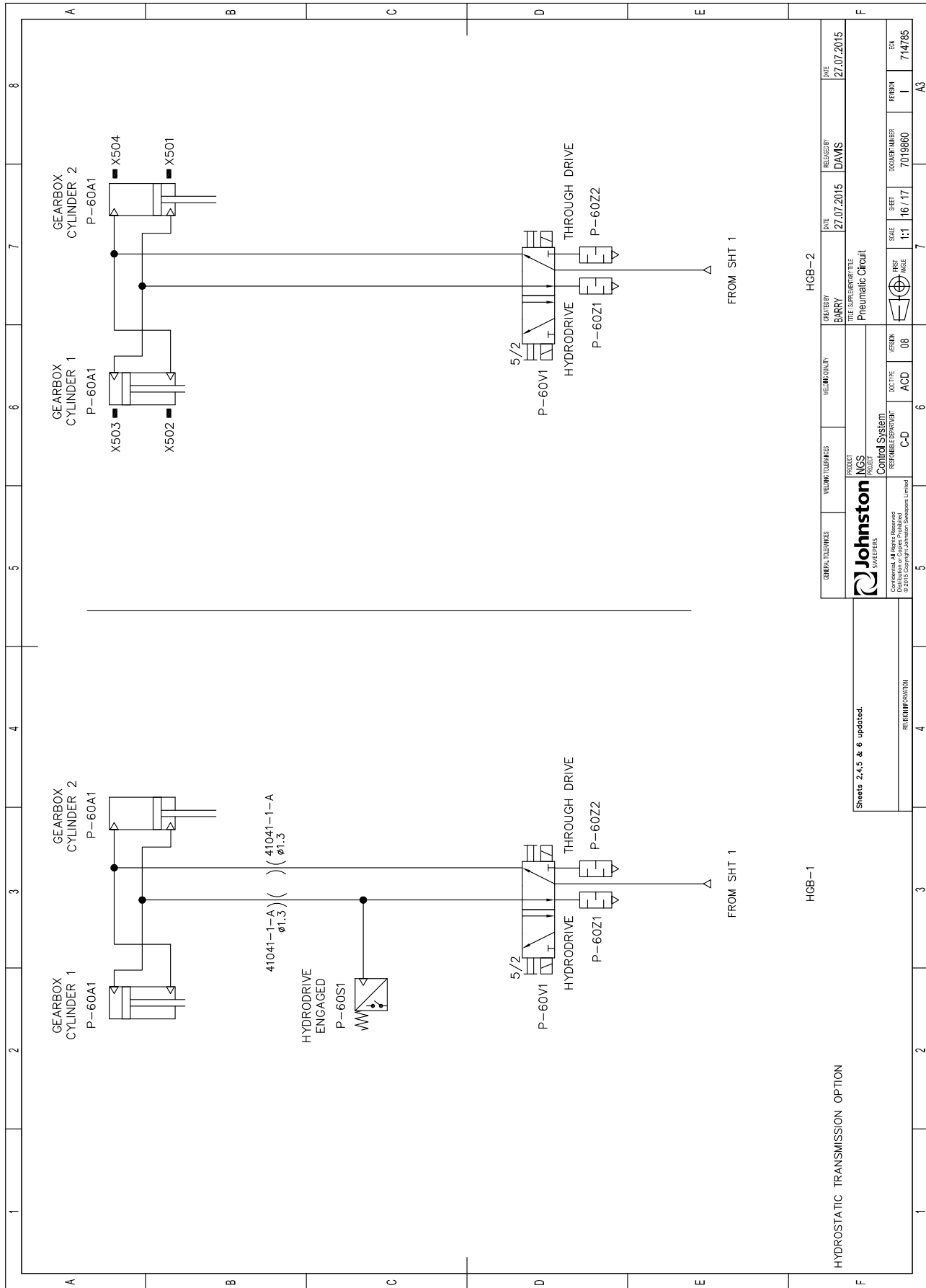
Sheets 2,4,5 & 6 updated.

MESH SHAKERS OPTION

IN-CAB MESH SHAKERS OPTION

GENERAL USES	REVISIONS	REVISIONS	REVISIONS	REVISIONS	REVISIONS	REVISIONS	REVISIONS
Johnston SWEEPERS	PROJECT MCS Control System	REVISIONS C-D	REVISIONS ACC	REVISIONS 08	REVISIONS I	REVISIONS I	REVISIONS I
CONFIDENTIAL AND NOT BE REPRODUCED OR DISTRIBUTED WITHOUT THE WRITTEN PERMISSION OF JOHNSTON SWEEPERS LIMITED	DATE 27.07.2015	SCALE 15/17	DATE 27.07.2015	SCALE I	DATE 27.07.2015	SCALE I	DATE 27.07.2015
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	TITLE Pneumatic Circuit	SCALE I	TITLE Pneumatic Circuit	SCALE I	TITLE Pneumatic Circuit	SCALE I	TITLE Pneumatic Circuit
	REVISIONS C-D	SCALE I	REVISIONS ACC	SCALE I	REVISIONS I	SCALE I	REVISIONS I
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Hydrostatic Transmission Option - Sheet 16/17 Rev I

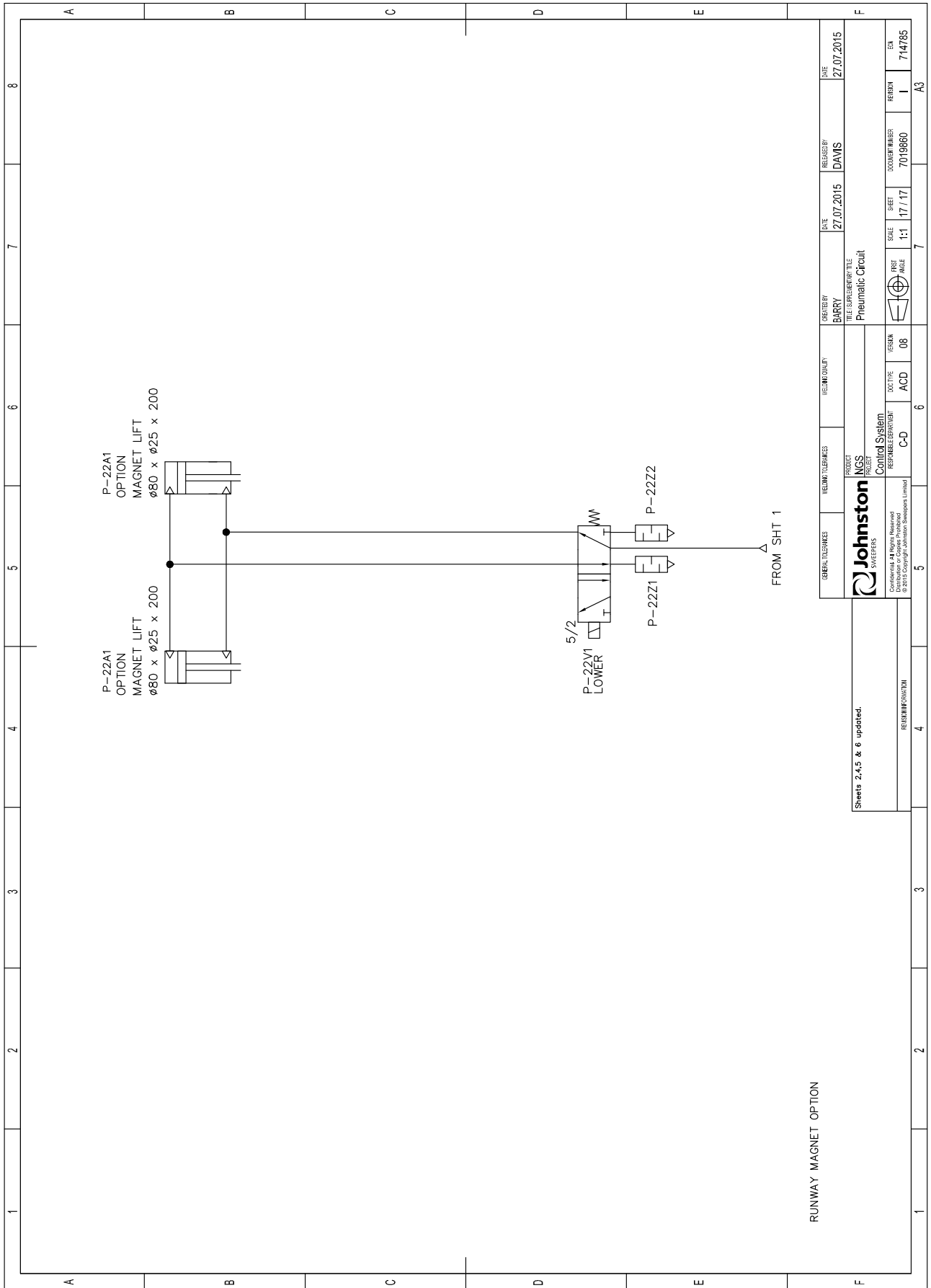


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Runway Magnet Option - Sheet 17/17 Rev I

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RUNWAY MAGNET OPTION

GENERAL NOTES	REVISIONS	REVISION	DATE	BY	DATE	BY	DATE	BY	
<b>Johnston</b> SWEEPERS Confidential All Rights Reserved Distribution or Copying Prohibited © 2015 Johnston Sweepers Limited		PROJECT MGS Control System REPAIRS/EXTRACTION	TITLE SUPPLEMENTARY TITLE Pneumatic Circuit	DESIGNED BY BARRY	DATE 17.07.2015	REVISION BY DAVIS	DATE 27.07.2015	SHEET 17 / 17	SCALE 1:1
Sheets 2,4,5 & 6 updated. REVISION POSITION		DOC NO ACC 08	PART NO 7019860	DRAWN I	CHECKED I	DATE 7/14/15	ENA 714785	A3	



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**CHAPTER****6****Wearing Items****Table of Contents**

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## WEARING PARTS - REPLACEMENT INSTRUCTIONS

It is important that the following safety precautions are observed when working on the machines.



### Safety Precautions



- Ensure the machine is standing on firm, level ground and there are no obstructions above or to the rear before raising the body.
- Ensure the safety prop is engaged at all times when working under the body.
- Ensure operators are fully conversant with the controls and operation.
- Isolate the air in the systems locker before working on any pneumatically operated or controlled equipment.
- Disconnect or isolate the vehicle battery when working on the electrical system.
- Do not approach the fan inlet while the fan is running.
- Do not grasp any part of the engine or exhaust system without first ascertaining whether it has cooled sufficiently to avoid scalding.
- Be aware of the safety instructions relative to the suction fan given in the equipment maintenance notes.
- Keep hands, loose clothing, hair etc. well clear of moving parts.
- Do not climb on the engine walkways unnecessarily or approach the fan inlet whilst the engine is running.
- Do not use ill-fitting tools such as spanners that may slip and cause injury.
- Always get a second person to check periodically that all is well when only one person is working on the machine or inside the body.

### Fan Impeller

#### Inspection

Remove the plate (A) to allow access to the impeller for inspection. This should be inspected on a regular basis as outlined in the routine maintenance. The impeller should be replaced as soon as the blade thickness is less than 2mm or the blades have visible signs of wear/damage.

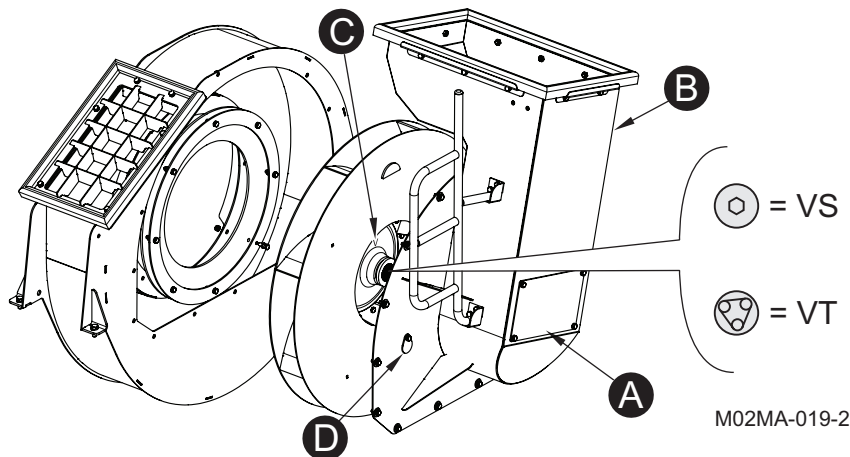
#### Removal

Raise the body and ensure the body prop is engaged in the rack.

Remove the fancase cover (B).

Before removing the fan impeller check for any lateral movement in a similar fashion to checking a wheel bearing. An excess of 2mm play would indicate wear in the gearbox bearing and would require overhaul/replacement.

Remove the 3 bolts securing the centre of the fan on the VT, or one M12 setscrew/capscrew on the VS. The fan should slide off the spline - a bearing puller can be used if required.



**Refitting**

Replacement is reverse procedure, taking note of the following.

Lightly grease the fan drive spline, using Kluber paste before refitting the impeller.

**VT Range:** If setscrews are fitted replace with Tuflock Capscrews and torque up the three impeller securing bolts to 80 Nm.

**VS Range:** If a setscrew is fitted replace with a Tuflock Capscrew and torque up to 101Nm.

From July 2009 all impellers have a "V" mark (C) at Top Dead Centre (TDC) applied when they are manufactured. When fitting a replacement impeller it should be rotated so this mark is at the 12 o'clock (TDC) position before fitting the impeller to the shaft. Once fitted ensure the retaining bolts/bolt are tightened to the prescribed torque.

**IMPORTANT**

- When replacing a fan impeller, always fit new securing screws. Never re-use existing hardware.
- Never use a second-hand or a non-Johnston fan.
- The fan impeller is supplied complete with the hub.  
Do not remove the hub or replace it, as the balancing will be adversely affected.
- Strictly adhere to the regular checking routines as outlined in the Johnston Operator's Guide.

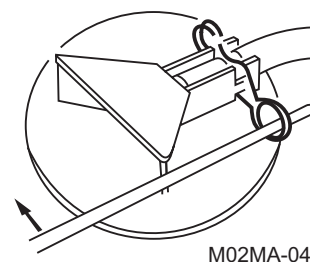
Refit fan case cover (B) using sealant part number 94-1, to the mating face having first removed the old sealant. Push the fan assembly towards the drive motor and then pull towards you. If there is excessive play the bearings will require replacement.

Refit the fan inspection plate (A) using sealant as for item 1.

An inspection cover (D) is provided to measure the fan speed by optical tachometer if required.

**Intake Duct Flap**

When the flap plate is in the open position, it is abraded by the material discharging from the intake duct into the body. The flap should be inspected periodically and replaced when worn. To inspect one must first open the rear door and suitably prop open, then depressurise the air system in the systems locker, this will allow the flap to be opened and closed manually from the interior of the body. Enter body and inspect the flap valve plate which is secured to actuating fingers by a pair of spring clips.

**Removal**

To remove a flap plate the springs must be withdrawn using a suitable tool or bar. Notice how the springs were fitted from each side of the finger guide and around the groove in the finger assembly. Once the springs are removed the flap plate can be detached from the finger.

**Refitting**

Before refitting or fitting a new flap plate, ensure the springs are in good condition and the finger adjustment areas have been cleaned, then locate flap on the finger and replace springs. Ensure the flap plate seats correctly on top of the inlet tube, if not, check for excessive wear on the inlet tube/flap, or adjustment of the flap operating mechanism.

**Wear Plate****Removal**

Enter the body after carrying out precautions as for intake duct flap.

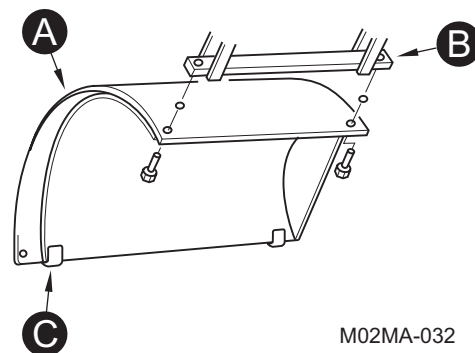
The wear plate (A) is secured by two screws and a clamp bar (B).

Before attempting to remove these screws, secure the plate using a suitable prop.

Once the screws are removed, support the wear plate and remove the prop.

Allow the wear plate to fall slightly and lift out from the hooks (C) and remove.

**Note:** Assistance may be required in removal as this unit weighs approximately 20kg.



## Intake Duct

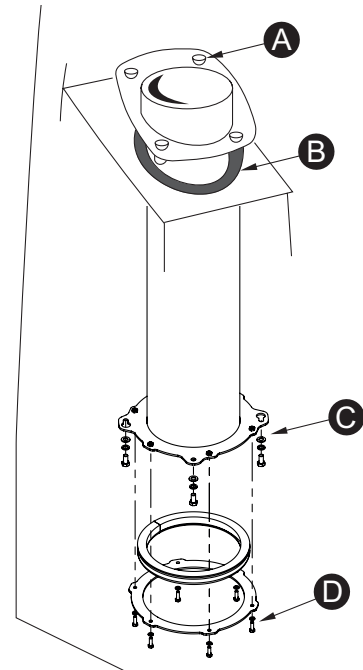
These parts are also abraded by the material being conveyed from the suction nozzle and must be periodically inspected and replaced when worn or holed. The duct is 250mm diameter.

### Removal

Enter body after carrying out the same precautions as for intake flap replacement. Remove the four screws securing the collar around the intake duct (A). Lift up the flap manually (if fitted) and remove collar. A rubber cord (B) will now be visible which should also be removed with care to prevent damage. Dismount from body. Tip body and support on prop. Remove the six screws (D) securing the make/break rubber seal retention flange. (This seal assembly can be kept intact for re-fitment to the replacement intake duct unless deemed requiring replacement too.) Release two of the screws (C) in the key-holed intake duct flange and remove the other two. Twist the intake duct so the two released screws pass through the larger part of the keyhole and remove the duct.

### Refitting

Reverse of removal procedure. Align slots in the intake duct flange with the released screws and twist. Fit the other two bolts and tighten. Re-fasten the make/break seal assembly to the intake duct flange with six screws. Replace the rubber cord and collar plate inside the body and secure by fully tightening the four duct top retaining bolts.



M02MA-022

## Intake Trunking

### Removal

Lower suction nozzle to the ground, release worm drive clips at either end and remove flexible trunking. The nozzle trunking has an inside diameter of 250mm.

### Refitting

Loosely fit worm drive clips to either end of trunking. Engage trunking onto the nozzle with a 55mm (2") overlap and tighten clip. Fit other end to the intake seat and secure. Check trunking is not twisted or rucked and does not foul anything when the nozzle is raised or lowered again.

## Intake Seat

### Removal

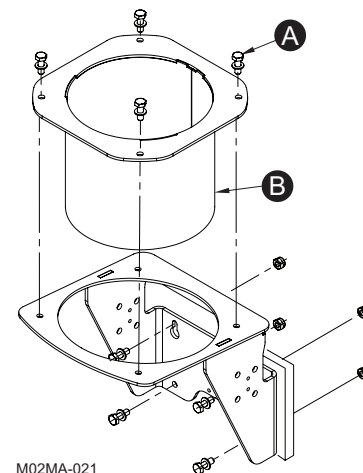
Raise the body and ensure the body prop is engaged in the rack.

Release trunking from tube as described on previous page.

Remove the four bolts (A). Lift seat (B) clear of bracket.

### Refitting

Reverse of removal procedure. As no adjustment for seal compression is provided, it is wise to check seal compression when the body is lowered.



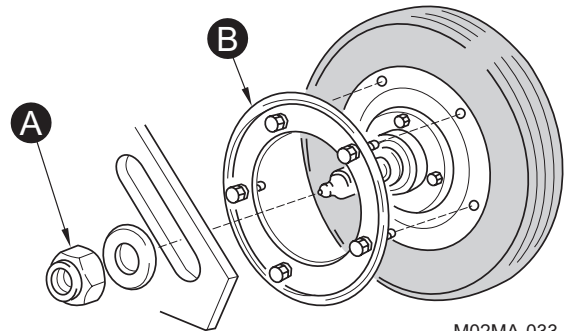
M02MA-021

**Nozzle Wheel****Removal**

Release nozzle wheel adjustment nut (A) on inner end of wheel spindle. Remove wheel complete.

**Refitting**

Reverse of removal procedure.



M02MA-033

**Tyre - Suction Nozzle Wheel****Removal**

Remove nozzle wheel as above. Remove five screws securing tyre plate (B) and prise off. Remove tyre from hub.

**Refitting**

Reverse of removal procedure.

**Note :** Ensure correct re-setting of nozzle rubbers in relation to the ground.

**Nozzle Wheel Bearings****Removal**

To withdraw bearing remove wheel assembly from carriage and remove the three setscrews from the retaining plate. Refit washer and nut, insert M6c x 50mm setscrews in the three unused tapped holes. Tighten each bolt half a turn at a time to extract the bearing. Remove drift bearing from shaft.

**Refitting**



Reverse of removal procedures.

**Suction Nozzle Rubbers****Removal**

This can be effected without removing the nozzle assembly from the machine but if personnel are inexperienced it will probably be easier to remove nozzle assembly and turn upside down. Release two screws retaining bump bar at kerb end of nozzle. Release securing nuts retaining the rubbers. Pull away the two short end rubbers, then remove the front and rear side rubbers.

**Refitting**

Reverse of removal procedure remembering to fit the radius rubber to the nozzle rear. Do not over tighten the nuts as this will cause distortion of the rubber. Refit bump bar.

**Channel Brush**

**Safety Notice**


Caution Sharp Objects

**Removal**

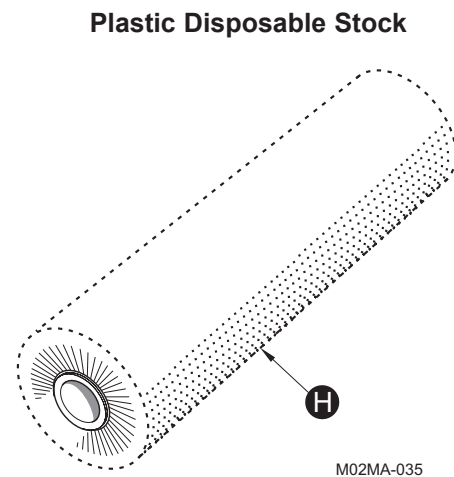
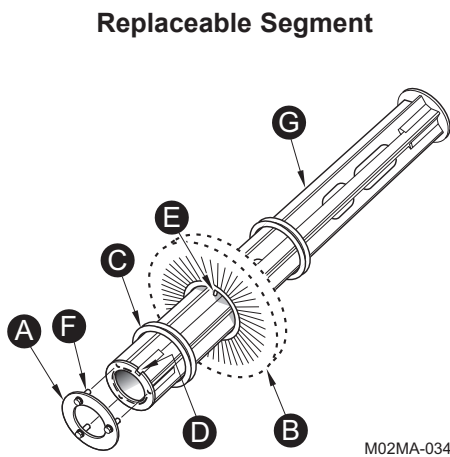
It is preferable to have brush in working position with auxiliary engine stopped. Loosen nuts securing brush stock assembly drive plate. Remove via key hole slot.

**Refitting**

Reverse of removal procedure. Any loops of steel tines which project above the head of the stock should be hammered flush before offering up brush stock assembly to driving plate.

**Wide Sweep Brush**
**Wide Sweep Core Assembly - Brush Fills**

There are two types of brush fills:


**Removal**

Release and remove the retaining screws (F) securing the end plate / adaptor (A). Slide off the segments (B) and spacers (C) from the central core, or single Plastic Disposable Stock (H). **Note** : On earlier machines the driving pin (E) on the inner diameter of the segments must be aligned with a slot (D) on the core (G) where the two parts join.

**Refitting**

First slide on a segment then alternately a spacer and a segment. Sufficient spacers and segments must be fitted to allow the end plate to nearly abut with the core and also clamp them tightly. The peg (E) on the segment (B) to be alternatively located round the core clock face at 12, 2, 4 o'clock and so on until the core is filled, failure to observe this could cause the brush to bounce. The last segment must have the pin (E) on the segment (B) located in the cutout (D) to ensure the peg does not interfere when the parts are bolted together.

**Note** : Lightly smear the retaining screws (F) with grease.

This assembly is designed to accommodate 406mm diameter segments.

**Note** : The Plastic Disposable stock can be recycled.

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## CHAPTER

## 7

**Remove and Refit Procedures****Table of Contents**

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## REMOVAL AND REFITTING INSTRUCTIONS

This section describes the removal and refitting of some of the major components on the machine. These are not routine jobs and should normally only need to be undertaken when overhauling or exchanging these units.



### Safety Precautions



The hinged prop stowed beneath the body **SHOULD BE USED AT ALL TIMES** to prop the body when carrying out any inspection, servicing or maintenance work beneath the body.

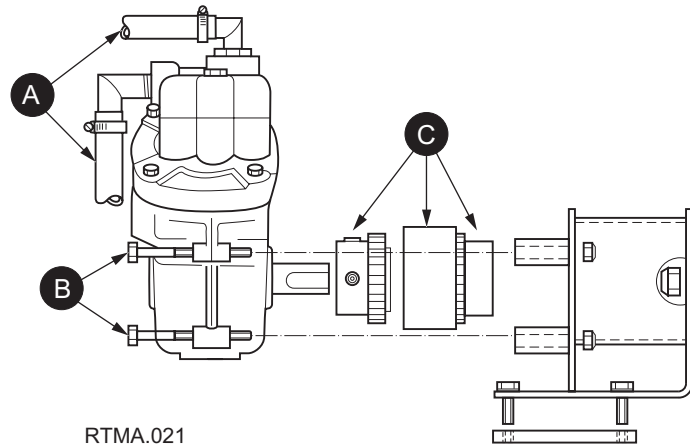
Disconnect the battery negative lead before undertaking any of the following operations on the auxiliary pack.

Isolate the air system at the filter regulator unit when working on the pneumatic system.

## 1 Water Pump - Dust Suppression

### Removal and Refitting

- 1 Isolate the water supply at the filter unit.
- 2 Disconnect the feed and pressure water pipes (**A**) to the pump.
- 3 Remove the 4 bolts (**B**) holding the water pump to the drive motor.
- 4 Withdraw the pump assembly from the drive coupling (**C**).
- 5 Refitting is the reverse procedure, ensure that the pump drive gear does not bottom in the drive coupling.



**Note:** It is possible to replace the pump diaphragms and valves with the pump in situ.

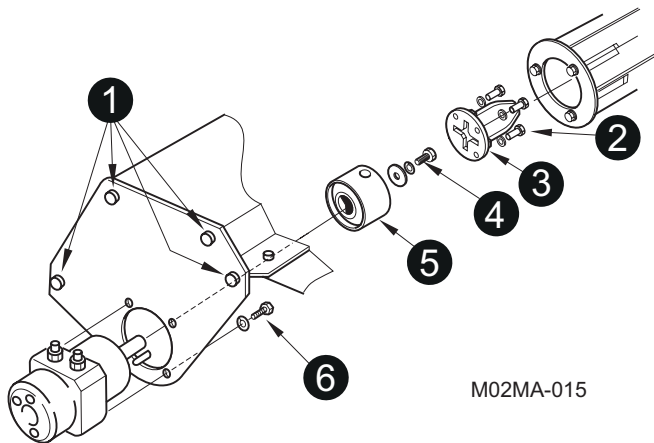
**Wide Sweep Brush Motor**

**Removal**

1. Remove the brush stock as described in Chapter 6.
2. Unscrew the four end plate securing setscrews and remove plate complete with motor assembly and drive shaft or drive dog.

**Refitting**

3. Refitting is the reverse of removal.



- 1 End plate securing screws.
- 2 Drive shaft retaining screws.
- 3 Drive shaft/drive dog.
- 4 Drive adaptor retaining screw.
- 5 Drive adaptor
- 6 Motor securing screws

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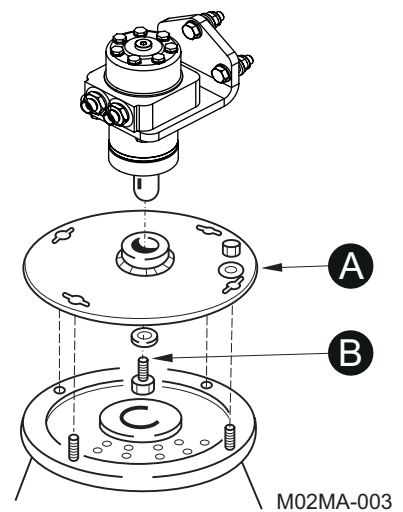
**Channel Brush Motor**

**Removal**

1. Unscrew the four nuts (A) from the coach bolts securing the channel brush to the drive adaptor plate and remove brush.
2. Unscrew the retention screw (B) from the centre of the drive adaptor plate and remove plate.
3. Disconnect the two hydraulic hoses from the motor.
4. Unscrew the two bolts securing the motor to mounting bracket and lift off motor.

**Refitting**

5. Refitting is the reverse of removal.

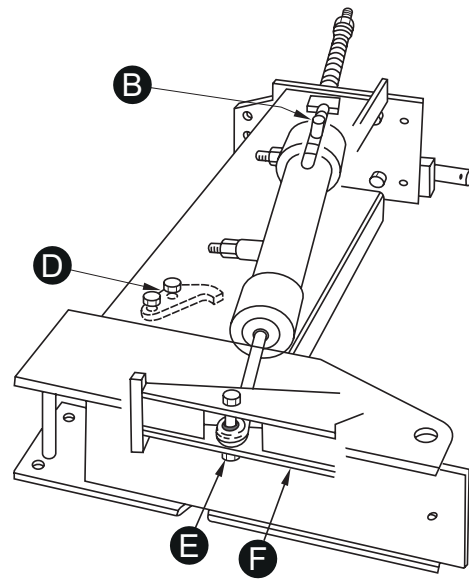


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**Channel Brush Cylinder****Removal and refitting**

1. Disconnect the two hydraulic hoses from rear of the cylinder.
2. Remove cylinder pin (**B**).
3. Remove stop from pivot frame (**D**).
4. Remove cylinder eye pivot (**E**) from pivot head lever (**F**). Lift out cylinder.
5. Refitting is the reverse of removal, grease items (**B**) and (**E**) prior to refitting.



M02MA-037

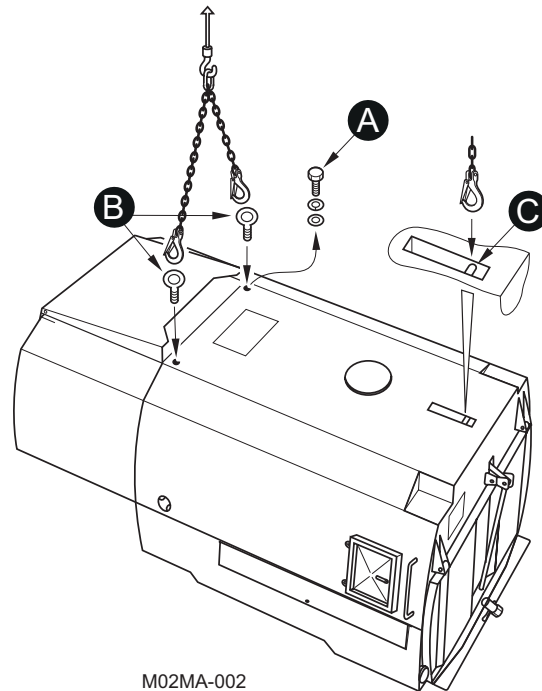
**Body Lifting or Removal****Raising the body.**

If it is necessary to raise the body, and neither the standard or the emergency methods can be used, then two holes are provided in the front of the body.

1. Remove blanking bolts (**A**).
2. Insert suitable eye bolts item (**B**) into the M16 socket.

**Removing the body.**

If it is necessary to remove the body use the two lifting eyes (**B**) together with a suitable chain at point (**C**). Care should be taken to ensure that the weight is evenly distributed so that the body lifts squarely



M02MA-002

## Hydrostatic Gearbox and Pumps



### Safety Notice



- If the gearbox is to be removed, the truck will be immobile. The ignition keys should be removed to prevent inadvertent starting and consequential damage to the drive line and components.
- Care should be taken before loosening the cap of the return filter, as the oil may be under pressure if the vehicle has just stopped, loosen the cap slowly.

## VS - Single Engine

Individual pumps may be removed in situ if required.

On the rear of the transmission pump is a single gear pump to power the sweeping equipment. This is replaced by a tandem pump when optional equipment such as Supawash is fitted.

The fan drive pump is mounted on the opposite side of the gearbox to the transmission pump (i.e. front to rear).

The transmission drive motor is always mounted on the opposite side of the gearbox to the transmission pump.

If the removal of any pump is required, it is first necessary to minimise oil loss by loosening the cap on the hydraulic return filter.

All hoses should be plugged after the removal of any pump to prevent dirt ingress and oil loss from the hoses.

### Hydrodrive gearbox

The Hydrodrive gearbox assembly can be removed as a complete unit by using a lifting jig, Part No 93828-1.

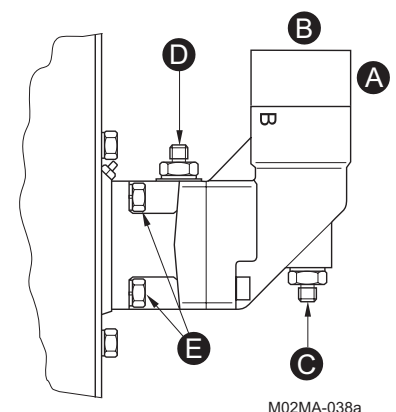
### Fan Drive Motor

#### Removal

1. Remove fan case cover and impeller as described earlier.
2. Loosen cap on hydraulic return filter.
3. Disconnect hydraulic hoses from ports **A**, **B**, **C** and **D**.
4. Remove 4 setscrews (**E**) holding motor on to the mount.
5. Withdraw motor.

#### Refitting

6. Refitting is the reverse procedure to removal. Lubricate motor drive shaft with Kluber paste 46MR401 before refitting.
7. Motor securing capscrew should be tightened to torque of 101 Nm.
8. Retighten cap on hydraulic return filter.



## VT - Twin Engine

### Radiator



#### Safety Notice



Insure the cooling system has adequately cooled before commencing

#### Removal

To remove the radiator it will first be necessary to remove the hydraulic oil cooler.

1. Drain the hydraulic oil to a level below that of the cooler using the remote drain under the systems locker.
2. Disconnect the hydraulic oil pipes from the cooler.
3. Remove the cover plate.
4. Remove the four screws retaining the oil cooler to the cooling pack case.
5. Remove the oil cooler.
6. Remove the cap from the expansion tank and drain the radiator coolant from the remote drain behind the systems locker.
7. Disconnect the water hoses from the radiator.
8. Remove the four screws retaining the radiator to the cooling pack case, and remove radiator.

#### Refitting

1. Attach the radiator to the cooling pack case with four screws.
2. Reconnect the radiator hoses.
3. Fill the cooling system via the expansion tank, first ensuring the remote coolant drain is closed. When full, replace the expansion tank cap.
4. Refit the oil cooler using the four screws, and refit the cover plate.
5. Ensure the remote hydraulic oil drain is closed and refill the hydraulic oil tank.
6. Run the engine to circulate the hydraulic oil through the system. Turn off the engine and top up the hydraulic oil to the correct level.
7. Check also the coolant level and top up if necessary.

## 7 Fan Impeller

#### Removal

1. Unscrew the fan inlet duct from the fan case to expose the fan impeller.
2. Prior to removing the fan impeller, check for excessive axial movement in a similar manner to checking an automotive wheel bearing. Any excessive play would indicate wear in the bearings/gearbox assembly requiring an overhaul.
3. Unscrew the three screws securing the fan to the gearbox shaft.
4. Withdraw the impeller from the splined shaft and fan case. A puller (part no. 437-2) is available if required. Note – the fan impeller is heavy (circa 40-50kg) and suitable lifting/handling equipment should be employed.

## 8 Fan Case

#### Removal

1. Carry out procedure 7.
2. Remove the engine exhaust silencer and tailpipe from the fan case.
3. Unscrew the four screws retaining the fan case mask to the transfer gearbox and remove.
4. Unscrew the four screws securing the fan case to the front and rear valances (two either side).
5. The fan case can now be removed. If the fuel tank prevents the fan case removal, loosen the four tank screws on its underside and slide the tank outwards.

## VT - Twin Engine

### 9 Gearbox Removal & Overhaul

#### Removal

1. Carry out procedures 7 and 8.
2. Drain fluid drive coupling as described in Chapter 7.
3. Remove the six setscrews securing the gearbox to the bell housing and the four bolts holding the two cover plates to the flywheel housing.
4. Withdraw the gearbox, supporting its weight so as not to damage the input shaft fluid drive coupling.

#### Repair / Overhaul

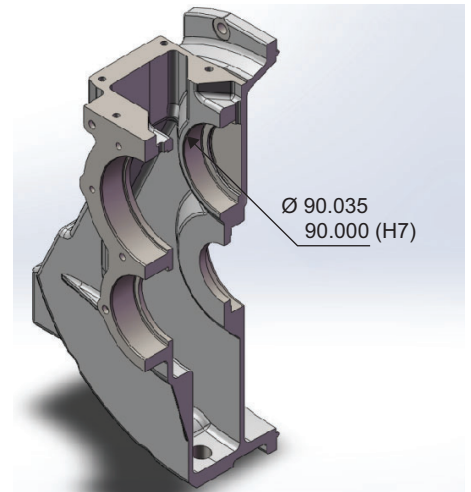
If it is proposed to carry out a repair or overhaul of the gearbox then it is important to check the following dimensions in respect to the bore supporting the output shaft.

In all cases maintenance of this gearbox should only be carried out by experienced and qualified personnel.

The integrity of the gearbox is reliant on the condition of the upper rear bearing housing. This bore needs to be checked and confirmed to be within the specified tolerances.

#### Note:

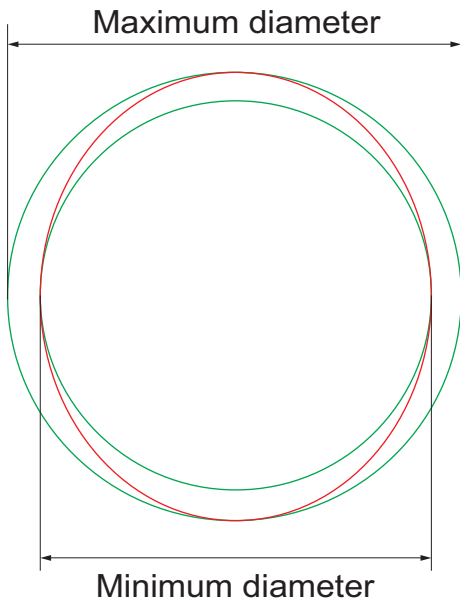
If the bore falls outside the tolerance of  $\text{Ø}90.000 - 90.035\text{mm}$  we recommend that the Gearbox is replaced.



M02MA-044

## VT - Twin Engine

### Checking the condition of the gearbox casing



M02MA-041

To determine whether or not a gearbox casing is serviceable the most important aspect to check is that the rear upper bearing bore is within tolerance. It should be remembered that the bore need not necessarily be round, but oval, triangulated, square, threepenny-bitted or any other shape. Experience has shown that the bores tend to wear oval

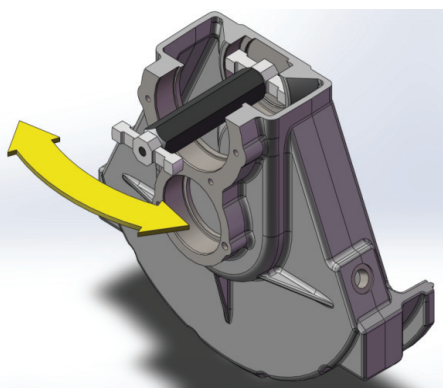
It is important to check the bore by measuring at a number of positions down the bore & in a number of positions at each height, not just two positions at right angles to each other



M02MA-042

There are different kinds of gauges for measuring the inside cylinder or bore. A bore gauge is a popular choice or a telescopic gauge used in conjunction with an outside micrometer, both of these however require a degree of familiarity or experience to obtain consistent results. A more suitable tool for this application is a 'segmental plug gauge' (Johnston Part No. 437-321)

**Note:** This measuring tool requires periodic calibration and should be included in your normal processes for the control of measuring tools



M02MA-043

The design of this particular type of plug gauge enables the indication of taper, barrelling & out of round conditions within upper & lower limits to be determined. This is achieved by rocking the gauge in the bore being inspected, as described above.

Provided all the measurements taken lie between the upper 'maximum' & the lower 'minimum' bore diameter then the bore is deemed to be within tolerance no matter what it's perceived shape.

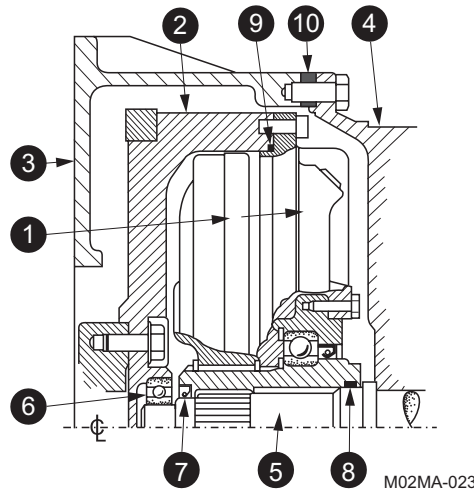


## VT - Twin Engine

### FLUID DRIVE COUPLING

#### Removal

1. Carry out procedures for Fan Impeller, Fancase and Gearbox removal
2. Remove the twenty socket head screws securing the coupling to the flywheel.
3. Insert M8 setscrews in the two blind extractor holes and tighten each half a turn at a time to ease the coupling from the flywheel.



#### Sectioned view of Fluid Drive Coupling and Flywheel

- |    |                          |
|----|--------------------------|
| 1  | Fluid coupling.          |
| 2  | Flywheel.                |
| 3  | Bell housing.            |
| 4  | Gearbox.                 |
| 5  | Gearbox input shaft.     |
| 6  | Gearbox support bearing. |
| 7  | Oil seal.                |
| 8  | 'O' ring.                |
| 9  | 'O' ring.                |
| 10 | Adaptor ring.            |

#### Refitting

1. Before fitting coupling, renew oil seal and 'O' rings (Items 8, 9 and 10, Figure 2).
2. Generously grease both 'O' rings and internal splines with Kluber Paste 46MR401.
3. Offer fluid drive to the flywheel ensuring bolt holes are in line. Push assembly together by hand, making sure not to trap and damage the large 'O' ring.
4. Refit fluid coupling securing screws.

#### Note

- For JCB engine, torque the 20 x M8 screws to 26Nm.  
For John Deere engine, torque the 20 x M6 screws to 19Nm.

### GEARBOX

#### Refitting

1. Lightly grease splines on the input shaft with Kluber Paste 46MR401.
2. Locate the adaptor ring with its holes aligned with those on the flywheel housing.
3. Ease the gearbox onto the engine bell housing whilst rotating the output shaft. Use the securing setscrews to finally pull the gearbox up to the housing.
4. Ensure the output shaft rotates freely after assembly.
5. Refit the two side cover plates.
6. At this point it is advisable to refill the fluid coupling and gearbox as described in Chapter 1 of this manual.

### FANCASE

#### Refitting

1. Refitting is the reverse to that described in Section C.
2. When re-assembling the fan mask to the gearbox ensure it abuts to the rubber diaphragm ring. Apply stud lock to its retaining screws before fitting.

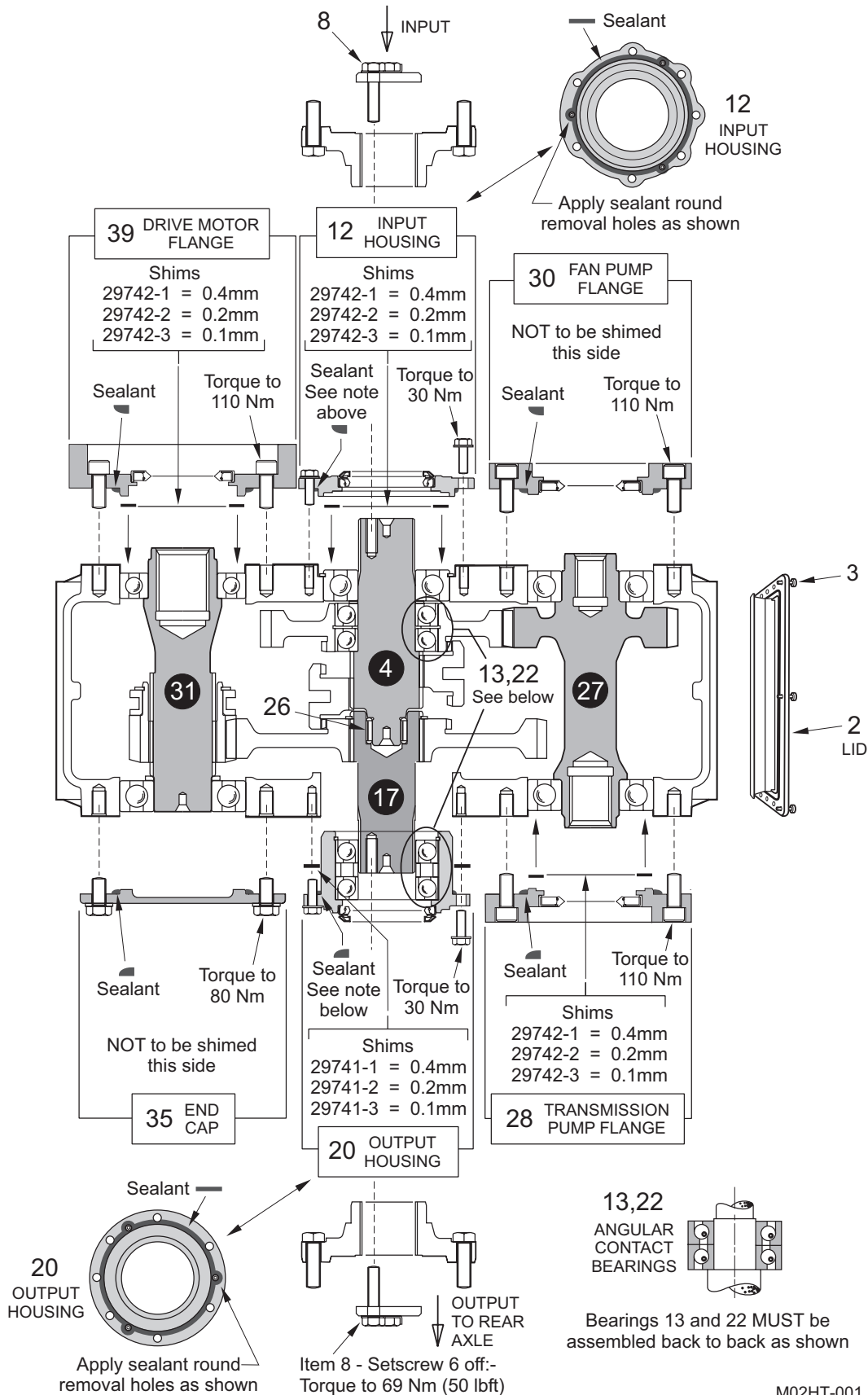
### FAN IMPELLER AND FANCASE COVER

#### Refitting

1. Reverse to that described in Section B. (See also Chapter 6)
2. Ensure the 'V' mark on the fan impeller is placed TDC.
3. The three screws securing the fan to the gearbox shaft to be torqued.  
Refer to Chapter 6 for torque values.

**VS - Single Engine**

**HYDROSTATIC GEARBOX ASSEMBLY HGB-1  
(Formally identified as MKIII)**



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**VS - Single Engine**

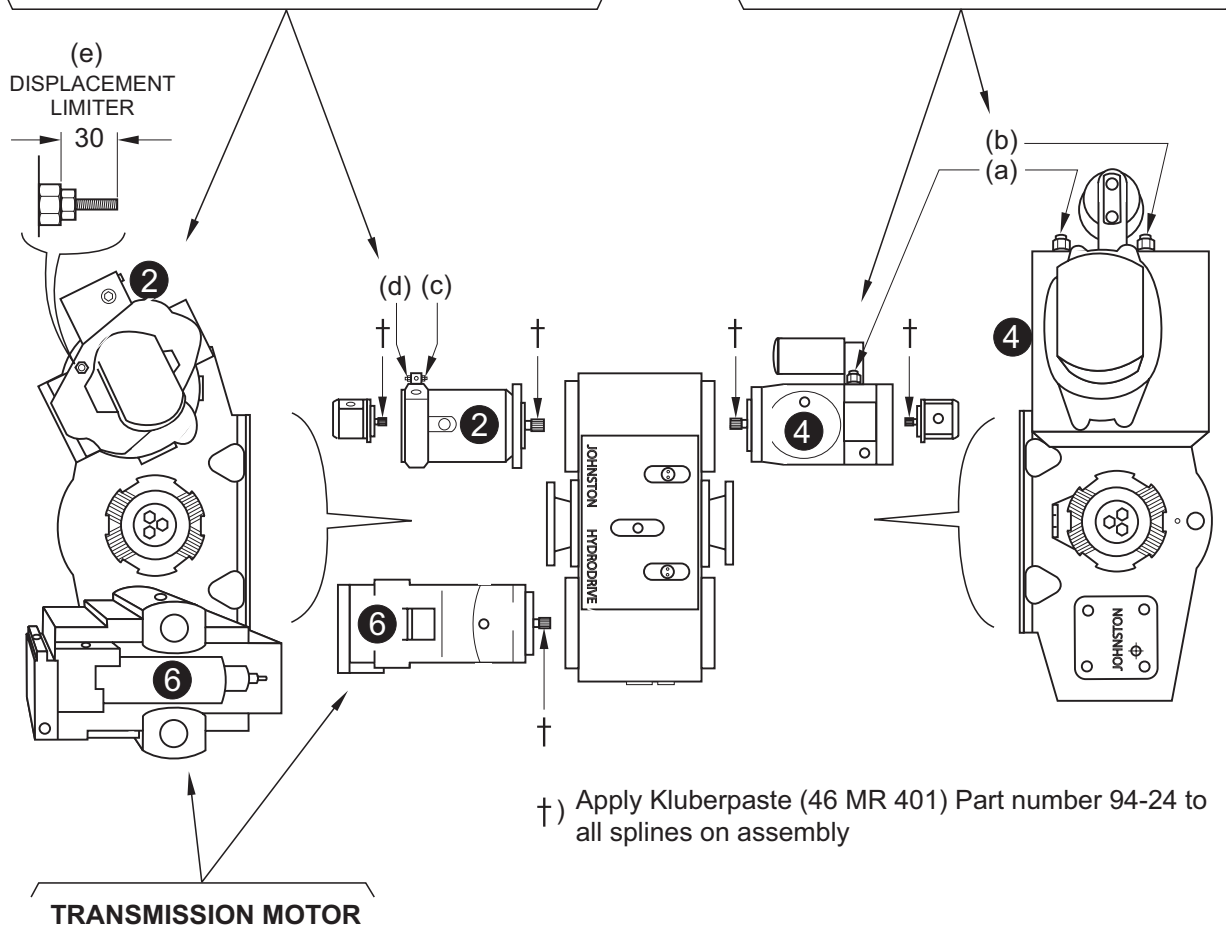
**MK III GEARBOX ASSEMBLY - SETTINGS AND ASSEMBLY DETAILS**

**2. FANDRIVE PUMP:-**

- c) "Standby" differential pressure setting
- d) Main relief valve maximum pressure setting
- e) Set displacement limiter dimension to 30mm

**4. TRANSMISSION PUMP:-**

- Charge Pump pre-set to **24 Bar**
- a) Forward drive relief setting **420 Bar**
- b) Reverse drive relief setting **350 Bar**



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- Test assembly for leaks
- Test 'free movement' of sliding gears at 1.0 bar maximum air pressure
- Test switches for on/off operation/engagement

M02HT-002a



## CHAPTER

## 8

## Fault Diagnosis

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## POWER SYSTEMS

### Hydraulic Systems

#### Fault Symptom

Hydraulic oil frothing

#### Possible Cause

1. Air getting into system. Check LP pipe to pump.
2. Defective pump shaft seal.
3. Return pipe separated from underside of return filter inside hydraulic tank.

Sluggish hydraulics

1. Cartridge valve not travelling full extent - measure oil flow.
2. Blocked filters.
3. Air in oil.

### Pneumatic Systems

#### Fault Symptom

Air leak from solenoid block

#### Possible Cause

1. Cylinder seals leaking internally.
2. Air solenoid faulty.

### Water Systems

#### Fault Symptom

Jet continuously leaking

#### Possible Cause

1. Grit under armature seating.
2. Armature stuck open.

No water to wash down hose or jets

1. Water pump filter blocked.
2. Water tank filter blocked.
3. Drain tap on filter open.
4. Filter isolation valve closed.
5. Filter assembled incorrectly.
6. Pump valves fitted incorrectly after overhaul.

Lack of pressure

1. Grit under relief valve seating.
2. Relief valve spring broken.
3. Relief valve stuck open.
4. Relief valve worn.

### Audible Warning

#### Fault Symptom

Audible warning on continuously

#### Possible Cause

1. Air pressure switch faulty.
2. Insufficient pressure in Johnston system.
3. Low Hydraulic oil level.
4. Body raised.
5. Rear door open.

**Electrical System****Fault Symptom****Possible Cause**

Beacon not working	<ol style="list-style-type: none"> <li>1. Check vehicle ignition is on</li> <li>2. Check beacon bulb/motor</li> <li>3. Check feed to beacon</li> <li>4. Check earth wire</li> <li>5. Check fuse No. 1 for front. Fuse 2 for rear</li> <li>6. Check switches</li> </ol>
Work lights not working	<ol style="list-style-type: none"> <li>1. Check vehicle ignition is on, master switch V is illuminated</li> <li>2. Check bulb</li> <li>3. Check feed to light</li> <li>4. Check earth wire</li> <li>5. Check fuse No. 1</li> <li>6. Check switch</li> </ol>
Flap (duals) fail to operate	<ol style="list-style-type: none"> <li>1. Check feed to solenoid/Plug LED's V11 or V12</li> <li>2. Check solenoid</li> <li>3. Check earth wires</li> <li>4. Check fuse No. 4</li> <li>5. Check switch</li> </ol>
Nozzle fails to lower	<ol style="list-style-type: none"> <li>1. Check feed to solenoid/Plug LED V2 or V10</li> <li>2. Check solenoid</li> <li>3. Check earth wires</li> <li>4. Check fuse No. 4</li> <li>5. Check switch</li> </ol>
Channel brush fails to lower	<ol style="list-style-type: none"> <li>1. Check feed to solenoid/Plug LED V4 or V10</li> <li>2. Check solenoid</li> <li>3. Check earth wires</li> <li>4. Check fuse No. 4</li> <li>5. Check switch</li> </ol>
Channel brush fails to rotate	<ol style="list-style-type: none"> <li>1. Check feed to solenoids/Plug LED (see Modus Operandi)</li> <li>2. Check solenoid</li> <li>3. Check earth wire</li> <li>4. Check fuse No. 4</li> <li>5. Check switch</li> </ol>
Channel brush water fails to operate	<ol style="list-style-type: none"> <li>1. Check feed to solenoid/Plug LED's W03/W08</li> <li>2. Check solenoid for operation/obstruction</li> <li>3. Check earth wire</li> <li>4. Check fuse No. 4</li> <li>5. Check Wide Sweep Brush hydraulic</li> </ol>
Wide sweep fails to lower	<ol style="list-style-type: none"> <li>1. Check feed to solenoids/Plug LED's V4</li> <li>2. Check solenoid</li> <li>3. Check earth wire</li> <li>4. Check fuse No. 5</li> <li>5. Check switch</li> </ol>
Wide sweep fails to rotate	<ol style="list-style-type: none"> <li>1. Check feed to solenoid/Plug LED</li> <li>2. Check coil for operation</li> <li>3. Check earth wire</li> <li>4. Check fuse No. 5</li> <li>5. Check switch</li> </ol>
Wide sweep water fails to operate	<ol style="list-style-type: none"> <li>1. Check feed to solenoid/Plug LED W01</li> <li>2. Check solenoid for operation/obstruction</li> <li>3. Check earth wire</li> <li>4. Check fuse No. 5</li> <li>5. Check switch</li> </ol>

**SUCTION SYSTEMS****Fault Symptom****No pickup performance****Possible Cause**

1. Hopper full, causing airflow to be throttled: - Discharge load.
2. Nozzle or nozzle trunking blocked or restricted by debris.  
Check the nozzle water jets are not blocked, are working correctly and lubricating the intake duct.
3. Intake flap not open (dual m/c's). Blanking plate not removed after using the Wanderhose (single m/c).

**Poor pickup performance**

1. Nozzle not set to the optimum opening., i.e. too close to ground.
2. Nozzle trunking partially restricted by debris. Check nozzle water jets are working correctly and so lubricating the duct.
3. Channel brush incorrectly set, not directing debris in line with nozzle.
4. Intake flap not fully opened (dual m/c's).
5. Rear body meshes blocked or restricted.
6. Low oil level in fluid flywheel.
7. Air silencer pack in roof of cowl blocked with debris and/ or sound absorbent material separating from its substrate causing a restriction.
8. Fan case inlet make and break seal fitted to inlet of fan case either degraded and not sealing or missing.  
**Note:** The fan case outlet seal, unlike the inlet seal, has no effect on air performance and only provides the function of a dust seal.
9. Engine is not running at correct operational speeds. Check fuel filter or air filter blocked/ causing a restriction.



## VT - Twin Engine

### POWER PACK

#### Auxiliary Engine

##### Fault Symptom

##### Possible Cause

Engine fails to turn over

1. Check truck ignition is on.
2. Check battery and connections.
3. Check ignition switch.
4. Check starter motor.

Engine turns over but will not start

1. Check fuel tank.
2. Check electric feed to engine injector shut off fuse 8.
3. Check injector shut off valve.
4. Check fuel lines for loose connections.
5. Check oil pressure sender and connections.
6. Check water temperature sender.
7. Bleed fuel system.

Engine runs but stops after 8 seconds

1. Check engine oil pressure is above 0.5 bar.
2. Oil pressure switch faulty.

RPM will not increase

1. Check throttle cable is not broken/jammed.
2. Check feed to actuator.
3. Check fuse 8.
4. Check switch.

#### Auxiliary Engine Electrics and Shut Down System

##### Fault Symptoms

##### Possible Cause

Oil pressure warning light not illuminated when ignition on engine stopped

1. Check fuse No. 9.
2. Check feed to oil pressure switch.
3. Check earth wire.
4. Check bulb.

Water temperature warning light illuminated

1. Unit overheated.
2. Low coolant level.
3. Blocked radiator.
4. Check temperature sender if engine fails to shut down.

Esos Electric Failure

1. Check fuse No. 8.
2. Check oil pressure switch.
3. Check water temperature switch.
4. Check feeds to ESOS.
5. Check ESOS valve.

## **SWEEP GEAR**

### **Wide Sweep Brush**

#### **Fault Symptom**

Not rotating

#### **Possible Cause**

1. Worn drive adaptor and plate.
2. Bearings seized.
3. Motor seized.
4. Foreign matter jammed in brush.
5. Check electrical feed to solenoid/Plug LED (see Modus Operandi).
6. Check hydraulic pressure to aid fault diagnosis.

Rotating slowly

1. Motor worn.
2. Hydraulic pump worn.
3. Brush end bearing seized.

Bouncing

1. Spring regulation adjustment incorrect.
2. Brush stock bent.
3. Linkage pins/brackets worn/damaged.
4. Air damping system not working.

Not dropping

1. Check feed to solenoid/Plug LED V4.
2. Solenoid faulty.
3. Switch on control box faulty.
4. Linkage/pivots/cylinders seized.

Lifts intermittently

1. Faulty or loose electrical connections.

Air leaking from wide sweep brush

1. Shuttle valve or regulator defective.
2. Lift ram seals worn.

Brush not slewing

1. Check slew cylinder for damage/Corrosion.
2. Check segment 5 of pneumatic valve block.

**Channel Brush****Fault Symptom**

Rotating slowly

**Possible Cause**

1. Motor worn.
2. Hydraulic pump worn.
4. Channel brush worn.
3. Check hydraulic pressure to aid fault diagnosis.

Works intermittently

1. Check switch in Control Panel and looms for loose connections.

Brush fails to lift

1. Check for electrical power at solenoid/Plug LED V5 or V6 if a dual.
2. Check pneumatic solenoid for correct operation.
3. Seals in cylinder leaking.

**Maxigap Nozzle****Fault Symptom**

Maxigap will not tilt

**Possible Cause**

1. Check feed to pneumatic solenoid/Plug LED V1 or V9 if a dual.
2. Pneumatic solenoid valve faulty.
3. Cylinder pivot/linkage seized.

## DISCHARGE

### Body Tip

#### Fault Symptom

Rear door will not open

#### Possible Cause

1. Check handbrake is on.
2. Check master switch V is illuminated.
3. Check green safety run button is pressed on pedant unit.
4. Check pendant unit has not become unplugged.

Body will not tip

1. Ensure handbrake is on.
2. Ensure master switch V is on (illuminated).
3. Check feed to solenoids/Plug LED.
4. Check green safety run button is pressed on pedant unit.
5. Check pendant unit has not become unplugged.

**VS - Single Engine****HYDRODRIVE GEARBOX SYSTEM****Fault Symptom**

No forward/reverse drive

**Possible Cause**

1. Is the chassis in the correct gear EG 1:1.
2. On dual sweep m/c has drive for power steering changeover been correctly selected.
3. Is master switch V1 illuminated.
4. Has engine increased from tickover to 1100 rpm.
5. Check boost pressure on transmission pump is 24 bar.
6. If fan/sweep gear operates check feed at Mills plug on transmission pump. The voltage at pins A and B should be 0-2.5 volts dependant upon pedal position. If okay, refit plug ensuring it is screwed fully home. If no voltage, call for service assistance.

## JOHNSTON VISUAL MODULE (JVM)

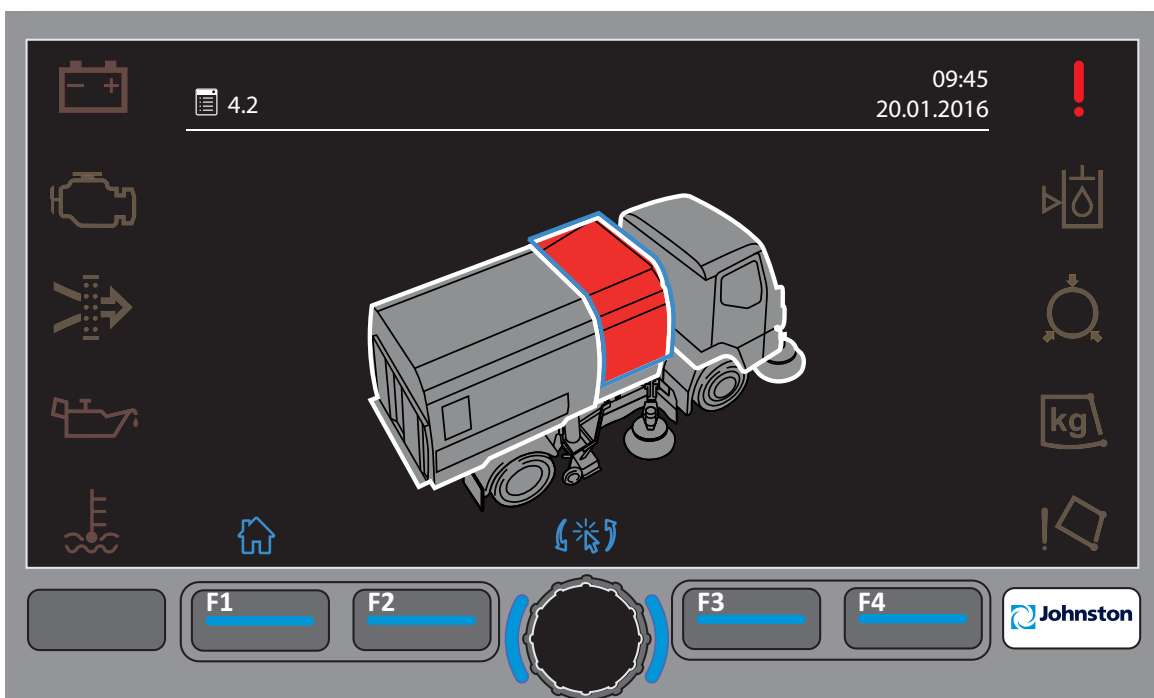
### JVM Emergency Codes

- Should a fault occur in any of the equipment operating systems the fault icon (!) is displayed over soft key **F2**.
- Selecting **F2** automatically opens Menu 4.2 (CANbus Network) which highlights the location of the affected Node.



### Menu 4.2 - CANbus Network Faults

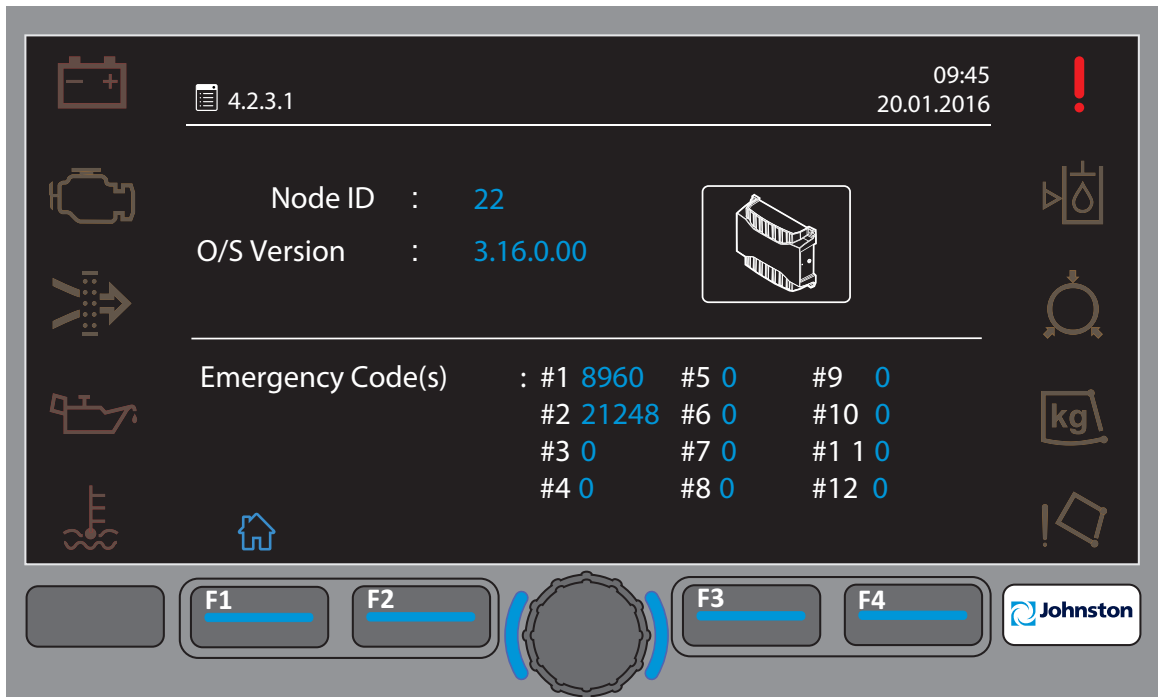
Rotate the encoder to highlight the indicated area (Powapak).  
Press the encoder to display the fault.



**Menu 4.2.3.1 - Powapak IO Node**

Should a fault occur within the CANbus network it will be accompanied by one or more emergency codes (EMCY), which will be logged in the system.

Turning the ignition off will deactivate warning lights and any active faults will be stored. These will still be visible when viewing nodes. To clear the inactive fault memory, press the encoder + F4 when viewing the node.



Node ID	Name	Location
16	System Locker	System Locker
17	Front Brush (option)	Front Brush (option)
18	Hopper	Subframe
20	JVM Display	Cab
22	Powapack (All except 85Kw JCB)	Powapack
24	85Kw JCB and Hydrostatic	Powapack
30	Pendent	Cab
40	Door Controller	Cab
41	Centre Console	Cab
99	Pneumatic Valve Island	System Locker
112	JCB Actuator	(JCB 85kW engine only)
127	Multiplex (option)	Cab

See pages 8:14 for complete list of emergency codes, code type, fault descriptions, fault area and connector.

**Truck Mounted Sweepers Emergency (EMCY) Codes**  
 Revision 04 Release Date: 10.04.2014

EMCY Code	Type	Description of Fault	System Locker Node - ID 16 Area of Fault	Powapak Node - ID 22 Area of Fault	Hydrostatic Node - ID 24 Area of Fault	Hopper Node - ID 18 Area of Fault
4097	Hydrostatic Gearbox	Low Oil Level	n/a	n/a	Low Level Gearbox Oil	n/a
8960	Digital Output 1	Over Current	WSB Motor	Engine Starter Solenoid	AntiSkid Valve	Rear Door Open
8961	Digital Output 2	Over Current	CB 1 Motor	Autolube Level Switch/ESOS Valve(85kW)	V41	Rear Door Close
8962	Digital Output 3	Over Current	CB 1 retract	Engine Heat Start	V42	Rear Door Release
8963	Digital Output 4	Over Current	CB 1 extend	Discharge Audible Warning	Discharge Audible Warning	Rear Door Lock
8964	Digital Output 5	Over Current	CB 2 motor	Water Supply Shut-off	Water Supply Shut-off	Hopper Raise
8965	Digital Output 6	Over Current	CB 2 retract	Rotatilt #1+	Rotatilt #1+	Hopper Lower
8966	Digital Output 7	Over Current	CB 2 extend	Rotatilt #1-	Rotatilt #1-	Not Used
8967	Digital Output 8	Over Current	WSB Spraybar	Rotatilt #2+	Rotatilt #2+	Cowl Worklight
8976	Digital Output 9	Over Current	CB 1 Water	Rotatilt #2-	Rotatilt #2-	Rear Beacons
8977	Digital Output 10	Over Current	Gutter Spray 1	Not Used	Used as Input	Supawash
8978	Digital Output 11	Over Current	CB 2 Water	Used as Input	Hydrostatic Reverse Output	Used as Input
8979	Digital Output 12	Over Current	Gutter Spray 2	Ignition Output Aux engine	Gearbox Sensors Output	Used as Input
8980	Digital Output 13	Over Current	Nozzle 1 Water	Combivak Nozzle #1	Not Used	Used as Input
8981	Digital Output 14	Over Current	Nozzle 2 Water	Combivak Nozzle #2	Fan Control	Used as Input
8982	Digital Output 15	Over Current	Body Discharge	Work Lamp RH	Work Lamp RH	Auto Lube Power
8983	Digital Output 16	Over Current	Additional Water	Work Lamp LH	Work Lamp LH	External Discharge Pump Run
8992	5V Reference	Over-Current	Not Used	Power for Analogue Inputs	Power for Analogue Inputs	Power for Analogue Inputs
8993	H-Bridge Output	Over-Current	Rear Warning/Work Lights	Not Used	Not Used	Powaboom Raise/Lower
8994	Safety Feed Power Input	Over-current	General Node Fault	General Node Fault	General Node Fault	General Node Fault
8995	Standard Feed Power Input	Over-current	General Node Fault	General Node Fault	General Node Fault	General Node Fault
9009	H-Bridge Output	No Load	Rear Warning/Work Lights	Not Used	Not Used	Powaboom Raise/Lower
9072	Analogue Output	Over Current	WSB Balance Regulator LH	WSB Balance Regulator RH	WSB Balance Regulator RH	Not Used
9120	Digital Output 1	No Load	WSB Motor	Engine Starter Solenoid	AntiSkid Valve	Rear Door Open
9121	Digital Output 2	No Load	CB 1 Motor	Autolube Level Switch/ESOS Valve(85kW)	V41	Rear Door Close
9122	Digital Output 3	No Load	CB 1 retract	Engine Heat Start	V42	Rear Door Release
9123	Digital Output 4	No Load	CB 1 extend	Discharge Audible Warning	Discharge Audible Warning	Rear Door Lock
9124	Digital Output 5	No Load	CB 2 motor	Water Supply Shut-off	Water Supply Shut-off	Hopper Raise
9125	Digital Output 6	No Load	CB 2 retract	Rotatilt #1+	Rotatilt #1+	Hopper Lower
9126	Digital Output 7	No Load	CB 2 extend	Rotatilt #1-	Rotatilt #1-	Not Used
9127	Digital Output 8	No Load	WSB Spraybar	Rotatilt #2+	Rotatilt #2+	Cowl Worklight

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EMCY Code	Type	Description of Fault	System Locker Node - ID 16 Area of Fault	PowaPak Node - ID 22 Area of Fault	Hydrostatic Node - ID 24 Area of Fault	Hopper Node - ID 18 Area of Fault
9136	Digital Output 9	No Load	CB 1 Water	Rotatilt #2-	Rotatilt #2-	Rear Beacons
9137	Digital Output 10	No Load	Gutter Spray 1	Not Used	Used as Input	Supawash
9138	Digital Output 11	No Load	CB 2 Water	Used as Input	Hydrostatic Reverse Output	Used as Input
9139	Digital Output 12	No Load	Gutter Spray 2	Ignition Output Aux engine	Gearbox Sensors Output	Used as Input
9140	Digital Output 13	No Load	Nozzle 1 Water	Combivak Nozzle #1	Not Used	Used as Input
9141	Digital Output 14	No Load	Nozzle 2 Water	Combivak Nozzle #2	Fan Control	Used as Input
9142	Digital Output 15	No Load	Body Discharge	Work Lamp RH	Work Lamp RH	Auto Lube Power
9143	Digital Output 16	No Load	Additional Water	Work Lamp LH	Work Lamp LH	External Discharge Pump Run
12320	5V Reference	5V Rail Failure	Not Used	Power for Analogue Inputs	Power for Analogue Inputs	Power for Analogue Inputs
12323	Standard Feed Power Input	Low Battery Voltage				
12324	Standard Feed Power Input	High Battery Voltage				
16896	General	Internal Temp				
16928	Analogue Output	Power Dissipation	WSB Balance Regulator LH	WSB Balance Regulator RH	WSB Balance Regulator RH	Not Used
20481	Safety Feed Power Input	Safety Switch Failure				
20482	General	Internal Comms Failure				
20992	H-Bridge Output	Lock Out	Rear Warning/Work Lights	Not Used	Not Used	Powaboom Raise/Lower
21248	-	Lock Out	System Locker IO Node	Powapak IO Node	Hydrostatic IO Node	Hopper IO Node
21264	Digital Outputs 1-16	Lock Out	System Locker IO Node	Powapak IO Node	Hydrostatic IO Node	Hopper IO Node
21760	Analogue Output	Lock Out	WSB Balance Regulator LH	WSB Balance Regulator RH	WSB Balance Regulator RH	Not Used
32769	General	System Parameter Reset				
33025	General	PDO -1 Timeout				
33026	General	PDO -2 Timeout				
33027	General	PDO -3 Timeout				
33028	General	PDO -4 Timeout				
33057	General	CAN Failure	CAN Hi, CAN Lo wires crossed	CAN Hi, CAN Lo wires crossed	CAN Hi, CAN Lo wires crossed	CAN Hi, CAN Lo wires crossed
36864	Digital Output 1	Short to ground	WSB Motor	Engine Starter Solenoid	AntiSkid Valve	Rear Door Open
36865	Digital Output 2	Short to ground	CB 1 Motor	Autolube Level Switch(ESOS Valve)(85kW)	V41	Rear Door Close
36866	Digital Output 3	Short to ground	CB 1 retract	Engine Heat Start	V42	Rear Door Release
36867	Digital Output 4	Short to ground	CB 1 extend	Discharge Audible Warning	Discharge Audible Warning	Rear Door Lock
36868	Digital Output 5	Short to ground	CB 2 motor	Water Supply Shut-off	Water Supply Shut-off	Hopper Raise
36869	Digital Output 6	Short to ground	CB 2 retract	Rotatilt #1+	Rotatilt #1+	Hopper Lower
36870	Digital Output 7	Short to ground	CB 2 extend	Rotatilt #1-	Rotatilt #1-	Not Used
36871	Digital Output 8	Short to ground	WSB Spraybar	Rotatilt #2+	Rotatilt #2+	Cowl Worklight
36880	Digital Output 9	Short to ground	CB 1 Water	Rotatilt #2-	Rotatilt #2-	Rear Beacons

### Truck Mounted Sweepers Emergency (EMCY) Codes (continued)

Revision 04 Release Date: 10.04.2014

EMCY Code	Type	Description of Fault	System Locker Node - ID 16 Area of Fault	PowaPak Node - ID 22 Area of Fault	Hydrostatic Node - ID 24 Area of Fault	Hopper Node - ID 18 Area of Fault
36881	Digital Output 10	Short to ground	Gutter Spray 1	Not Used	Used as Input	Supawash
36882	Digital Output 11	Short to ground	CB 2 Water	Used as Input	Hydrostatic Reverse Output	Used as Input
36883	Digital Output 12	Short to ground	Gutter Spray 2	Ignition Output Aux engine	Gearbox Sensors Output	Used as Input
36884	Digital Output 13	Short to ground	Nozzle 1 Water	Combivak Nozzle #1	Not Used	Used as Input
36885	Digital Output 14	Short to ground	Nozzle 2 Water	Combivak Nozzle #2	Fan Control	Used as Input
36886	Digital Output 15	Short to ground	Body Discharge	Work Lamp RH	Work Lamp RH	Auto Lube Power
36887	Digital Output 16	Short to ground	Additional Water	Work Lamp LH	Work Lamp LH	External Discharge Pump Run
36896	Analogue Output	Short to ground	WSB Balance Regulator LH	WSB Balance Regulator RH	WSB Balance Regulator RH	Not Used
36897	H-Bridge Output	Short-Circuit	Rear Warning/Work Lights	Not Used	Not Used	Powaboom Raise/Lower

### Truck Mounted Sweepers 85kW Engine Specific

Revision 04 Release Date: 10.04.2014

Note: All of the Codes below are displayed on page 4.8

Code	Type	Description of Fault
4096	Engine Fault (85kW Engine only)	Low Oil Pressure
4097	Engine Fault (85kW Engine only)	Low Oil Level
4098	Engine Fault (85kW Engine only)	Coolant Temp High
4099	Engine Fault (85kW Engine only)	Loss of Speed Signal
4100	Engine Fault (85kW Engine only)	Water in Fuel
4101	Engine Fault (85kW Engine only)	Coolant Temp Shutdown
4102	Engine Fault (85kW Engine only)	Low Fuel Shutdown

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**CHAPTER****9****Service Tools****Table of Contents**

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## SERVICE TOOLS

The following tools are available through our Spares Network

<b>TOOL NO</b>	<b>ITEM</b>	<b>FUNCTION</b>
7028665	ESU Unpacking Control Unit 12v (501, 651 & 801)	Rear door control enables ESU's to be unpacked
7021548	ESU Unpacking Control Unit 24v (501, 651 & 801)	Rear door control enables ESU's to be unpacked
7030357	ESU Unpacking Control Unit 12v (501, 651 & 801)	Rear door and body control enables ESU's to be unpacked
7030309	ESU Unpacking Control Unit 24v (501, 651 & 801)	Rear door and body control enables ESU's to be unpacked
437-2	Bearing Puller	Removal of fan impeller bearings etc
437-3	Pressure Gauge Set	Measure hydraulic, pneumatic and water pressures
437-4	Optical Tachometer	Measure fan rpm
437-7	0-55 Litres/Min Flow Gauge	Hydraulic flows
437-311	Nylon Tube Cutter	Ø4 - Ø16mm
93828-1	Hydrodrive Gearbox-Lift Jig	Removal of hydrodrive gearbox and pump assemblies by a cradle to fit a trolley lift jack.

*VS - Single Engine*

HYDRODRIVE TRANSMISSION

***HydroDrive  
Transmission System***

***Set-Up and Commissioning Procedure  
For Truck Mounted Units***

***Incorporating CAN communications  
Via JVM control system  
Software Revision J Onwards  
Employing Sauer Sundstrand Hydrostatic  
Transmission Components***

***Note:- This section covers the following:  
HYDROSTATIC GEARBOX ASSEMBLY HGB-1  
(Formally identified as MKIII)***

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**Safety Notice**

Suitably guard/fence off the machine to ensure no personnel can inadvertently walk into the revolving rear wheels.

**Introduction**

The purpose of this chapter is to provide guidance and set-up data for commissioning the hydrostatic transmission components associated with the Johnston HydroDrive system. The data is specific to truck mounted sweepers together with Sauer Sundstrand transmission equipment and the Johnston JVM control system.

It is presumed that the selection of the chassis and its characteristics along with the **HydroDrive** system would have already been predetermined and installed to the relative guidelines. This Chapter only gives details on the set-up and adjustments required to the hydrostatic pump and motor together with associated components.

**Initial Set-up Procedures**

When starting the chassis engine and engaging the Hydrostatic gearbox for the first time from a 'dry-start' for commissioning and set-up, the following procedures must be adhered to:-

1. Jack-up the rear wheels and secure on axle stands and fully chock both front wheels.
2. Fill hydraulic reservoir to the middle of the sight glass with Shell Tellus T46 oil or equivalent.  
**Note:** Hopper resting on prop.
3. Remove the top cap of the boost canister and fill with filtered oil. When the canister is full some of the oil will drain into the pumps, at the same time displacing air, so the canister will require topping-up several times. It may take some time before the oil in the canister maintains its correct level (i.e. covering the filter) at which time the top can be replaced and tightened.
4. Attach a suitable 0-25 bar gauge via an extension tube to the test point **T4**, refer to section 23 of the Technical Manual for test point location.
5. With chassis gearbox in neutral, start chassis engine to ensure air pressure is present (7.5 bar) 108 PSI.



## Safety Notice



**When the *HydroDrive* is engaged if the chassis is in gear and the clutch is released the front prop shaft will be turning**

### Note:

On either new machines or after repairs the following checks should be carried out to ensure that the system is free of air.

- Select **HydroDrive** gearbox by operating the appropriate switch **F** located on the centre console, the warning LED **H** should illuminate. If not, simply select 1st gear, release the clutch to its bite point and the **HydroDrive** gearbox will engage and the LED illuminate.
- Monitor the pressure on **T4**, select 1st gear on the chassis release the clutch for 20 seconds and then depress it again. Wait a short while then repeat. Keep repeating this process until the pressure at **T4** starts to increase. Depending on the ratio of the chassis gearbox the pressure may stabilize below the required 24bar. In order to achieve a higher pressure, progressively change gear i.e. 2nd - 3rd etc. until 24bar is achieved. Top up hydraulic tank as required.

6. To enable the engine rpm to increase to the minimum operating speed select the correct gear that gives 1:1 ratio, and activate the Sweeper ignition switch **E** located on the centre console. Selecting the ignition switch will automatically increase the chassis rpm to its preset Minimum limit of 1100, on condition that the correct gear has been selected.

### Note:

If the incorrect gear has been selected then the chassis engine rpm will remain at idle.

Release the handbrake.

Ensure all other switches are in their off - select forward using the drive select joystick.

Progressively press the pedal until the rear wheels start to rotate.

Allow the wheels to rotate slowly for a short while then return the drive select to neutral and allow the wheels to stop.

Select reverse and again progressively press the pedal until the rear wheels start to rotate.

During this process keep an eye on the oil level - top up as required.

7. Alternating between forward and reverse, repeat this process six times.

### Note:

At all times the pressure on the gauge for **T4** should be maintained at approximately 24 bar.

## Pump Set-up - Relief Valve Settings

Pressure setting -

Maximum forward - 420bar - test point **T3** - **located on transmission pump.**

Maximum reverse - 350bar - test point **T1** - **located on anti skid block.**

Attach suitable 0-500bar gauges via an extension tube to the test points **T1** and **T3**, refer to section 23 of the Technical Manual for test point locations.

**Pump Set Up continued:**

1. With the vehicle jacked-up and secured on axle stands and both front wheels fully chocked - engage the **HydroDrive** and select the 1:1 ratio.
2. Release the clutch and increase the engine rpm to the maximum 1700. Keep handbrake applied, select forward using the drive select control, depress the accelerator pedal and read the pressure from test point **T3**,
3. Then select reverse and read the pressure from test point **T1**.

**Note:** The forward and reverse relief valves are located adjacent to the filter on the transmission pump. The top valve is for reverse (350 bar) and the lower for forward (420 bar). Adjustments are made by turning the valves clockwise to increase the pressure and counterclockwise to reduce it.

**Pump - Control System Checks**

The pump is equipped with an electronically controlled proportional control valve which acts to convert an electrical current (mA) input into a hydraulic servo control pressure. In order to check that this function is operating correctly, a pressure signal of 8-18bar should be recorded at test point **T2** with accelerator pedal fully relaxed or fully depressed.

**ANTI SKID MODULE SET-UP**

1. Fit a 400bar minimum pressure gauge on test point **H-15Z6** adjacent to the valve on the anti skid block.
2. Disconnect and remove the electrical coil from the cartridge valve.
3. With **HydroDrive** engaged, select reverse using the joystick, (the chassis gearbox in 1:1 drive and the parking brake applied, depress the accelerator pedal to its maximum position and read the pressure on the gauge. Adjust the relief valve **CT2** on the antiskid module as required to achieve a nominal 200bar setting.



## Motor Set-Up - Pressure Control Adjustment

The motor is equipped with two in-built pre-set control features:

### 1 Threshold Control.

Instigates a decrease in the motor displacement resulting from a signal from the main control valve in the pump.

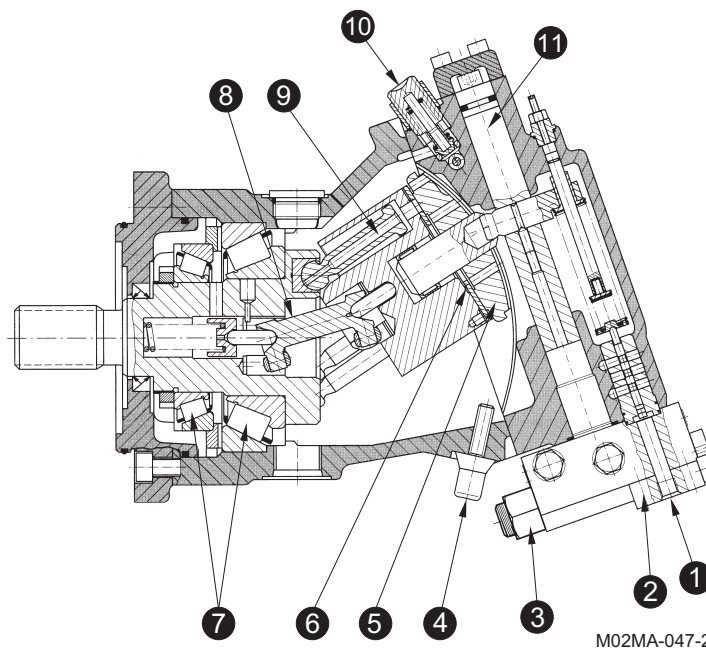
### 2 Pressure Compensator Override (PCOR).

Instigates a increases in the motor displacement resulting from higher circuit pressure.

Both these controls are pressure sensitive and factory set and on this basis should not be adjusted. However, to ensure conformity we like to check the displacement actuation pressure. This is achieved by connecting suitable pressure gauges (40bar) to test point **T4B** with Hydrodrive engaged, handbrake released, select forward drive and using the hand held PPU on position **C2**, slowly increase its value until a road speed of between 8-10 km/h is reached, at the same time observing the reading on pressure gauge, it should be 24 bar, until 8-10 km/h is reached. At this point the pressure should start to reduce.

The object of this test is to ensure the pump boost pressure (24 bar) is maintained at **T4B** until the speed criteria is achieved when motor displacement starts to change.

### Sectioned view of transmission motor



M02MA-047-2

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 1 Control Pressure Port          | 7 Tapered Roller Bearings       |
| 2 Hydraulic Proportional Control | 8 Synchronizing Shaft           |
| 3 Pressure Compensator Override  | 9 Piston                        |
| 4 Minimum Displacement Limiter   | 10 Change Pressure Relief Valve |
| 5 Valve Segment                  | 11 Servo Piston Cylinder        |
| 6 Bearing Plate                  |                                 |

### Completion of Setup

Remove guarding. Lower the vehicle off the axle stands and road test the vehicle in hydrostatic drive to confirm 40 kph can be achieved along the flat and that the vehicle can climb hills in Forward and Reverse. Please note max speed in reverse along the flat is restricted to 10 kph approximately.



# CHAPTER 10

## Health and Safety

### Introduction

The information presented in this chapter does not infer that there are hazards associated with the Johnston Sweepers. It is given as a guide to general precautions that should be exercised in the course of their maintenance work.

Whilst every effort has been made to ensure completeness of this document, owners and operators of Johnston sweepers are reminded of their responsibilities to comply with all relevant legislation including Risk/COSHH Assessments and Approved Codes of Practice.

## HEALTH AND SAFETY PRECAUTIONS

The information presented in this section does not infer there are any particular hazards associated with these machines. It is given as a guide to the general precautions that should be taken in any workshop environment when working on machines of this nature in the course of their maintenance.



### **Safety symbol:**

The universal symbol is used throughout this manual to indicate information which is essential for health and safety of all operating personnel.

Refer to all state, district/company, or council Health and Safety Regulations and follow the procedures laid down.

The repair and maintenance of machinery such as this can involve physical hazards or other risks to health. This section lists some of these hazards and the precautions necessary to avoid them.

The list is only general but all other operations, procedures and the handling of materials should be carried out in accordance with the requirement of health and safety laws, which is the responsibility of the Owner/Operator/Maintainer.



### **Sharp objects warning:**

There can be a risk of injury from sharp objects such as discarded hypodermic needles becoming lodged in the sweeping system. The use of 'needle stick gloves' is recommended when changing brushes, using the wanderhose/Littasnatch and when cleaning out the machine.



### **Anti Freeze:**

Anti-freeze may be absorbed through the skin in toxic or harmful quantities. If swallowed, seek medical attention immediately. Some types, i.e., isopropanol, ethylene glycol and methanol are flammable.



### **Batteries:**

Gases released during charging are explosive. Never use naked flames or allow sparks near charging or recently charged batteries.



### **Disconnection:**

Disconnect the negative battery lead from battery first. The positive cable must always be disconnected last.

### **Re-connection:**

Always reconnect the positive battery cable first.

### **Jump-starting and use of auxiliary (booster) batteries:**

Do not jump-start maintenance free batteries if in a deeply discharged state as internal short circuits may occur.

If a maintenance free battery is found to be in a deeply discharged state, it is essential to remove the battery and recharge off the vehicle. Jump-starting will not enable the vehicles own charging system to initiate the charging process.

**Jump starting procedure:**

Always follow this procedure when connecting a booster battery.

Take care not to cause sparking which could ignite hydrogen gas being given off by the batteries.

1. Apply the park brake, turn off ignition, lights and other electrical loads.
2. If the slave battery is mounted on another vehicle, ensure that the vehicles are not touching.
3. Ensure that the donor battery voltage is compatible with the vehicle battery.
4. Ensure that adequate ventilation is available to the vehicle and slave batteries.
5. Connect positive terminal of the donor battery group to positive terminal of the discharged battery group.
6. Connect negative terminal or slave battery group to chassis earth of the discharged battery group.
7. Attempt to start the casualty vehicle.
8. Once the vehicle has started, remove the negative lead from the chassis and then the slave battery.
9. Remove positive lead from discharged chassis and then the donor chassis.

If the vehicle will not start with a booster battery, contact your local Johnston Service Network.

**Chemical materials:**

Chemical materials such as solvents, sealers, adhesive, paints, resin foams, battery acids, anti-freezes, brake fluids, oils and grease should always be used with caution and stored and handled with care.

Chemical materials may be toxic, harmful, corrosive, irritant or highly flammable and give rise to hazardous fumes and dust.

Always consult the appropriate safety standards for handling such materials.



Typical biohazard symbol



Typical radioactive material symbol



Typical poison symbol



Always use appropriate protective clothing

**REMINDERS**

## Chemical materials

- DO** Remove chemical materials from the skin and clothing as soon as practical after soiling. Change heavily soiled clothing and have it cleaned.
- DO** Carefully read and observe hazard and precaution warnings given on hazardous material containers and in any accompanying leaflets, posters or other instructions. Hazardous material health and safety data can be obtained from manufacturers.
- DO** Organise work practices and use protective clothing to avoid soiling of the skin and eyes; breathing vapours, aerosols, dust, and fumes; inadequate container labelling; fire and explosive hazards.
- DO** Wash before job breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials.
- DO** Keep work areas clean, uncluttered and free of spills.
- DO NOT** Mix chemical materials except in accordance with the manufacturer's instructions. Some chemicals can form other toxic or harmful substances; give off toxic or harmful fumes; be explosive when mixed together.
- DO NOT** Spray chemical materials, particularly those based on solvents, in confined spaces; for example, when people are inside a vehicle.
- DO NOT** Apply heat or flame to chemical materials, except under the manufacturer's instructions. Some are highly flammable and some may release toxic or harmful fumes.
- DO NOT** Leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas, pits, etc.
- DO NOT** Transfer chemical materials to unlabelled containers.
- DO NOT** Clean hands or clothing with chemical materials. Chemicals, particularly solvents and fuels will dry the skin and may cause irritation with dermatitis. Some can be absorbed through the skin in toxic or harmful quantities.

**Dusts:**

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations.

Wear respiratory protection in accordance with the requirement of the Health and Safety Acts.

**Electric shocks:**

When working on electrical systems, remove watches, bracelets and rings as these can conduct electricity and cause shorts and/or burns.

Electric shocks can result from the use of faulty electrical equipment or from the misuse of equipment even in good condition.

Ensure that electrical equipment is maintained in good condition and frequently inspected and tested.

Ensure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Ensure that electrical equipment is protected by the correct rated fuse and if used outside an earth-leakage circuit breaker is used.

Never misuse electrical equipment and never use equipment that is in any way faulty. The results could be fatal.

Use reduced voltage equipment (110 or 24 volt) for inspection and working lights where possible.

Ensure that the cables of mobile electrical equipment cannot be trapped and damaged such as in a vehicle hoist, trolley jacks, etc.

Use air operated mobile equipment where possible in preference to electrical equipment.

**Exhaust fumes:**

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, leads and aromatic hydrocarbons.

Engines should only be run under conditions of adequate extraction or general ventilation and not in confined spaces.

**NB :** Catalyst exhausts/silencers can run at extremely high temperatures.

**Fire and welding:**

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Disconnect battery, microprocessors, etc. before commencing welding. Failure to observe this could cause failure of components.

Ensure before using electrical or welding equipment that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

Special precautions must be taken before any welding or cutting takes place on vessels which have contained combustible materials, e.g. fuel tanks.

The sound insulation foam used on the equipment must be removed if any welding is to be carried out in that area of the machine.

**First aid:**

It is desirable for someone in the workshop to be trained in the first aid procedures. Splashes or particles in the eye should be flushed with clean water for at least ten minutes and medical attention sought.

Soiled skin should be washed with soap and water.

Inhalation affected individuals should be removed to fresh air immediately.

If hazardous material has been swallowed or if the effects of exposure to hazardous materials persist, consult a doctor with information (label) on material used.

Do not induce vomiting (unless indicated by the manufacturer).

**High-pressure air and lubrication equipment:****Always**

Keep high-pressure equipment in good condition and regularly maintained, particularly at joints and unions.

**Never**

Direct a high (or low) pressure nozzle at the skin as the fluid may penetrate to the underlying tissue, etc, and cause serious and potentially fatal injury.

**Oils and greases:**

Prolonged and repeated contact with mineral oil may result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis.

Gross and prolonged contact, especially with used engine oil, which contains potentially harmful contaminants, may cause skin cancer.



Where there is a risk of eye contact, e.g., by splashing, eye protection should be worn, for example, chemical goggles or face shields; in addition, an eyewash facility should be provided.

Adequate means of skin protection and washing facilities should be provided.

Repeated or prolonged skin contact should be avoided by wearing protective clothing, including impervious gloves where practical. Particular care should be taken with used oils and greases containing lead.

First Aid treatment should be obtained immediately for open cuts and wounds.

Apply barrier cream before each work period to help when removing oil from the skin.

Use proprietary hand cleaners only if they can be removed from the skin using water.

Overalls must be cleaned regularly. Discard clothing that cannot be cleaned and footwear that has become impregnated.

In the event of a skin condition occurring consult a doctor and tell him/her that your work involves using oil.



**Solvents:**

Solvents such as acetone, white spirit, toluene, xylene and trichloroethane are flammable.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing.



When using solvents ensure good ventilation; avoid breathing fumes, vapours, spray-mists and keep containers tightly sealed. Do not use in confined spaces. When spraying materials containing solvents, for example paints, adhesives or coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturer's instructions.

**Suspended loads:**

Never work under an unsupported, suspended or raised load. For example, jacked up vehicle, raised tipper body, suspended engine, etc.

Always ensure that lifting equipment e.g., jacks, hoists, axle stands, slings, etc are adequate and suitable for the job, in good condition and regularly maintained.

**NEVER** improvise lifting tackle. **ALWAYS** ensure body props and/or axle stands are used when working under bodies or chassis.

**Workshop tools and equipment:**

Only use tools and equipment for their intended purposes.

Never overload equipment such as hoists, jacks, axles stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time the equipment is used.

Never use damaged or defective tools or equipment.



Always wear suitable eye protection when using grinding, chiselling or air guns.

Always wear a suitable breathing mask when using sand blasting equipment, working with asbestos based materials (such as brake linings) or using spraying equipment.



**ALWAYS** use approved safety platforms/gantries when working above ground level.

