

Nilfisk Liberty SC50

Instructions for Use

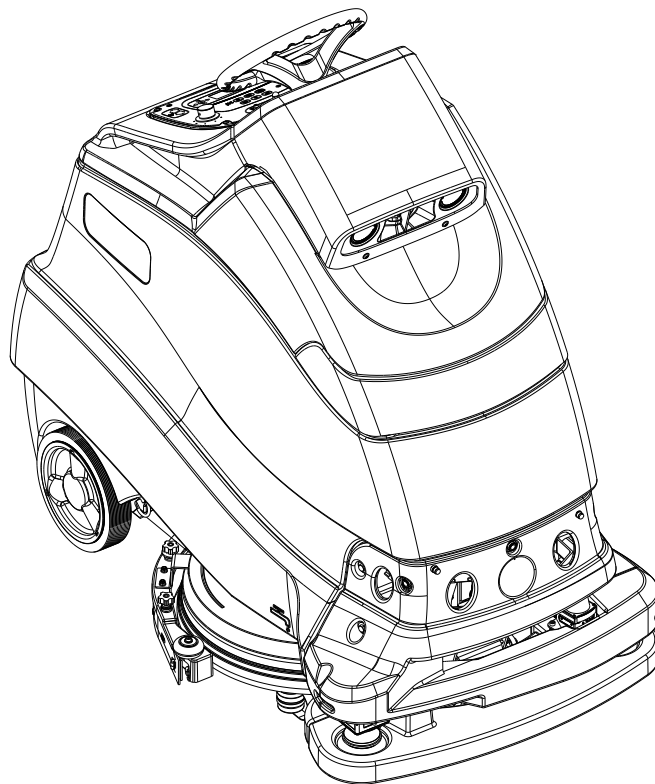
Instructions for Use
Original Instructions

12/2017 revised 6/2020 REV C
Form no. 56091197



ecoflex™

A-English



Model No:
56104502 (X20D), 56104506 (X20D), 56104508 (X20D)
56104503 (X20R), 56104507 (X20R), 56104509 (X20R)
MMC Firmware 4.1 or above



WARNING:

The operation of this machine is strictly reserved to trained and qualified operators.

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INTRODUCTION

This manual will help you get the most from your Nilfisk Scrubber. Read it thoroughly before operating the machine.

Note: Bold numbers in parentheses indicate an item illustrated on pages A-10 – A-14.

This machine is only suitable for commercial use, for example in hotels, schools, hospitals, factories, shops, offices and rental businesses. The Nilfisk Liberty SC50 is a battery powered floor cleaning machine.



WARNING:

The operation of this machine is strictly reserved to trained and qualified operators.

PARTS AND SERVICE

Repairs, when required, should be performed by Nilfisk, Inc., who employs factory trained service personnel, and maintains an inventory of Nilfisk original replacement parts and accessories.

Call NILFISK, INC. for repair parts or service. Please specify the Model and Serial Number when discussing your machine.

MODIFICATIONS

Modifications and additions to the cleaning machine which affect capacity and safe operation shall not be performed by the customer or user without prior written approval from Nilfisk, Inc. Unapproved modifications will void the machine warranty and make the customer liable for any resulting accidents.

NAME PLATE

The Model Number (also known as Part Number) and Serial Number of your machine are shown on the Nameplate, located on the inside of the battery compartment.

Date of Manufacture "Date Code" is marked on the nameplate. Date Code: A18, means January 2018.

This information is needed when ordering repair parts for the machine. Use the space below to note the Model Number and Serial Number of your machine for future reference.

MODEL NO. _____

SERIAL NO. _____

UNCRATE THE MACHINE

When the machine is delivered, carefully inspect the shipping packaging and the machine for damage. If damage is evident, save the shipping carton (if applicable) so that it can be inspected. Contact the Nilfisk Customer Service Department immediately to file a freight damage claim. Refer to the unpacking instruction sheet included with the machine to remove the machine from the pallet.

TRANSPORTING THE MACHINE

CAUTION!

Before transporting the machine on an open truck or trailer, make sure that . . .

- All tanks are empty.
- Recovery tank cover is latched securely.
- The machine is tied down securely - see Tie Down Locations **(6)** in *Know Your Machine*. Only use locations designated as "Tie Down Locations" to secure the machine during transport. Using any other location of the machine to tie down the machine may cause damage or injury.
- The machine's electromagnetic brake is engaged (not manually overridden), see *Electromagnetic Brake* section if necessary.

CAUTIONS AND WARNINGS

SYMBOLS

Nilfisk uses the symbols below to signal potentially dangerous conditions. Always read this information carefully and take the necessary steps to protect personnel and property.

DANGER!

Is used to warn of immediate hazards that will cause severe personal injury or death.

WARNING!

Is used to call attention to a situation that could cause severe personal injury.

CAUTION!

Is used to call attention to a situation that could cause minor personal injury or damage to the machine or other property.



Read all instructions before using.

GENERAL SAFETY INSTRUCTIONS

Specific Cautions and Warnings are included to warn you of potential danger of machine damage or bodily harm.

This machine is for commercial use, for example in hotels, schools, hospitals, factories, shops and offices other than normal residential housekeeping purposes.

WARNING!

- This machine shall be used only by properly trained and authorized persons.
- The operation of this machine is strictly reserved to trained and qualified operators.
- This machine is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge.
- While on ramps or inclines, avoid sudden stops. Avoid abrupt sharp turns. Use low speed down ramps.
- Observe the Gross Vehicle Weight, GVW, of the machine when loading, driving, lifting or supporting the machine.
- Keep sparks, flame and smoking materials away from batteries. Explosive gases are vented during normal operation.
- Charging the batteries produces highly explosive hydrogen gas. Charge batteries only in well-ventilated areas, away from open flame. Do not smoke while charging the batteries.
- Remove all jewelry when working near electrical components.
- Turn the machine power OFF and disconnect the batteries before servicing electrical components.
- Never work under a machine without safety blocks or stands to support the machine.
- Do not dispense flammable cleaning agents, operate the machine on or near these agents, or operate in areas where flammable liquids exist.
- Do not clean this machine with a pressure washer.
- Only use the brushes or pads provided with the appliance or those specified in the instruction manual. The use of other brushes or pads may impair safety.
- Do not look at the laser beams used by the machine. Permanent eye damage could result. Lasers are eye-safe if viewed briefly, such as to determine that they are functioning. Do not look directly into lasers or stare at them without wearing protective laser safety glasses.
- The vehicle protection zone is no more than 200mm from the floor
- Do not operate the machine close to overhanging objects such as racking, ladders, wall hung fire extinguishers, tables and similar objects.

CAUTIONS AND WARNINGS - CONTINUED** CAUTION!**

- This machine is not approved for use on public paths or roads.
- This machine is not suitable for picking up hazardous dust.
- Do not use scarifier discs and grinding stones. Use only pads or brushes intended for floor cleaning. Nilfisk will not be held responsible for any damage to floor surfaces caused by using the wrong or improper pads or brushes.
- When operating this machine, ensure that third parties, particularly children, are not endangered.
- Before performing any service function, carefully read all instructions pertaining to that service task.
- After use power the machine off at the power switch, do not leave the machine unattended where it can be accessed by others.
- Power the machine OFF at the power switch and remove the magnetic SmartKey, before changing the brushes, and before opening any access panels.
- Take precautions to prevent hair, jewelry, or loose clothing from becoming caught in moving parts.
- When working on the Liberty SC50 and a battery disconnect is needed, ensure that the Autonomy Module is completely powered off before the power is pulled from the system. To verify that the Autonomy module is completely powered down simply wait for both the safety LiDAR's and Dropoff lasers to power off, plus an additional 15 seconds after that. If this procedure is not followed when disconnecting the battery there is a chance that the Autonomy Module could be permanently damaged, and would need replacement.
- Use caution when moving this machine in below freezing temperature conditions. Any water in the solution, recovery or detergent tanks or in the hose lines could freeze, causing damage to valves, pumps and fittings. Flush with low-temperature windshield washer fluid.
- The batteries must be removed from the machine before the machine is scrapped. The disposal of the batteries should be safely done in accordance with your local environmental regulations.
- Do not use on surfaces having a gradient exceeding that marked on the machine.
- All doors and covers are to be positioned as indicated in the instruction manual before using the machine.
- This machine should only be used and stored indoors.
- Do not spray this machine with pressurized water.
- The machine's magnetic SmartKey has a built-in magnet. Do not place objects having magnetic bands (such as credit cards, electronic keys, phone cards) near the key. The built-in magnet can damage or erase the data stored on the magnetic bands.
- Only use locations designated as "Tie Down Locations" to secure the machine during transport. Using any other location of the machine to tie down the machine may cause damage or injury.
- Do not operate the machine in an environment exceeding 104°F (40°C).
- Do not operate the machine without the Bumper **(18)** in place.
- Avoid driving the machine onto stairways or escalators, into open elevator shafts, or into any area where there is a significant drop in elevation. Serious machine damage may result if it falls down stairs, escalators, or open shafts. The machine cannot climb stairs. Machine is designed for use only on flat surfaces (less than 2 degree incline). Place garbage can or similar object in front of escalators while recording plan to prevent machine entry.
- Do not operate the machine on a grade outside that which is written on the nameplate.
- While driving the machine manually, to develop navigational maps as part of recording the autonomous plans, it is the Operator's responsibility to avoid contact with obstacles and individuals. The machine will not avoid them in the manual operating mode. There are no autonomous safety functions operating in the manual mode.
- Do not operate the machine on wet floors.
- Do not operate the machine near other autonomous vehicles.
- Ensure daily and periodic safety checks are completed.

CAUTIONS AND WARNINGS - CONTINUED**CAUTIONS AND WARNINGS SPECIFIC TO DROP-OFF SENSOR (16)**

This product uses a semiconductor laser as its light source.

** DANGER!**

- This product is only intended to detect object(s). Do not use this product for the purpose to protect a human body or part of a human body.
- This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.

** WARNING!**

- This product uses DC power. The product may explode or burn if an AC voltage is applied.
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.
- Laser emission from this product is not automatically stopped when it is disassembled. Do not disassemble this product.
- Precautions on Class 1 Laser Product
 - Do not stare into the direct or specularly reflected beam.

** CAUTION!**

- Do not wire the cable along with power lines or high-tension lines, as the sensor may malfunction or be damaged due to noise.
- When using a commercially available switching regulator, ground the frame ground terminal and ground terminal.
- Do not use this product outdoors or in a location in which its light-receiving surface will come in direct contact with stray ambient light.

CAUTIONS AND WARNINGS - CONTINUED**CAUTIONS AND WARNINGS SPECIFIC TO 2D MAPPING SENSOR (14)**** WARNING!****Risk Of Potential Equalization Currents**

The 2D mapping sensor is designed to be operated in a system with professional grounding of all connected devices and mounting surfaces to the same ground potential. If this condition is not met, potential equalization currents may through along the cable shields, causing the following hazards:

- Dangerous contact voltage on the metal housing
- Malfunction or destruction of the TiM
- Heating of the cables with possible spontaneous combustion.

** CAUTION!****CLASS 1 LASER PRODUCT**

The 2D Mapping Sensor corresponds to laser class 1 (eye-safe).

The laser beam is not visible to the human eye.

- The use of controls, or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Do not open the housing (opening the housing will not switch off the laser).
- Pay attention to the laser safety regulations as per IEC 60825-1 (latest version).

CAUTIONS AND WARNINGS - CONTINUED** CAUTION!****CAUTIONS SPECIFIC TO SAFETY SENSOR (17)**

Read the following guidelines for correct use of the Safety Sensor (17). Proper handling and usage will ensure the safety sensor to operate accordingly.

GENERAL PRECAUTIONS

- Safety sensor is designed to protect human beings or systems by monitoring the hazardous area. It is not designed for the protection from high speed objects or the electromagnetic radiation.
- Perform pre operation tests in order to verify the performance of safety sensor.
- Do not modify or disassemble safety sensor. Such modifications will affect the detection capability leading to injuries or death.
- Do not modify or disassemble safety sensor to maintain its housing rating. Such modifications will void the warranty.
- The person in charge should be qualified to operate safety sensor. The person must be trained, on safety requirements with necessary cautions for handling the device.
- The person in charge should train the user with correct installation, operation, inspection and maintenance procedures.
- The person in charge is responsible to ensure the proper working environment for safety sensor.
- The person in charge is responsible for the compliance with the local safety requirements, standards, rules and regulations, laws of respective nations, states or districts when safety sensor is used in a safety related system.
- Safety sensor has been manufactured and shipped under the strict quality control. If you find any defect in the product contact the nearest distributor or sales representative.
- Manufacturer cannot be held responsible for the damages or failure due to misuse of the product.
- User should prepare test pieces for detection capability verification. The test piece should emulate the smallest object that is intended to be detected during the operation.
- Maximum level of homogeneous pollution for safety sensor to operate normally is under 30%. Safety sensor will report error if the pollution exceeds the stated limit. Always keep the optical window in clean condition to avoid the error.
- Before resetting the interlock of safety sensor, user must ensure the surrounding is safe especially the protected area.
- Apply sufficient measures to ensure safety of the protected area when decommissioning safety sensor. Protective materials such as guards or light curtain should be used to prevent the passage to the hazardous area.
- Safety sensor including its accessories are subject to change without prior notice for the improvement.
- Safety sensor should be disposed as industrial waste or in accordance with the local disposal directives.

SAVE THESE INSTRUCTIONS

REGULATORY

FCC:

FCC ID: ZQ6-AP6356SDXX / ZMF-ME501 / UDV-SIM7100A / Z64-WL18DBMOD

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Users are not permitted to make changes or modify the device in any way. Changes or modifications not expressly approved by Nilfisk, Inc. will void the user's authority to operate the equipment.

This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. Non body-worn devices must be placed at least 8" (20cm) away from the body.

IC:

IC ID: 11956A-AP6356SDXX / 9746A-ME501 / 8460A-SIM7100A / 451I-WL18DBMOD

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

The term «IC» before the equipment certification number only signifies that the Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment. This device complies with RSS247 or/and RSS210 of Industry Canada. The radio transmitter has been approved by Industry Canada to operate only with the antenna supplied. Use of any other antenna is strictly prohibited for use with this product.

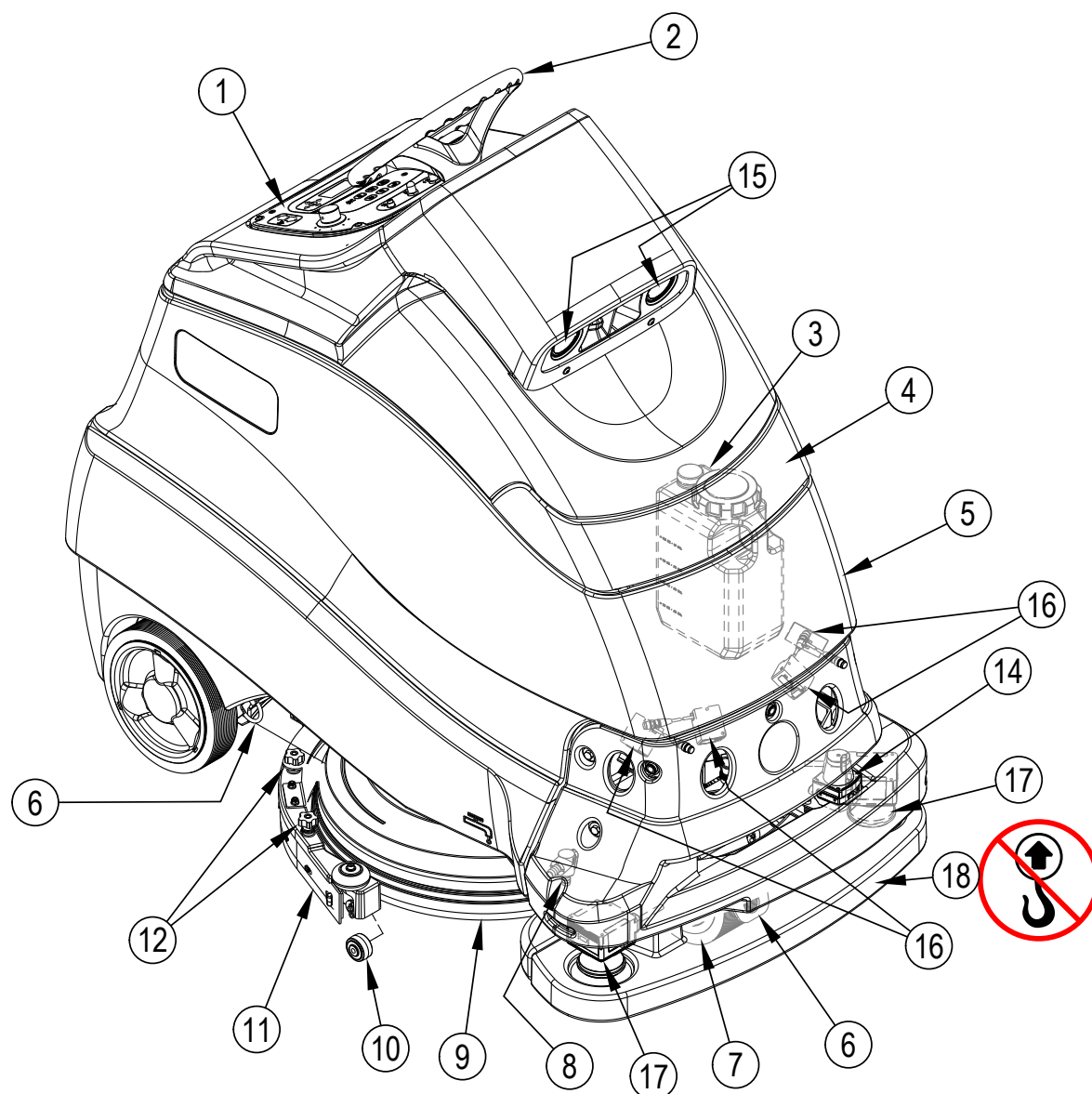
This device complies with the ICES RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and any part of the human body.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

KNOW YOUR MACHINE

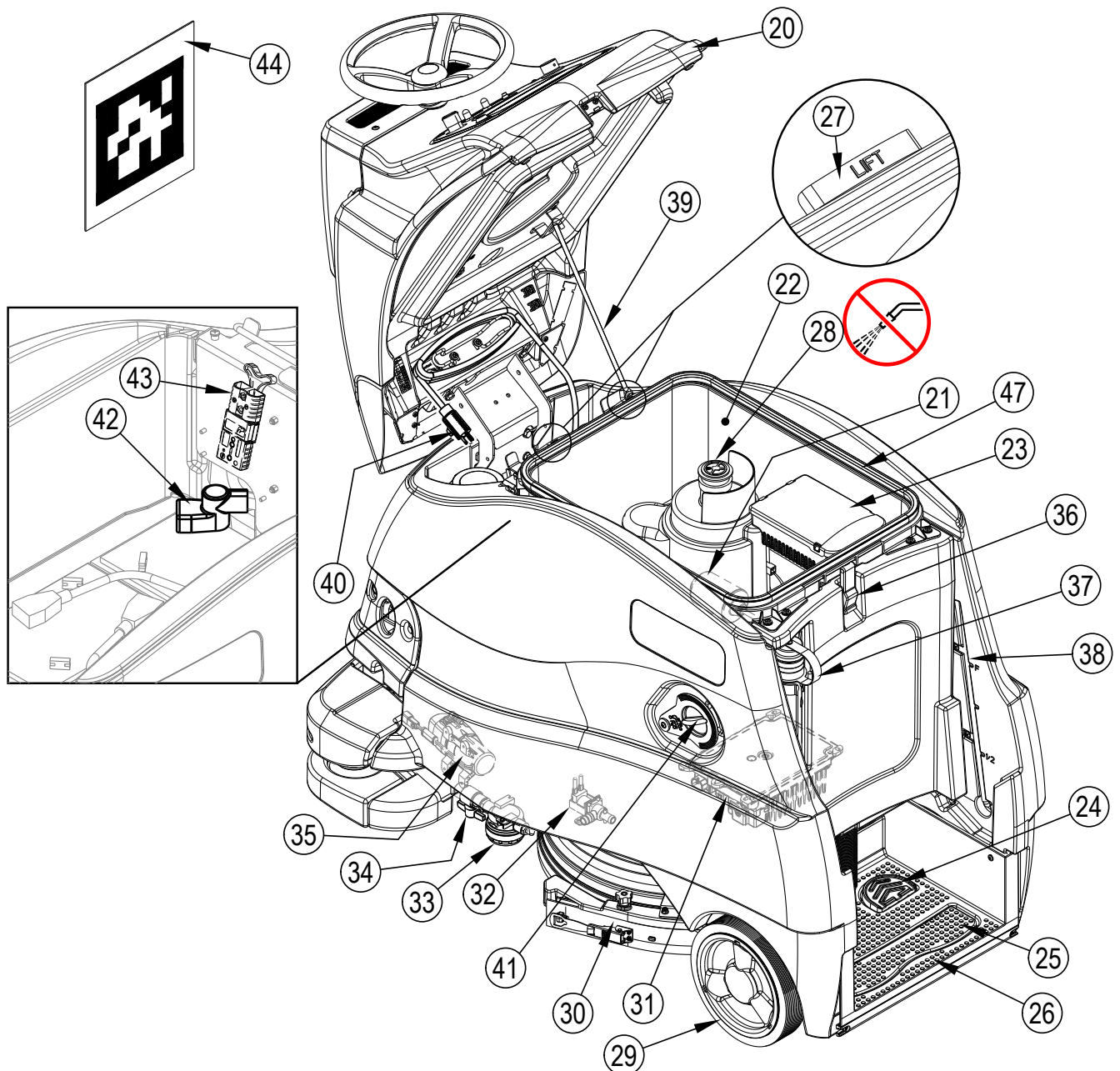
As you read this manual, you will occasionally run across a bold number or letter in parentheses - example: **(2)**. These numbers refer to an item shown on these pages unless otherwise noted. Refer back to these pages whenever necessary to pinpoint the location of an item mentioned in the text. **NOTE:** Refer to the service manual for detailed explanations of each item illustrated on the next 4 pages.

- | | | | |
|---|------------------------|----|--|
| 1 | Control Panel | 10 | Squeegee Roller Wheels (2) |
| 2 | Steering Wheel | 11 | Squeegee Assembly |
| 3 | Detergent Cartridge | 12 | Squeegee Cover Knobs (4) |
| 4 | LED Status Bar | 14 | 2D Mapping Sensor |
| 5 | Solution Tank | 15 | 3-D Vision Sensor Lenses |
| 6 | Tie Down Locations (3) | 16 | Drop-Off Sensor (4) |
| 7 | Drive Wheel | 17 | Safety Sensor (2) |
| 8 | Solution Drain Valve | 18 | Bumper (NOT a lifting or tie down point) |
| 9 | Scrub Deck | | |



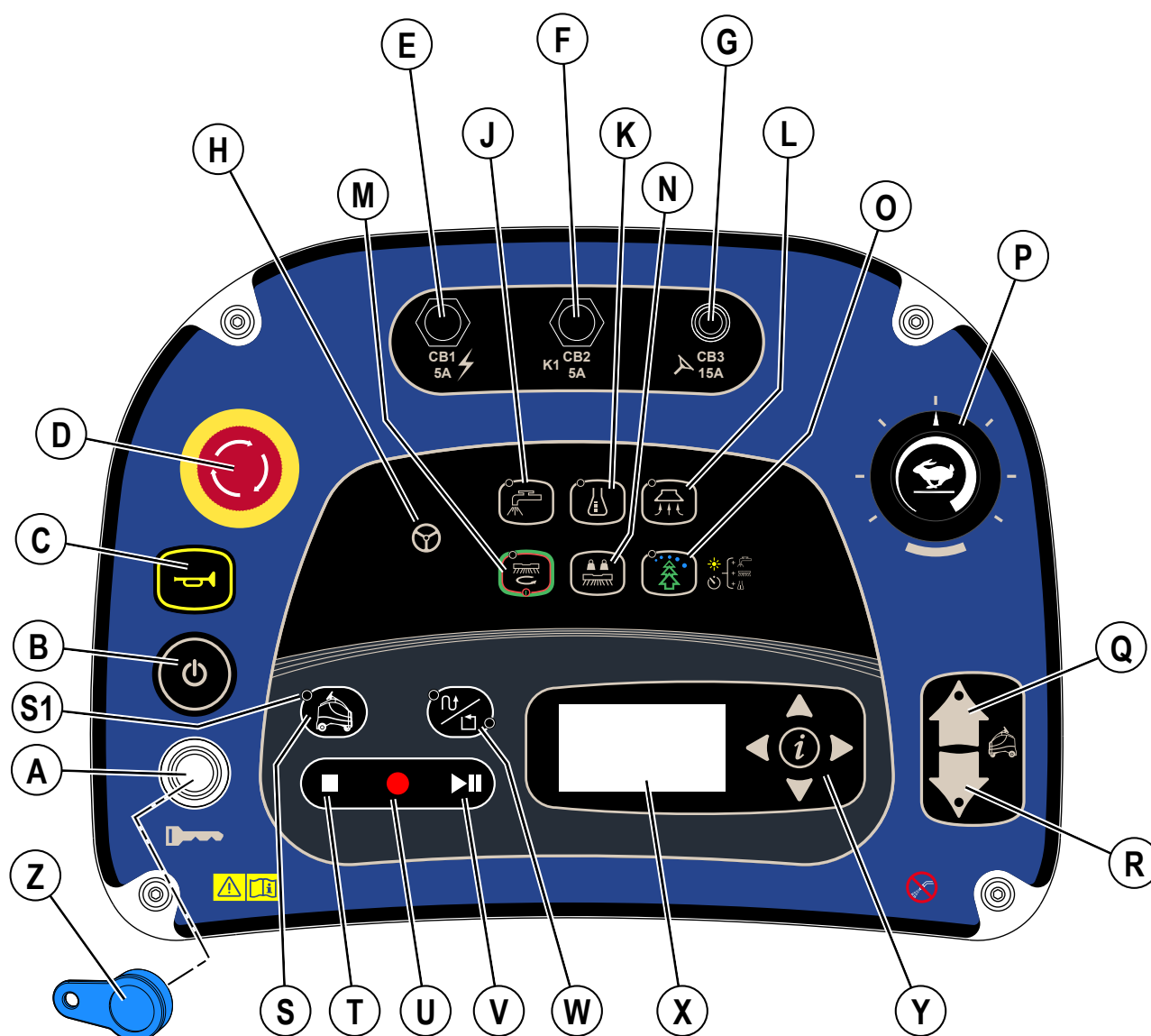
KNOW YOUR MACHINE

- | | | | |
|----|---|----|--------------------------------------|
| 20 | Control Panel Housing / Recovery Tank Cover | 33 | Solution Filter |
| 21 | Recovery Tank Full Float | 34 | Solution Shutoff Valve |
| 22 | Recovery Tank | 35 | Solution Pump |
| 23 | Debris Catch Tray | 36 | Latch |
| 24 | Go Pedal | 37 | Recovery Tank Drain Hose |
| 25 | Operator Presence Pedal | 38 | Solution Tank Level Sight Tube |
| 26 | Platform | 39 | Prop Rod |
| 27 | Recovery Tank Lift Handles (2) | 40 | On-Board Charger Power Cord |
| 28 | Vacuum Motor Fan Inlet Screen | 41 | Solution Tank Fill Port |
| 29 | Rear Wheel (2) | 42 | Fuse Holder Boot (Main Fuse 100 Amp) |
| 30 | Rear Squeegee Blade Removal Latch | 43 | Machine Battery Connector |
| 31 | Battery Charger | 44 | Location Tag |
| 32 | Solution Solenoid Valve | 47 | Recovery Tank Gasket |



CONTROL PANEL

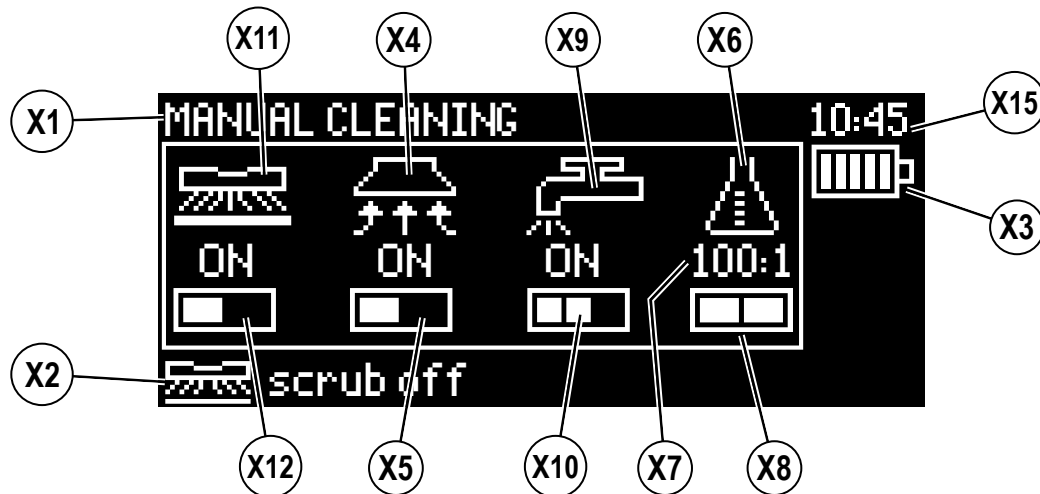
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|---|---|----|--|
| A | SmartKey™ Reader | Q | Forward Drive Switch |
| B | Power Switch | R | Reverse Drive Switch |
| C | Horn Switch | S | Autonomous Help Screen Switch |
| D | Emergency Stop | S1 | Autonomous Mode Indicator |
| E | Control Circuit Breaker (5 Amp) | T | Stop Switch |
| F | Circuit Breaker (K1) (5 Amp) | U | Record Switch |
| G | Steering Motor Circuit Breaker (15 Amp) | V | Play/Pause Switch |
| H | Manual Operation Indicator | W | CopyCat™/Fill-In Switch |
| J | Solution Flow Adjustment Switch | X | Display (see Control Panel-Continued) |
| K | Detergent Switch | Y | Information Switch & Navigation Switches |
| L | Vacuum Switch | Z | Magnetic SmartKey™ |
| M | One-Touch™ Scrub ON/OFF Switch | | -Blue = User |
| N | Extra Pressure Switch | | -Yellow = Supervisor |
| O | Burst of Power Switch | | |
| P | Speed Adjustment Knob | | |



CONTROL PANEL - CONTINUED

- X1** Display Header (information will vary)
- X2** Display Footer (information will vary)
- X3** Battery Charge Indicator [see page 56]
- X4** Vacuum Indicator
- X5** Vacuum Indicator Bar Graph
 - FIRST = Quiet Mode
 - SECOND = Regular Mode
 - NONE = Off
- X6** Detergent Indicator
- X7** Detergent Ratio/Percentage Indicator
- X8** Detergent Indicator Bar Graph
 - FIRST = Detergent Low Mode
 - SECOND = Detergent High Mode
 - NONE = Off

- X9** Solution Flow Indicator
- X10** Solution Flow Rate Bar Graph
 - FIRST = Low
 - SECOND = Medium
 - THIRD = High
 - NONE = Off
- X11** Scrub Pressure Indicator
- X12** Scrub Brush Pressure Bar Graph
 - FIRST = Regular
 - SECOND = Heavy
 - NONE = Off
- X15** Time Display (Local)



CONTROL PANEL - CONTINUED

X14 Fault Indicator

X16 Recovery Tank Full Indicator

X17 Purge Indicator

X19 No Key Indicator

X20 Key Read Error Indicator [see Troubleshooting]

X21 Restricted User Key Indicator [see Troubleshooting]

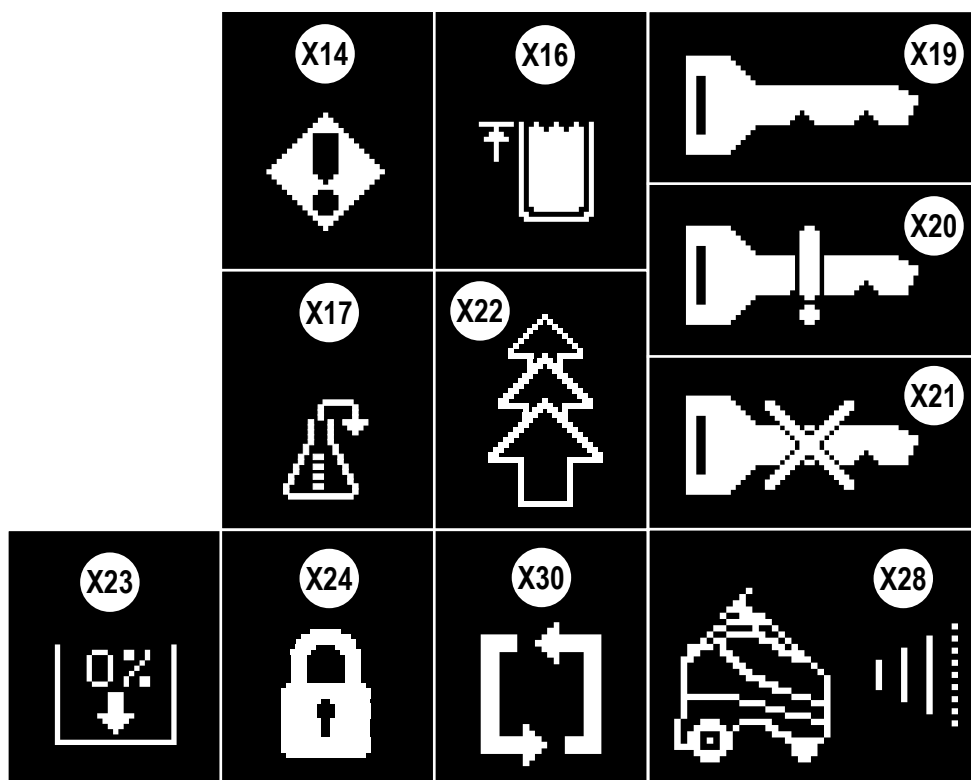
X22 Burst of Power Indicator

X23 Solution Tank Empty Indicator

X24 Impact Lockout Indicator

X28 Advancing Lines (Playing back)

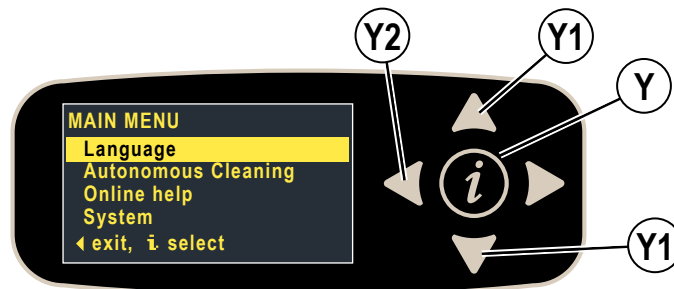
X30 Spinning Arrows / Computer Processing



INFORMATION MENU DISPLAY

Menu Display

Pressing the Information Switch (Y) will bring up the menu shown below which allows the operator to change machine settings and gather machine information. Use the two Navigation Arrows (Y1) (up & down) to move through the menu. Use the left Navigation Arrow (Y2) to exit or go back up a menu level. The information switch is used to select or save a setting within the menu.



Menu visible with either blue (User) or yellow (Supervisor) SmartKey.

Menu Level		Notes
1	2	
Language		
	English*	Menu display language
Autonomous cleaning		
	Delete this plan**	Deletes the plan the machine is currently on
	Add new Location tag**	Adds a new location tag
	Delete current tag #NNN**	Deletes the current tag NNN (deletes all plans associated with the current tag)
	Scan Location tag	Forget the current tag and scan for a known tag
Online help		
	QR code displayed. User can scan to navigate to additional resources online. GUIDES.NILFISK.COM/SC50	
System		
	MMC F/W	Display current firmware revision
	Charger F/W	Display current charger firmware revision
	Charger P/N	This is the custom SW part number of Nilfisk charger. Only available in new chargers. Old chargers will show "Legacy" New charger will show "NDS10002"
	Serial Num	Display PCB serial number from factory
	CRL Compute	Display current autonomy Compute controller firmware
	CRL Platform	Display current autonomy Platform controller firmware
	CRL Safety	Display current autonomy Safety controller firmware
	CRL Camera	Display current 3-D Vision Sensor firmware
	CRL Laser	Display current 2D Mapping Sensor firmware
	Impact Log	Display list of impact events with max value, timestamp and user id (only if enabled) - single item view will show max values for each axis (x,y,z)
	Log a Problem	It puts a tag in autonomy log to help find the root cause of the autonomy problem the user experiences
	CRL Wireless Update	Go to menu for wireless update of autonomy firmware
	Network Status	Is network up, or down (down includes an error number)
	IP Address	IP Address of machine, shown as 123.456.789.555
	QR String	QR string scanned in from "Scan QR Code" menu command
	MAC Address	MAC address of the autonomy Kit
	Autonomy ID	Autonomy Kit Unique ID
	F/W Checksum***	The CRC32 of the running firmware in the MMC
	Update F/W***	Option to update autonomy and MMC (Main Machine Controller) firmware

*Default setting

**Only visible to blue User key if permission is granted by Supervisor.

***Supervisor and Technician Only

INFORMATION MENU DISPLAY – CONTINUED

Menu visible with either blue (User) or yellow (Supervisor) SmartKey.

Menu Level		Notes
1	2	
Hours		Displays various system hours
	On Time	Displays Power ON hours
	Drive Time	Displays drive (non-neutral) hours
	Scrub Time	Displays scrub/brush ON hours
	CopyCat Record	Displays hours spent recording CopyCat plans
	Fill-In Record	Displays hours spent recording Fill-In plans
	CopyCat Replay	Displays hours spent playing back CopyCat plans
	Fill-In Replay	Displays hours spent playing back Fill-In plans
	Recovery Time	Displays recovery/vacuum ON hours
Log a Problem		
		It puts a tag in autonomy log to help find the root cause of the autonomy problem the user experiences
Software Update		
	Scan QR Code	Used to scan QR Code
	Download Update	Used to download updated software
	Install Update	Used to install updated software after it has been downloaded
Faults**		
	Active Faults	Displays list of active faults w/ timestamp and description
	Fault History	Displays list of fault history w/ timestamp and description
	Clear History	Clear history of all faults
	Clear Active Faults	Clear current active faults

**See Fault Code Display

Menu visible only with yellow (Supervisor) SmartKey.

Menu Level			Notes
1	2	3	
Options			Supervisor selectable options
	Language	English* Français Deutsche	Menu display language
	Scrub Max	Light Heavy*	Maximum scrub level allowed
	Solution	SmartFlow* (proportional to speed) Fixed	Adjust solution flow to speed, or fixed flow
	Solution In Rev	No* Yes	Leave solution on in reverse?
	Warning Beep	Backup Beep* Beep On Beep Off	Beep when backing up, beep always on when moving, beep off
	Robot Beep	Beep Off* Beep Low Beep Medium Beep High	Beep when scrubbing autonomously – off, low, medium, high volume
	Other Sounds	Normal* Quiet Off	Volume of sounds (apart from horn, starting autonomy beep, and backup beep)

*Default setting

INFORMATION MENU DISPLAY – CONTINUED

Menu visible only with yellow (Supervisor) SmartKey.

Menu Level			Notes
1	2	3	
Options			Supervisor selectable options
	Manual Light	On to Scan* Always On Always Off	"On to Scan" means the LED strip will be white with blue corners when the 3-D vision sensor is attempting to read a Location Tag
	Obstacle Color	Orange* Red	Color of "Obstacle" chasing lights displayed on LED status bar when an obstacle is encountered
	Detergent Low	(300,256,200,150,128,100,64,50,32,26):1 – ratio cannot be > Detergent High (0.3, 0.4, 0.5, 0.7, 0.8, 1.0, 1.5, 2.0, 3.0, 3.8)% – percentage cannot be > Detergent High	Set detergent ratio for detergent low level
	Detergent High	(300,256,200,150,128,100,64,50,32,26):1 – ratio cannot be < Detergent Low (0.3, 0.4, 0.5, 0.7, 0.8, 1.0, 1.5, 2.0, 3.0, 3.8)% – percentage cannot be < Detergent Low	Set detergent ratio for detergent high level
	Detergent shown as	xxx:1 x.x%	Ratio or percentage
	Neutral Delay (s)	min = 0.5* max = 5.0 step = 0.5	Time to keep brushes on when in neutral (seconds)
	Vac Off Delay (s)	min = 15* max = 25 step = 1	Time to keep vacuum on after turning off scrub system (seconds)
	Burst Of Power (s)	min = 60* max = 300 step = 60	Burst-of-power (BOP) time span (seconds)
	Fwd Speed Max (%)	min = 50% max = 100%* step = 10	Maximum forward speed as percentage of maximum available speed in manual mode
	Record Speed Max (%)	min = 50% max = 100%* step = 10	Maximum forward speed allowed while recording (as percentage of maximum available speed in manual mode)
	Inactive Time (min)	min = 5 max = 60 step = 5 default = 15	Inactivity time before putting machine in sleep mode (minutes)
	User	Replay Only* Replay/Record Replay/Record/Delete	User key plan permissions -- only replay; replay and record; replay, record, and delete plans
		No Add/Delete Tags* Add Tags Add/Delete Tags	User key location tag permissions -- no permissions, can add tags, can add and delete tags
	Delete ALL PLANS?	No* Yes	Deletes all plans
	Delete ALL TAGS?	No* Yes	Delete all tags (and plans)
	Ignore water meter?	No* Yes	Ignore water meter and do constant flow with no feedback loop. Allows operator to keep cleaning in autonomous or manual mode with a broken flow meter.

*Default setting

INFORMATION MENU DISPLAY – CONTINUED

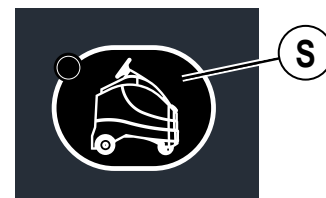
Menu visible only with yellow (Supervisor) SmartKey.

Menu Level			Notes
1	2	3	
Options			Supervisor selectable options
	OvrCurProt. Enabled?	No Yes*	Over Current Protection can be disabled for using the machine on certain rubber flooring where current draw is higher than expected
	Impact Level	High* Low	Impact detection sensitivity level. If nuisance tripping occurs (i.e. driving over a floor transition), adjust setting to low.
	Impact Action	Log Only* Log & Lock	Impact detection status Log Only – Impact is recorded Log & Lock – Impact is recorded and User is locked out of scrub functions (Display shows (X24)) until machine is reset with a Supervisor key.
	Impact Log User ID?	No* Yes	Whether to record the User ID in the impact log
	Show Charging Lights?	Yes* No	LED status bar will display a visual indication of the batteries level of charge while batteries are being charged (see page 51)
	Date/Time/Timezone		Set the date, time and timezone
		Timezone	Choose timezone that matches machine's location
		Hour	Set current time, hours in 24-hour format
		Minute	Set current time minutes
		Second	Set current time seconds
		Year	Set current year
		Month	Set current month
		Day	Set current day

*Default setting

AUTONOMOUS HELP SCREEN

Pressing the Autonomous Help Screen Switch (S) will bring up a help screen of information and/or actions the operator can take at that particular point in time (screen will vary depending upon what the machine is currently doing, where it's located and what is allowed). Use the four Navigation Arrows (Y1) to move through the screen. Use the information switch to make a selection and the left arrow key to exit the screen. The table below shows actions that can be taken directly from the screen, the table on the previous page shows informational messages.



Machine State	Appears on Display	Autonomous Help Screen
At machine start up, autonomy system is booting up	MACHINE READY 10:45 For autonomous cleaning, drive to location tag i menu, scrub on	AUTONOMY BOOTING UP ... 48 Manual mode available ◀ exit Tag: ...
No location tag scanned nor stored, machine CANNOT see a location tag	MACHINE READY 10:45 For autonomous cleaning, drive to location tag i menu, scrub on	NO LOCATION TAG Set new location tag ◀ exit, i select
Location tag scanned. Machine not located on a recorded plan	MACHINE READY 10:45 To play back or record plan, drive to start point i menu, ● record	NOT ON PLAN Record new plan (●) Scan location tag Delete tag #227 ◀ exit, i select Tag: 227
Location tag scanned. Machine is located within the start area of a recorded plan.	AUTONOMOUS CLEANING 10:45 Start point found Press ▶▶ to start plan i menu, ▶▶ start	AUTONOMY Start plan (▶▶) Scan location tag Delete this plan Delete tag #227 ◀ exit, i select Tag: 227
Location tag scanned. Machine is located on a recorded plan but not within the start area of the plan.	MACHINE READY 10:45 To play back or record plan, drive to start point i menu, ● record	ON PLAN Record new plan (●) Scan location tag Delete tag #227 ◀ exit, i select Tag: 227
Autonomy module is not responding	MACHINE READY 10:45 Autonomy not responding. Manual cleaning only. i menu, scrub on	AUTONOMY UNAVAILABLE Autonomy not responding Manual mode only ◀ exit

*Tag: 0 . . moving "0" indicates that machine is actively scanning for a location tag.

**Tag: Example "Tag: 227" where "227" is the location tag ID number.

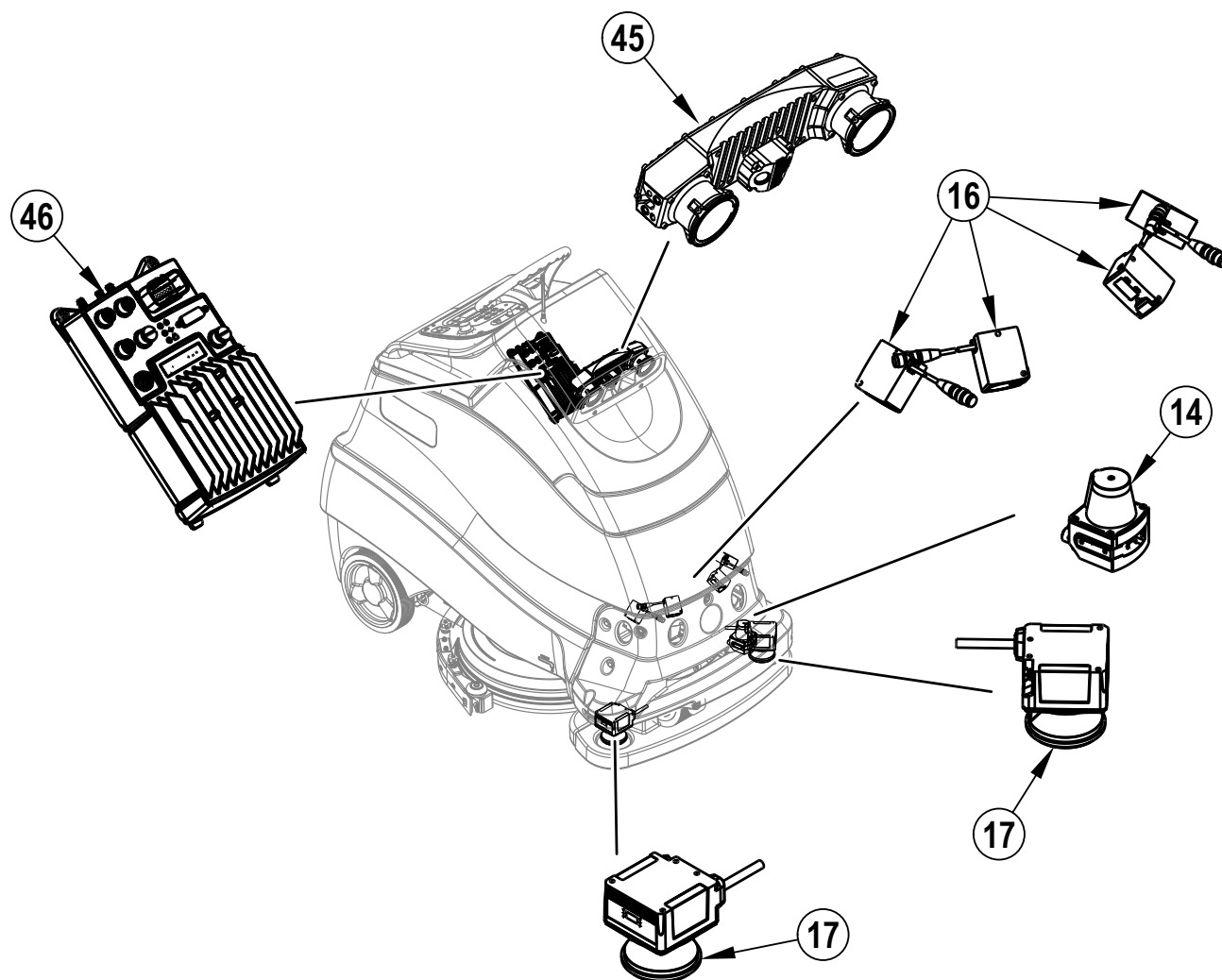
UNDERSTANDING AUTONOMY

The Nilfisk Liberty SC50 can function autonomously meaning that it functions (operates) on its own, on a plan determined by an operator without further operator involvement. The machine can record an area to clean independently and actively maneuver around certain obstacles.

Components that make up the Autonomy system, and their basic function, include the following (shown in Figure 1-1):

- 3-D Vision Sensor (45) - provides a three-dimensional image of the area in front of the machine.
- 2D Mapping Sensor (14) - provides detection of obstacles in front of and to the left of the machine.
- Drop-Off Sensor (16) - detect drop-offs, or major changes in floor elevation.
- Safety Sensor (17) - located at front corners of machine – aides in collision prevention and presence detection in the area of an operating machine.
- Autonomous Controller (46). This is the primary computer for safety during operation.*
- Computer software Interface, (not shown). Defines how the autonomous control system interfaces with machine control software and control system.

FIGURE 1-1



PREPARE THE MACHINE FOR USE

BATTERIES

If this machine shipped with batteries installed do the following:

- Check that the batteries are connected to the machine.
- Press the Power Switch (B) to power ON machine and check the Battery Indicator (X3). If the gauge is completely filled the batteries are ready for use. If the gauge is less than full the batteries should be charged before use. See the "Charging the Batteries" section.
- **IMPORTANT!: IF YOUR MACHINE HAS AN ONBOARD BATTERY CHARGER REFER TO THE OEM PRODUCT MANUAL FOR INSTRUCTIONS REGARDING SETTING THE CHARGER FOR BATTERY TYPE.**

If this machine shipped without batteries installed do the following:

- Consult an Authorized Nilfisk dealer for recommended batteries.
- Install the batteries by following the instructions below.
- **IMPORTANT!: THIS MACHINE HAS AN ONBOARD BATTERY CHARGER REFER TO THE OEM PRODUCT MANUAL FOR INSTRUCTIONS REGARDING SETTING THE CHARGER FOR BATTERY TYPE.**

INSTALL THE BATTERIES

WARNING !

Use extreme caution when working with batteries. Sulfuric acid in batteries can cause severe injury if allowed to contact the skin or eyes. Explosive hydrogen gas is vented from inside the batteries through openings in the battery caps. This gas can be ignited by any electrical arc, spark or flame. If battery acid makes contact with your skin or eyes, flush the affected area with water for 5 minutes and seek medical attention.

When Servicing Batteries...

- Remove all jewelry to avoid accidental shorts.
- Do not smoke.
- Wear safety glasses, a rubber apron and rubber gloves.
- Work in a well-ventilated area.
- Do not allow tools to touch more than one battery terminal at a time.
- ALWAYS disconnect the negative (ground) cable first when replacing batteries to prevent sparks.
- ALWAYS connect the negative cable last when installing batteries.

CAUTION !

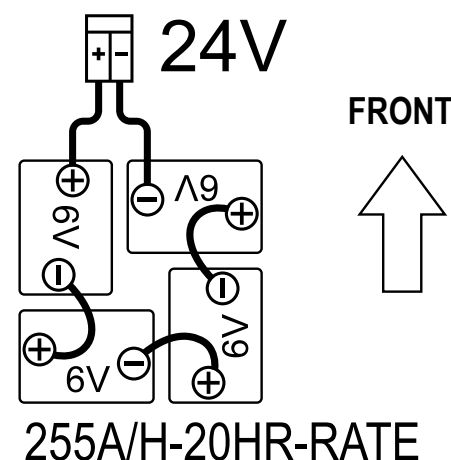
Electrical components in this machine can be severely damaged if the batteries are not installed and connected properly. Batteries should be installed by Nilfisk or by a qualified electrician.

Only batteries approved for use in this machine by Nilfisk shall be installed.

- 1 Empty the Recovery Tank (22) using the Recovery Tank Drain Hose (37).
- 2 Press the Power Switch (B) to power OFF machine and remove the magnetic SmartKey. Unlatch (36) then swing open the Recovery Tank Cover (20) and set the Prop Rod (39).
- 3 Tip the Recovery Tank (22) back towards the operator's platform to expose the battery compartment. Note: The recovery tank can be removed for complete access to the batteries if desired. See service manual for recovery tank removal steps.
- 4 Using (2) people and an appropriate lifting strap, carefully lift the batteries into the compartment tray exactly as shown. Refer to the molded diagram on the underside of the Recovery Tank Cover.
- 5 **See Figure 2-1.** Install battery cables as shown and carefully tighten the nut in each battery terminal until the battery cable will not rotate. Do not over-tighten the terminals, or they will be very difficult to remove for future service.
- 6 Install the battery boots and secure tightly to the battery cables with the supplied tie straps.
- 7 Connect the machine's main power cables to the batteries. Close the recovery tank cover.

When changing batteries or the charger, please contact a local authorized service center for correct battery, charger and machine settings to prevent battery damage.

FIGURE 2-1



LOCATION TAG

The machine uses a Location Tag (44) to identify its specific position within the building see **Figure 2-2**.

- 1 The location tag should be mounted permanently on a wall or fixed flat object.
- 2 Machine needs an unobstructed view of the tag.
- 3 Place the tag in an area where there is a static environment*.
- 4 Tag needs to be in a well-lit area for machine to scan.
- 5 Mount the tag at a maximum height of 4' (1.2 m)**.
- 6 The top edge of the tag must be level with the floor.
- 7 A unique tag is required for each floor of a building.
- 8 Have a location tag no more than 65' (20m) from the plan start for best results.
- 9 Dividing up very large areas and using more than one tag can improve performance.
- 10 Do not place one tag within view of another tag.***

When scanning a location tag, park machine so that it is;

- 1 Perpendicular to the wall to properly read the tag.
- 2 A distance of about 3' (1m) away from the tag.

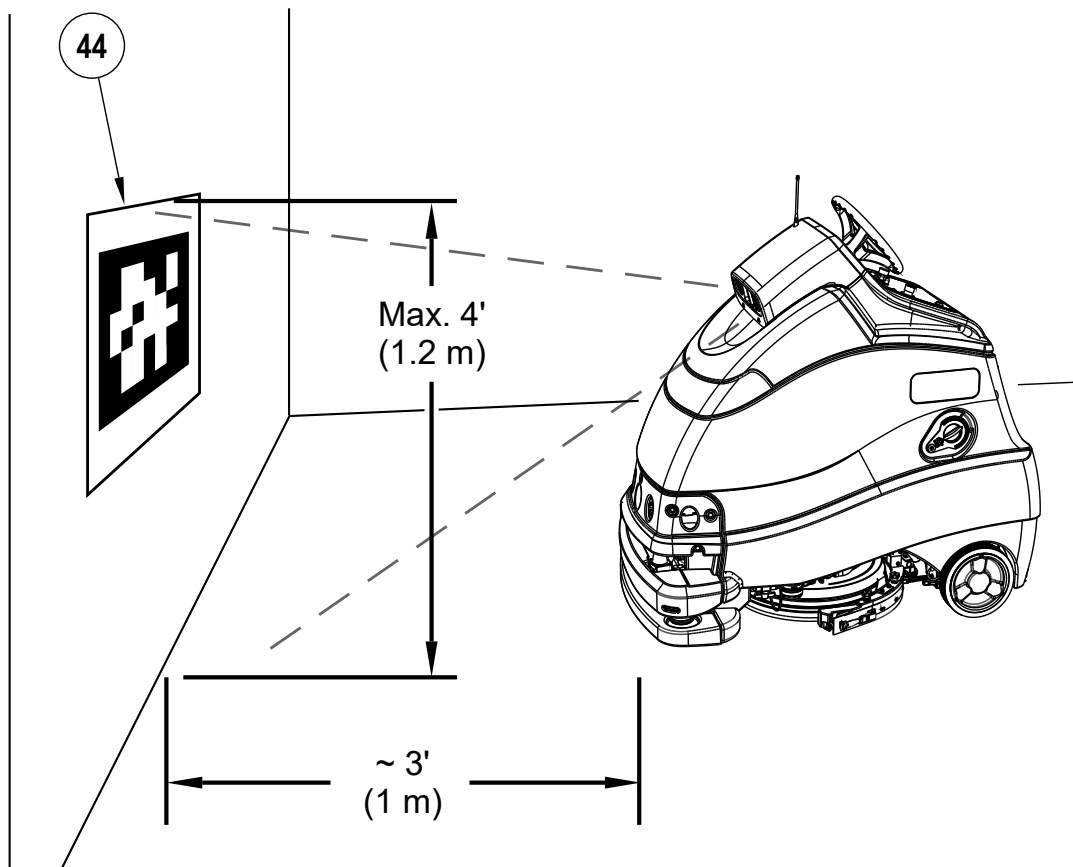
*The location tag should be placed in an area where there are not movable objects (i.e. garbage cans or other equipment). The machine records information when setting the location tag position, if there are new obstacles each time within the vicinity of the location tag, the recorded plan will shift.

** The machine's 3-D vision sensor cannot see much above the height of the steering wheel. Placing the tag so the top edge is 4' (1.2m) or less off the floor will ensure the tag is visible to the 3-D vision sensor.

*** If using more than one tag in a large area, do not place them so close together that two could be seen by the 3-D vision sensor at the same time. Scanning errors may occur.

IMPORTANT! Prior to recording any plans the location tag has to be installed and identified by the machine.

FIGURE 2-2



LOCATION TAG POSITION

• SCAN LOCATION TAG

At Machine Start Up Need to View Location Tag

Each time the machine is powered ON, a location tag will need to be scanned for autonomous use (manual mode available without scanning tag).

- 1 Follow the steps under "Location Tag" section of this manual to properly affix a location tag (44) to the wall.
- 2 **See Figure 2-21.** Power machine ON. Upon machine start up Countdown Timer (X26) indicates Autonomy system is booting up. The machine prompts operator to drive to a location tag by displaying "For autonomous cleaning, drive to location tag".
- 3 Drive the machine so the location tag is within view of the machine's 3-D vision sensor (1-2 meters in front of location tag).
- 4 Once autonomy system is booted up the machine will begin actively scanning for a location tag. Moving "o" (X35) indicates machine is actively scanning for a location tag **see Figure 2-22.**
- 5 Machine processes Location Tag (LED Status Bar will be white with blue corners when attempting to read location tag).
 - a. If the Location Tag is new the machine will"
 - indicate "New tag found." ask to "Add this tag?". Select "Yes" to add this as the current location tag **see Figure 2-23.**
 - emit a two tone ascending sound.
 - moving "o" will be replaced with location tag ID # i.e. 155 **see Figure 2-24.**
 - LED Status Bar will turn off.
 - b. If the Location Tag is recognized the machine will;
 - load the existing map associated with the tag.
 - emit a two tone ascending sound.
 - moving "o" will be replaced with location tag ID # i.e. 155 **see Figure 2-24.**
 - LED Status Bar will turn off.
- 6 Machine is ready for autonomous use.

FIGURE 2-21

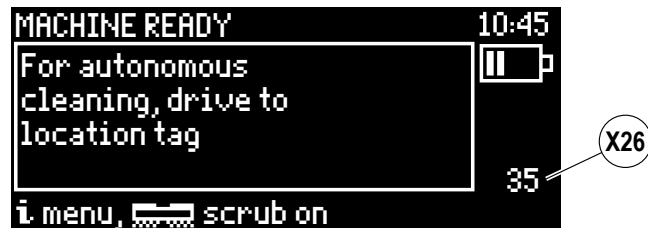


FIGURE 2-22

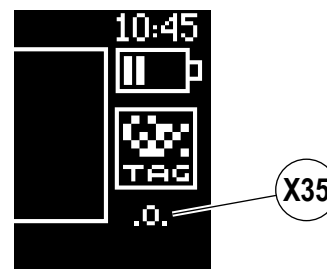


FIGURE 2-23

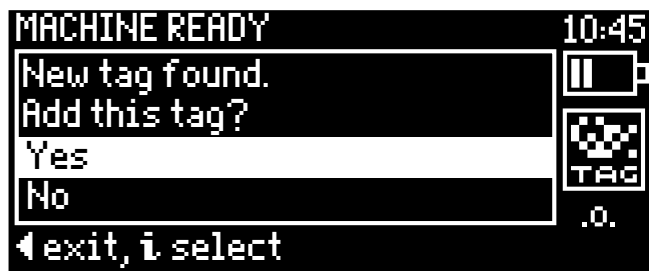


FIGURE 2-24



LOCATION TAG POSITION - CONTINUED

• SCAN LOCATION TAG

The machine can save multiple Location Tags and each tag can associate to multiple plans. Only one Location Tag is active at a time. To playback a plan associated to a different tag, machine needs to be told to Scan Location Tag (disassociate the current tag and scan a different tag). **See Figure 2-25. NOTE:** Menu options will vary based on key permissions.

- 1 Drive the machine so the desired location tag is within view of the machine's 3-D vision sensor (1-2 meters in front of location tag).
- 2 Press Autonomous Help Screen Switch (**S**) to enter menu.
 - a. **See Figure 2-26.** Press up or down arrow to highlight "Scan location tag" to use a different tag and playback it's saved plans.
 - b. Press "i" button to "select".
 - c. Press up arrow to highlight "Yes".
 - d. Press "i" button to "Save".
 - e. Display will change and machine will begin actively scanning for a location tag. Moving "0" below "TAG" indicates machine is actively scanning for a location tag.
 - f. After tag is scanned, machine will emit a two tone ascending sound and the display will show location tag ID # (xxx). Plans saved to this location tag can now be played back.

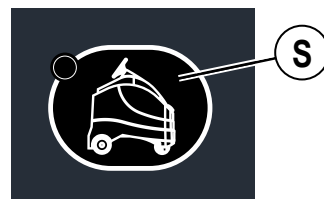


FIGURE 2-25

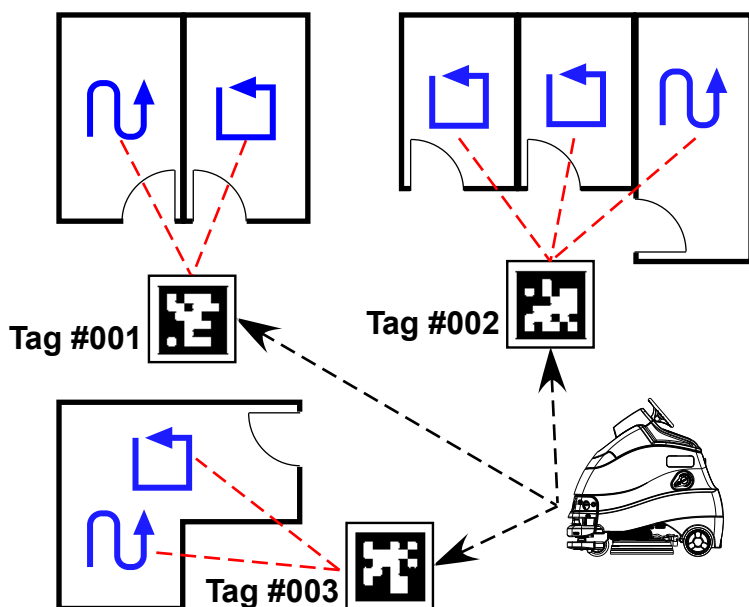


FIGURE 2-26

```
NOT ON PLAN
Record new plan (●)
Scan location tag
Delete tag #227
← exit, i select Tag: 227
```

• DELETE LOCATION TAG

- 1 Drive the machine so the new location tag is within view of the machine's 3-D vision sensor.
- 2 Press Autonomous Help Screen Switch (**S**) to enter menu.
 - a. **See Figure 2-27.** Press up or down arrow to highlight "Delete tag #xxx" to delete.
 - b. Press "i" button to "select".

FIGURE 2-27

```
NOT ON PLAN
Record new plan (●)
Scan location tag
Delete tag #227
← exit, i select Tag: 227
```

MAGNETIC SMARTKEY™

The use of a Magnetic SmartKey™ (Z) is required to operate this machine. Pressing the power switch without a key in place on the SmartKey Reader (A) will cause the machine to momentarily turn on and display Key Indicator (X19) before turning off.

- The key is required at machine startup. If the operator steps off the machine and removes the key, it must be placed back on the reader before machine operation is allowed.
- The key can be removed at any time after initial machine start up, but must be removed from the reader before autonomous playback can begin.

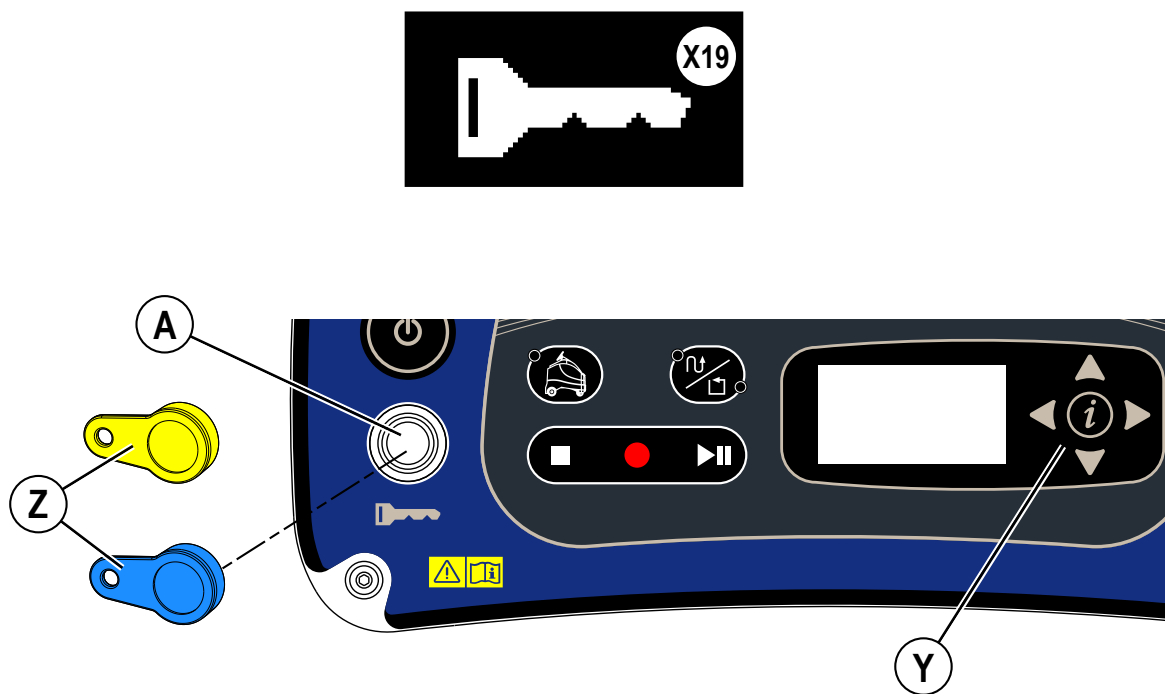
There are two different Magnetic SmartKeys (Z).

1. The "User" (blue) key allows a basic level of access to the information menu (press Information Switch (Y)).
2. The "Supervisor" (yellow) key allows an additional level of access.

NOTE: Use the yellow "Supervisor" key during initial machine set up. By default the blue "User" key doesn't have access to add/delete Location tags or record/delete plans.

3. Additional access is available as a "Technician". The service menu allows observing operational and user parameters. The configuration menu allows adjusting machine settings. See Service Manual for more details.

FIGURE 2-3



INSTALL THE BRUSH (DISC SYSTEM)

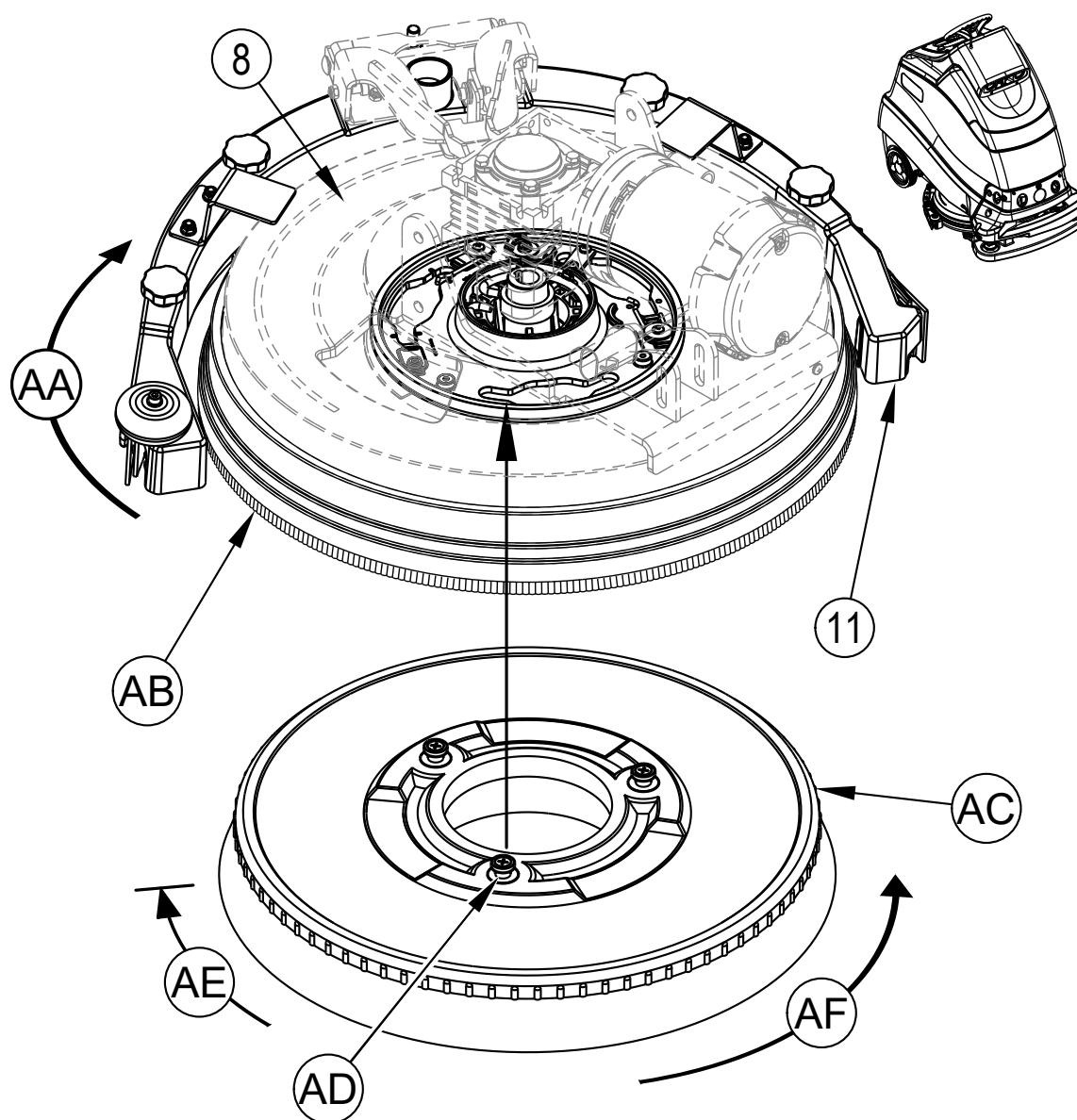
- 1 Verify which brush or pad is appropriate for the floor surface to be cleaned.
- 2 Make sure the Scrub Deck (8) is in the RAISED position. Make sure the Power Switch (B) is off.

CAUTION !

Turn the machine OFF at the power switch and remove the SmartKey, before changing the brush.

- 3 **See Figure 2-4.** From the right side of the machine, rotate the Squeegee Assembly (11) towards the left side of the machine to create better access to the brush, (AA).
- 4 Lift the Scrub Deck Skirt (AB) up and slide the brush under the scrub deck.
- 5 If using a pad, install the pad on the pad holder. It uses a central locking device.
- 6 To mount the Brush (AC) (or pad holder) lift the brush and align the Lugs (AD) on the brush with the holes on the mounting plate then turn to lock in place (from the right side of the machine, turn the outside edge of brush towards the rear of machine as shown (AE)). **NOTE:** During operation the brush should rotate in direction (AF).

FIGURE 2-4



INSTALL THE PAD (REV SYSTEM)

- 1 Make sure the Scrub Deck is in the RAISED position. Make sure the Power Switch (B) is off.

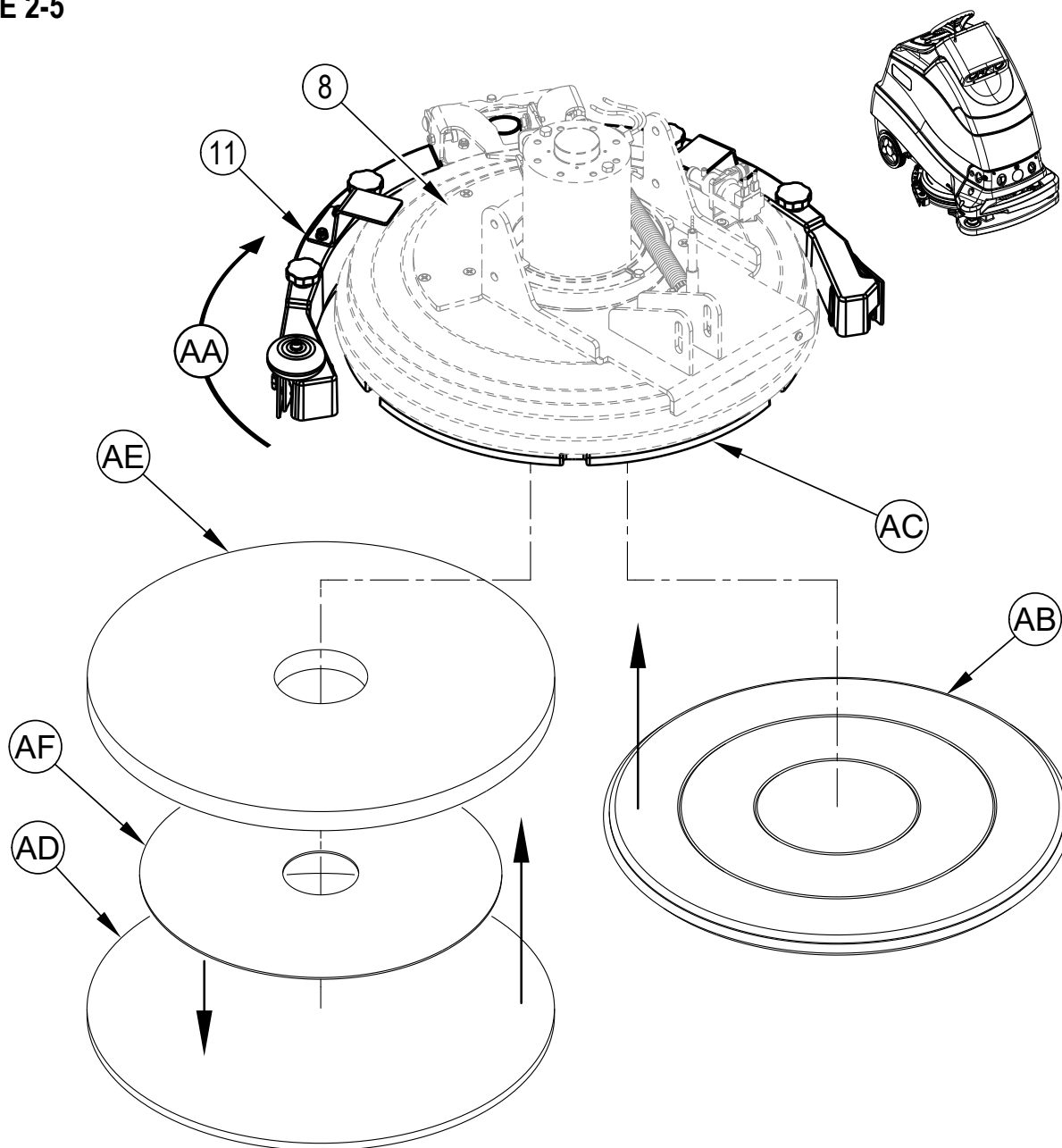
CAUTION !

Turn the machine OFF at the power switch and remove the SmartKey, before changing the pad.

- 2 **See Figure 2-5.** From the right side of the machine, rotate the Squeegee Assembly (11) towards the left side of the machine to create better access to the pad, (AA).
- 3 **Daily Scrubbing:** Slide a daily scrubbing pad (AE) or Microfiber Pad (AB) under the pad driver, center it on the fixed pad driver (AC) and lift it upwards and press it onto the harpoon face of the pad driver.
- 4 **Floor Finish Removal:** Install a new red pad (AE) to the pad driver (AC) as described in step 3 above. If using the optional double sided Velcro (AF), attach it to the center of maroon SPP pad (AD) and slide this assembly under the red pad and center it and then press upwards to attach this assembly to the red pad. If the optional double sided Velcro is not used, install a new red as described in step 3 above and place a new maroon SPP pad on the floor centered on the red pad. Lower the deck to the floor on top of the maroon SPP pad and check that it is centered.

NOTE: Never attach a maroon SPP pad directly to the pad driver, damage to the pad driver will result requiring replacement.

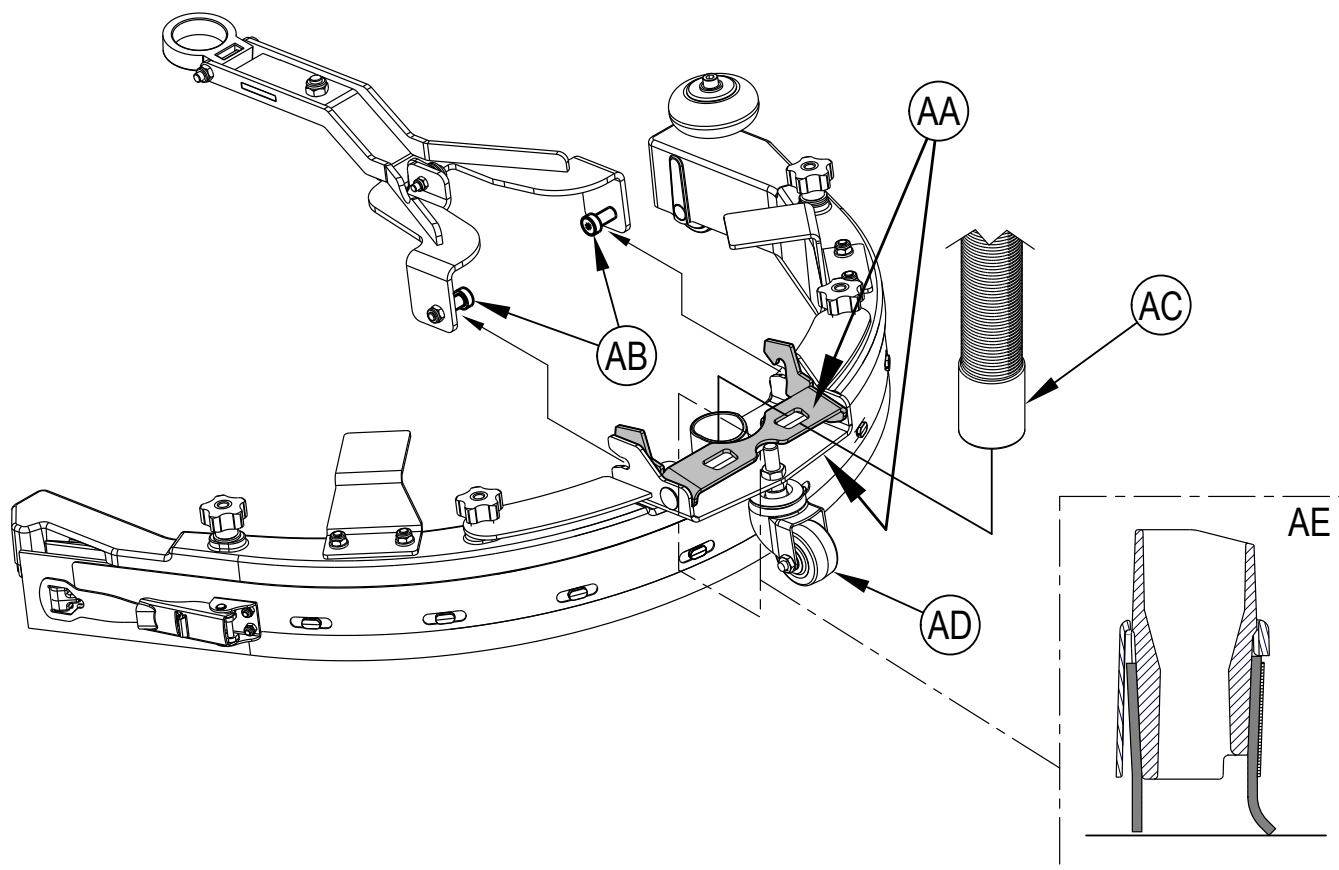
FIGURE 2-5



INSTALL THE SQUEEGEE

- 1 **See Figure 2-6.** Squeeze the back of the Squeegee Mount Bracket (**AA**) to open and release the bracket once it's in place over the deck arm Pins (**AB**).
- 2 Lower the scrub deck and squeegee.
- 3 Connect the Recovery Hose (**AC**) to the squeegee inlet.
- 4 Move the machine ahead slightly. If necessary adjust the rear squeegee height using the Rear Caster Wheel (**AD**) so that the rear squeegee blade touches the floor evenly across its entire width and is bent over slightly as shown in the squeegee cross section (**AE**).

FIGURE 2-6



FILL THE SOLUTION TANK

Open the Solution Tank Fill Cap (41) then fill the tank with a maximum of 14 US gallons (53 liters) of cleaning solution. The amount of solution in the tank can be observed by looking at the Solution Tank Level Sight Tube (38).

The machine is equipped with EcoFlex a detergent dispensing system. When using this system the solution tank should be filled with plain water. The machine can also be used conventionally with detergent mixed with water in the tank. Always follow the dilution instructions on the detergent container label. The solution should be a mixture of water and the proper cleaning detergent for the job.

CAUTION!

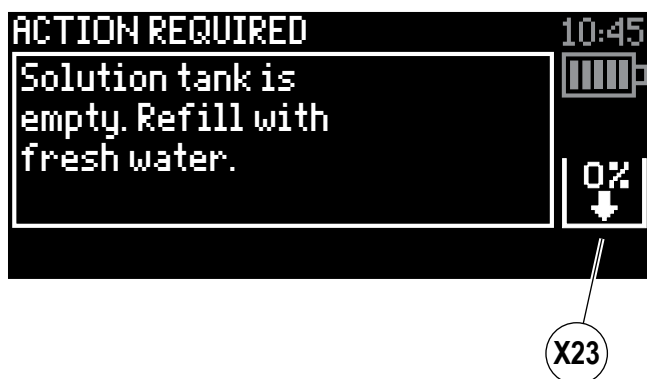
Use only low-foaming, non-flammable liquid detergents intended for automatic scrubber machine applications. Water temperature should not exceed 130 degrees Fahrenheit (55 degrees Celsius).

NOTE: When refilling the solution tank always empty the recovery tank using Recovery Tank Drain Hose (37).

SOLUTION TANK INDICATOR

See Figure 2-7. The solution pump can sense when there is no solution present and send a signal that the solution tank is empty. Once the tank is empty the Solution Empty Indicator (X23) will flash on the display.

FIGURE 2-7



DETERGENT SYSTEM PREPARATION (ECOFLEX)

FILL THE DETERGENT TANK

CAUTION!

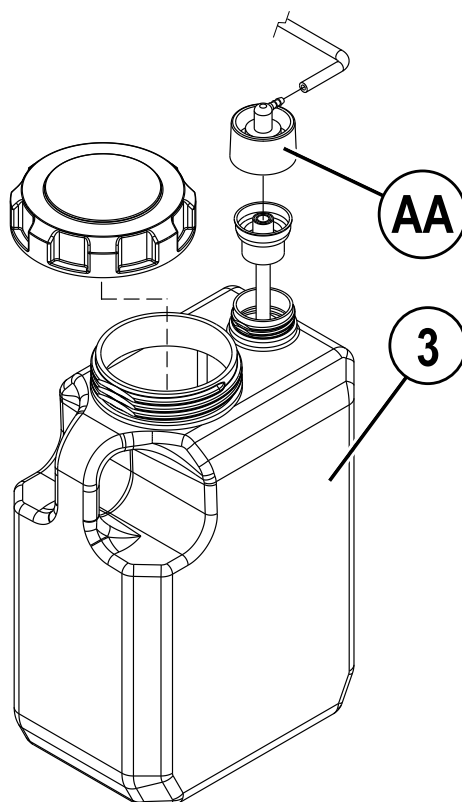
Always follow the instructions on the labels of the detergent bottles when using floor cleaning detergents. Wear the appropriate personal protective equipment such as gloves and eye protection when handling floor cleaning detergents.

The Detergent Cartridge (3) is located under the Control Panel Housing (20). Fill the detergent cartridge with a maximum of 1 gallon (4 Liters) of detergent. **SERVICE NOTE:** Remove the detergent cartridge from the machine prior to filling to avoid spilling detergent on the machine.

It is recommended that a separate cartridge be used for each detergent you plan to use. The detergent cartridges have a white decal on them so you can write the detergent name on each cartridge for clarification. When installing a new cartridge, remove the factory cap and place the cartridge in the machine. Install the Dry Break Cap (AA) as shown in **Figure 2-8**.

The system should be purged of previous detergent when switching to a different detergent (see "To Purge When Changing Detergent" below).

FIGURE 2-8



DETERGENT SYSTEM PURGE

To Purge When Changing Detergent (SCRUB AND SOLUTION SYSTEMS MUST BE OFF):

SERVICE NOTE: Move machine over floor drain before purging because a small amount of detergent will be dispensed in the process.

- 1 Disconnect and remove the detergent cartridge.
- 2 Place the Magnetic SmartKey (Z) onto SmartKey Reader (A). Press the Power Switch (B) to power ON machine. Wait a few seconds for the start-up sequence to finish.
- 3 Press and hold the Solution Switch (J) and the Detergent Switch (K) down for 2 seconds. Release the switches when the Detergent Purge Indicator (X17) appears on the display (the Detergent Switch Light (K1) and Solution Switch Light (J1) will be ON). **NOTE:** Once activated the purge process takes 20 seconds (timer countdown will display). Press (J) and (K) again before 20 seconds to cancel purge. See illustration on next page for Detergent System indicators. Normally one purge cycle is adequate to purge the system.

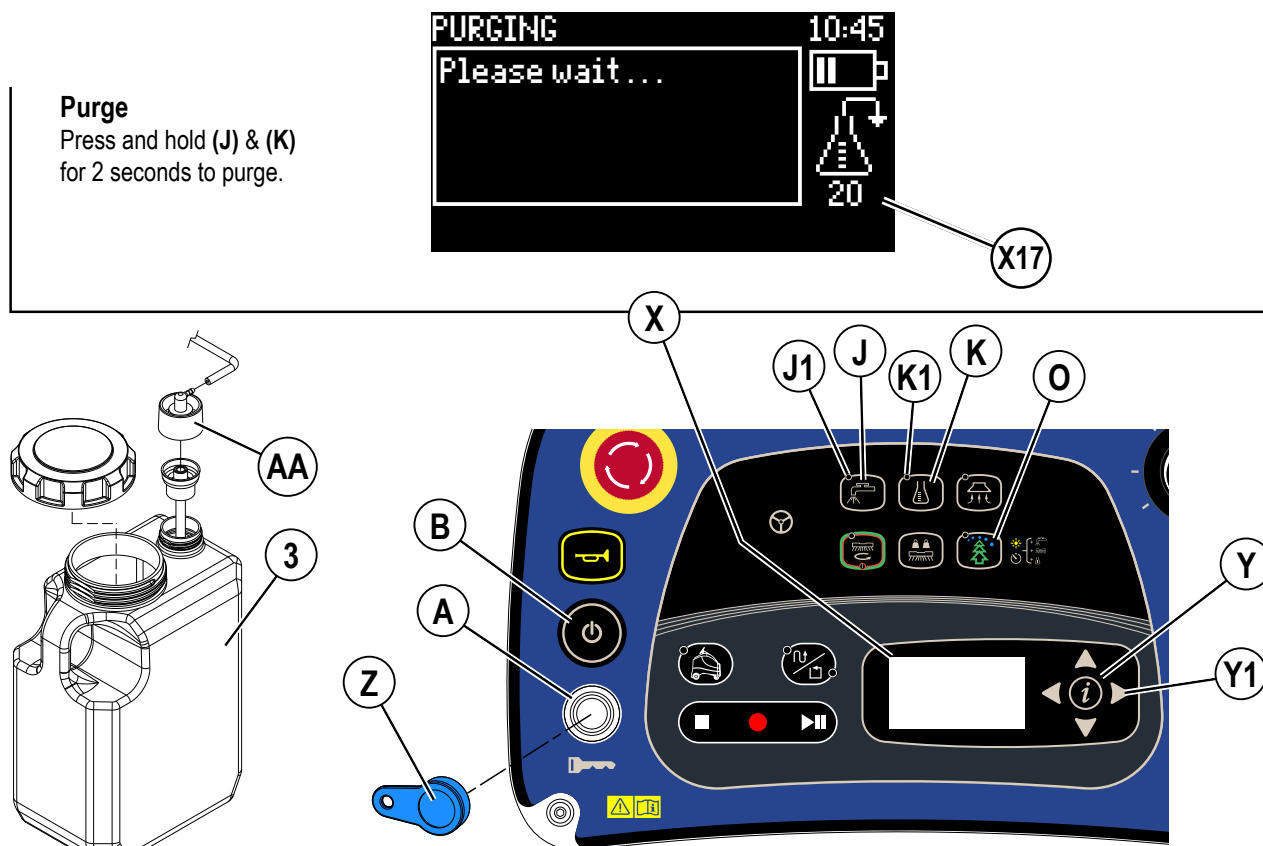
To Purge Weekly (SCRUB AND SOLUTION SYSTEMS MUST BE OFF):

- 1 Disconnect and remove the detergent cartridge. Install and connect a Cartridge filled with clean warm water.
- 2 Follow steps 2 and 3 from "To Purge When Changing Detergent".

When the detergent level is nearing the bottom of the cartridge it is time to refill or replace the cartridge.

SERVICE NOTE: Follow the "To Purge Weekly" instructions above if the machine is going to be stored for an extended period of time.

FIGURE 2-9



DETERGENT SYSTEM USE (ECOFLEX)

Detergent Ratio (SCRUB AND SOLUTION SYSTEM MUST BE ON):

No detergent is dispensed until the scrub and detergent systems are activated, direction is selected (**Q**) or (**R**) and the Go Pedal (**24**) is pushed.

- The Detergent Indicator (**X6**) will be displayed in scrub mode when the detergent system is installed on the machine.
- The Detergent Ratio/Percentage Indicator (**X7**) will display the selected ratio/percentage when the detergent system is on.

There are 4 modes of EcoFlex operation:

- 1A. Chemical Free Cleaning Mode** - During scrubbing, the detergent system can be turned off at any time by pressing the Detergent Switch (**K**) to allow scrubbing with water only. Detergent Ratio/Percentage Indicator (**X7**) will be blank and Detergent Indicator Bar Graph (**X8**) will display no bars filled. Detergent Light (**K1**) will be off.
- 2A. Detergent Low Mode** - Activated by pressing the Detergent Switch (**K**) when detergent is off (repeated presses will cycle to High Mode, off and back to low mode). Detergent Ratio/Percentage Indicator (**X7**) will display the current low detergent level and Detergent Indicator Bar Graph (**X8**) will display first bar filled. Detergent Light (**K1**) will be on. See below the steps "To program the Detergent Low Level".
- 3A. Detergent High Mode** - Activated by pressing the Detergent Switch (**K**) when detergent is at low mode (repeated presses will cycle to low mode, off and back to high mode). Detergent Ratio/Percentage Indicator (**X7**) will display the current high detergent level and Detergent Indicator Bar Graph (**X8**) will display left and right bars filled. Detergent Light (**K1**) will be on. See below the steps "To program the Detergent High Level".
- 4A. Burst of Power Cleaning Mode** - Press the Burst of Power Switch (**O**) to enter Burst of Power mode. Burst of Power Indicator (**X22**) will blink for one minute on the display along with a 60 second timer countdown. Press Switch (**O**) again before 60 seconds to cancel Burst of Power. The amount of time Burst of Power runs is adjustable (see "Information Menu Display" submenu "Options").
 - Detergent ratio will increase to the pre-programmed "high concentration" detergent level (as noted in programming instructions below). Detergent system will be turned ON at "high concentration" detergent level if it was OFF.
 - Solution flow rate will increase to the next higher level.
 - Scrub pressure will increase to the next level.
 - Vacuum power will increase to the next level, unless the vacuum system is off then it will remain off.

To program the Detergent High Level

1. Press the Information Switch (**Y**) to enter the information menu. Use the four Navigation Arrows (**Y1**) (up, down, left & right) to move through the menu.
2. Scroll to "Options" and press the right navigation button to enter the Options menu. **NOTE:** Supervisor key required to access Options menu.
3. Scroll down to "Detergent High" press the right navigation button to select the ratio/percentage.
4. Scroll up or down to "Edit" (cycle through) available values: (Note: only ratios/percentages that are a higher concentration than the low detergent setting will be available.
Ratio = 300:1, 256:1, 200:1, 150:1, 128:1, 100:1, 64:1, 50:1, 32:1, 26:1
Percentage = 0.3%, 0.4%, 0.5%, 0.7%, 0.8%, 1.0%, 1.5%, 2.0%, 3.0%, 3.8%.



CAUTION!

Do not use a concentration level exceeding the detergent manufacturer's recommendation.

5. Once the desired level is displayed on the screen press the right navigation button to "Save" your changes, or the left navigation button to "Cancel" your changes.

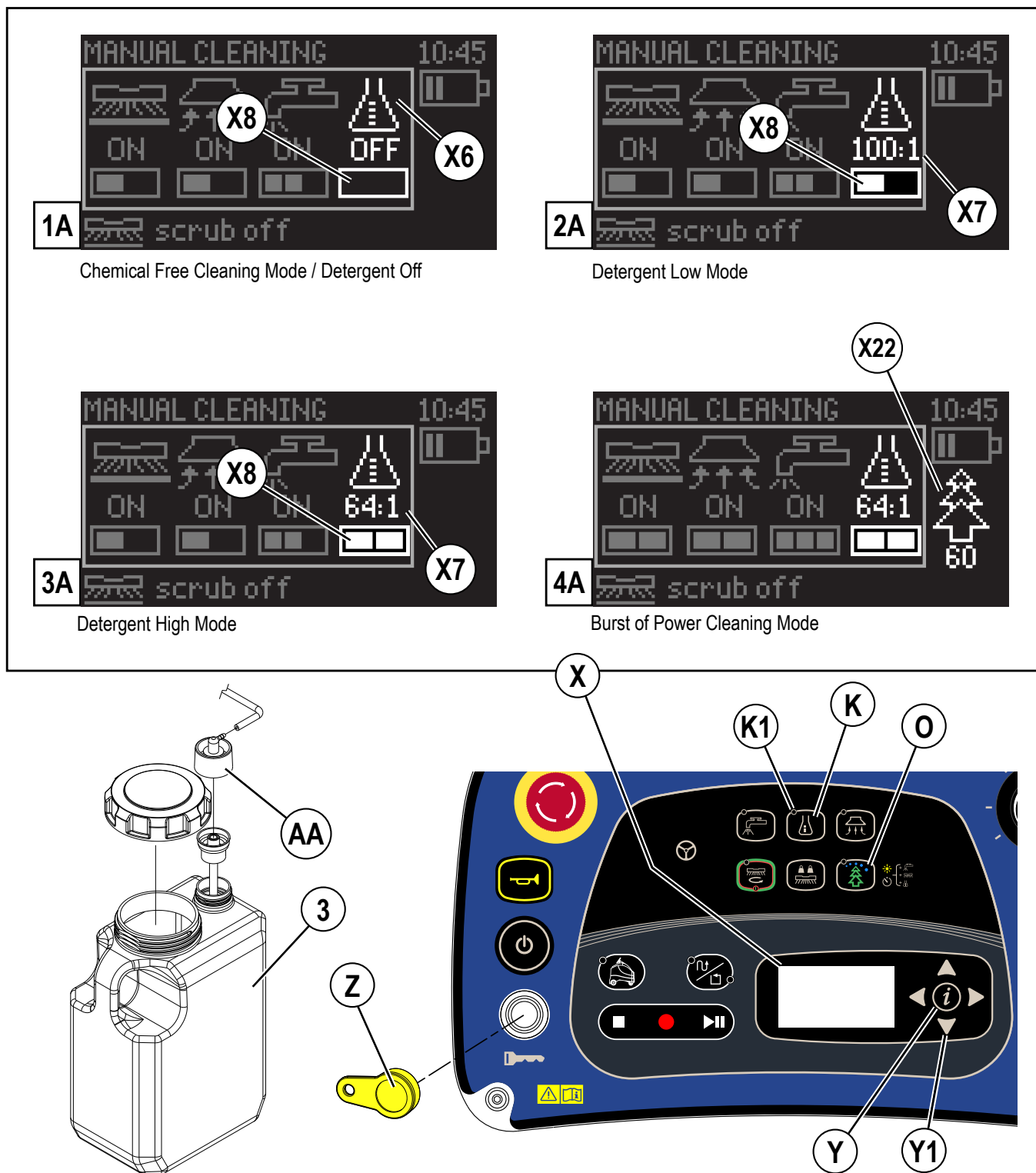
To program the Detergent Low Level

1. Press the Information Switch (**Y**) to enter the information menu. Use the four Navigation Arrows (**Y1**) (up, down, left & right) to move through the menu.
2. Scroll to "Options" and press the right navigation button to enter the Options menu. **NOTE:** Supervisor key required to access Options menu.
3. Scroll down to "Detergent Low" press the right navigation button to select the ratio/percentage.
4. Scroll to cycle through the available options. (Note: only ratios/percentages that are a lower concentration than the high detergent setting will be available.
5. Once the desired level is displayed on the screen press the right navigation button to "Save" your changes, or the left navigation button to "Cancel" your changes.

Once set, the detergent flow rate automatically increases and decreases with the solution flow rate, but the detergent ratio/percentage remains the same.

DETERGENT SYSTEM PREPARATION AND USE (ECOFLEX)

FIGURE 2-10



OPERATING THE MACHINE

WARNING!

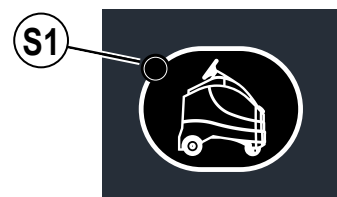
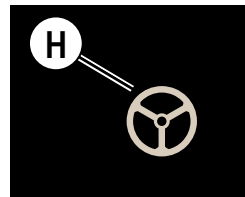
Be sure you understand the operator controls and their functions.

While on ramps or inclines, avoid sudden stops. Avoid abrupt sharp turns. Use low speed down ramps.

Operating Modes

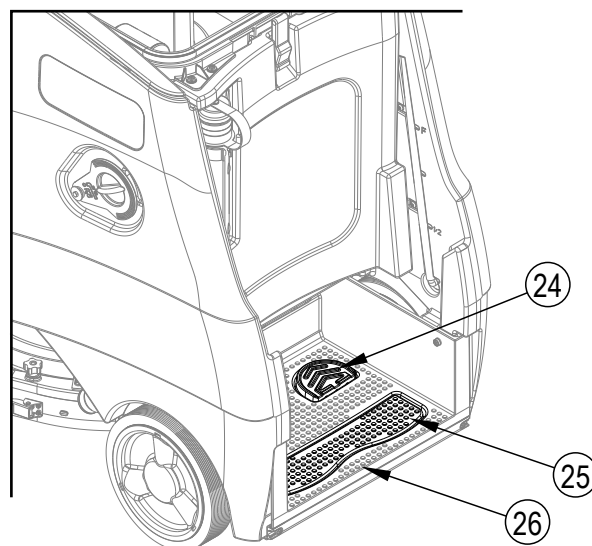
The Nilfisk Liberty SC50 has three operating modes:

- **Manual Operating Mode:** Provides normal functioning of the machine, without autonomy. In this mode the machine is driven and controlled by an operator, and operates in a conventional manner. The machine must be driven in the manual mode while creating plans the machine will follow during Autonomous Operation. This includes driving to and from the autonomous scrubbing plans (locations). Full details of the Manual Operating Mode are contained in the *OPERATING THE MACHINE MANUAL MODE* section of this manual.
 - This mode is active whenever the Manual Operation Indicator (**H**) is lit.
- **Autonomous Mode:** The Autonomous Operating Mode is used to perform scrubbing operations automatically, without active Operator involvement. This is done by recording a specific path to follow or the perimeter of an area.
 - Plans may also include specific actions the machine will make while performing the scrubbing activity. Such actions might include knowing when to raise or lower the scrub deck, how much solution to dispense. When played back, the plan tells the machine exactly what to do; what path it should follow, and what scrubbing actions it should take along the way.
 - To operate autonomously, the machine needs to always know exactly where it is in relation to the recorded plan, and the operating environment. This mapping process operates constantly, in every operating mode, whenever the machine is turned on.
 - This mode is active whenever Autonomous Mode Indicator (**S1**) is lit.
- **Recording Mode:** Used to create plans (either CopyCat™ or Fill-In) the machine will follow when scrubbing autonomously. Before the machine can operate autonomously, the operator must record a specific plan(s) to follow while scrubbing. During recording, both the route to travel and scrub settings are recorded and saved.
 - This mode is active whenever both the Manual Operation Indicator (**H**) and Autonomous Mode Indicator (**S1**) are lit.



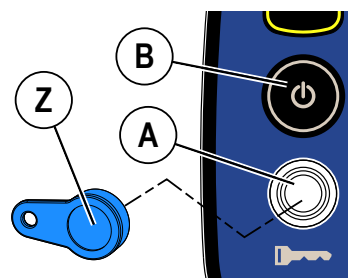
STARTING THE MACHINE

- 1 Follow the instructions in "Preparing the Machine for Use" section of this manual and verify the following;
 - Location tag is properly installed to a wall.
 - Location Tag Position is set (required for autonomous operation).
 - Vision and sensor lenses are clean, see *CLEAN SENSOR LENSES* section.
 - Batteries are fully charged.
 - Exterior of machine is free of damage. Report any damage to your supervisor.
 - Proper brush/pad is correctly installed.
 - Squeegee is installed.
 - Solution tank is full.
 - Recovery tank is empty.
 - Ensure that area to be scrubbed is clear of obstacles that are not fixed, such as hoses, buckets or pails, boxes, electrical cords, carts, pallets, etc.
- 2 **See Figure 3-1.** Step onto the Platform (26) compressing Operator's Presence Pedal (25).

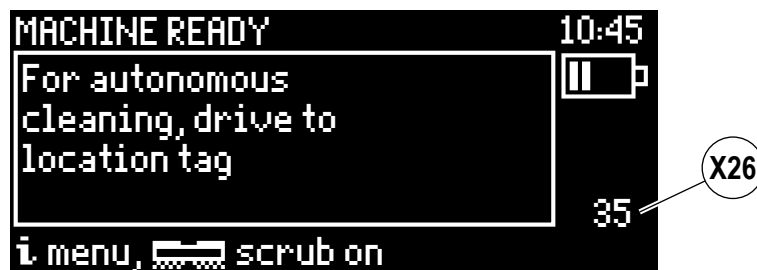


STARTING THE MACHINE - CONTINUED

- 3 Place the Magnetic SmartKey (Z) onto the SmartKey Reader (A). Press the Power Switch (B) to turn on the machine.



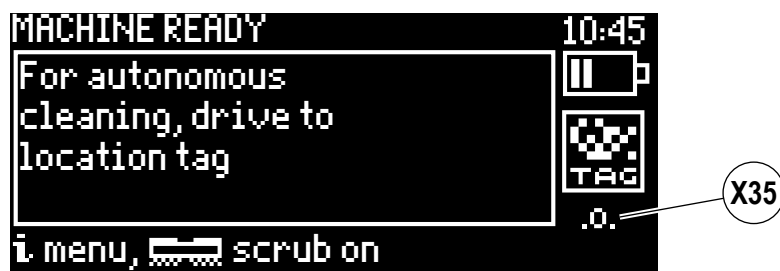
- 4 At startup, the machine conducts a system self-test for the Autonomous Operating Mode. This test takes about 70 seconds to complete. Display will indicate the system is booting by showing Countdown Timer (X26) during the startup sequence. If the autonomy system fails to boot up the display will show message "Autonomy not responding. Manual mode only." manual mode is available.



- 5 Once autonomy is ready the machine will begin actively scanning for a location tag, display will show a moving "o" (X35).

- 6 Drive the machine so the new location tag is within view of the machine's 3-D vision sensor.

- 7 After location tag is scanned the moving "o" will be replaced with the tag ID #.



- 8 Reference the Battery Condition Indicator (X3).

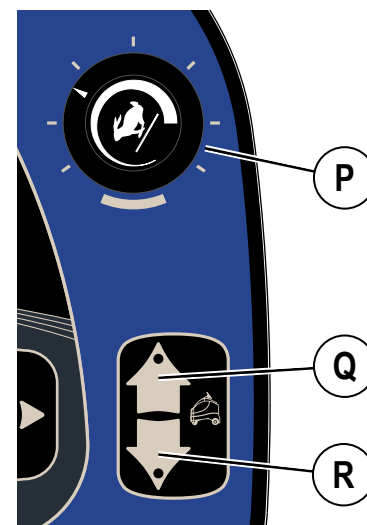
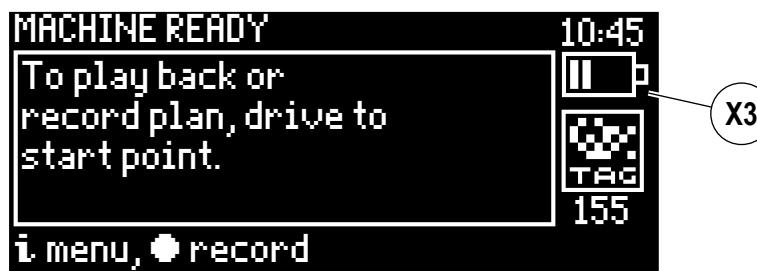
- 9 The Manual Operation Indicator (H) will be lit.

- 10 To transport the machine to the work area, first push the Forward Drive Switch (Q) or Reverse Drive Switch (R) to select the direction of travel and then apply pressure with your foot on the Go Pedal (24). An audible alert from the speaker will sound in reverse.

NOTE: Stepping off of the Operator's Presence Pedal (25) for more than 2 seconds will cause the Forward or Reverse Drive Switch Indicator to turn off. The operator will need to select forward or reverse again before the machine can be driven.

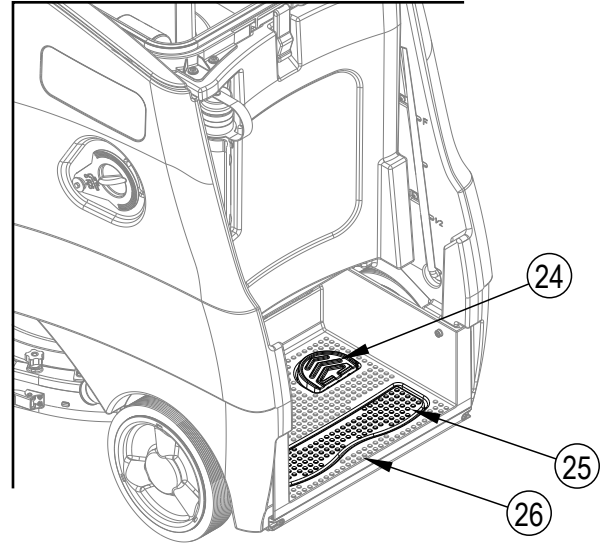
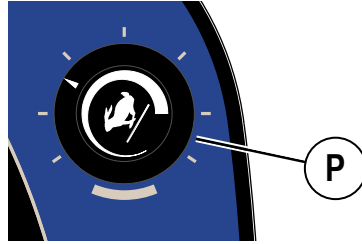
- 11 Adjust machine speed by rotating the Speed Adjustment Knob (P) clockwise to go faster or counterclockwise to go slower.

NOTE: While the machine is operating in autonomous mode the machine's speed is set by the computer and not adjustable by using the speed adjustment knob.

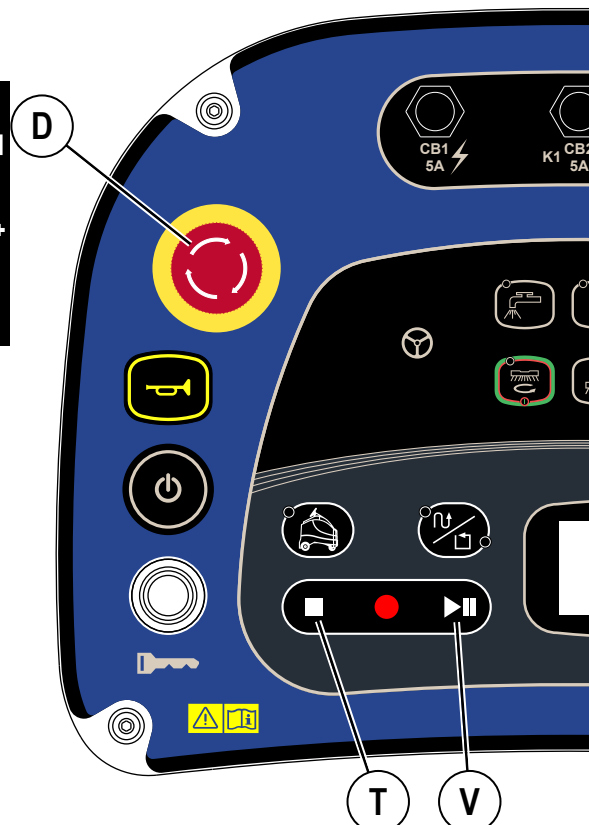
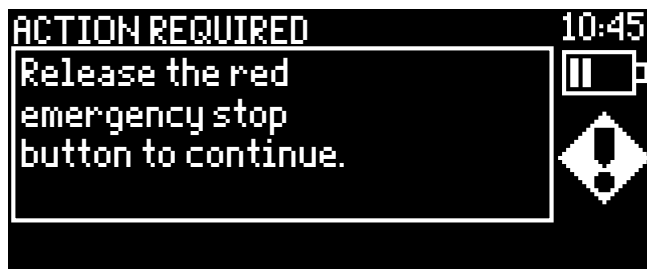


STOPPING THE MACHINE

- 1 Stop the machine by releasing the Go Pedal **(24)** or rotating the Speed Adjustment Knob **(P)** all the way counter-clockwise while operating in Manual Mode.

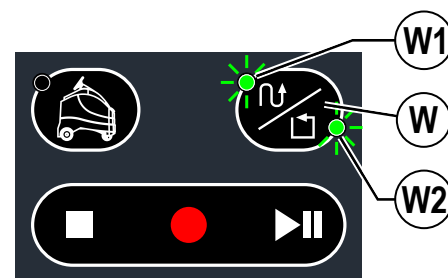


- 2 In Autonomous Mode machine can be stopped by one of the following methods;
- Stepping onto the Operator Presence Pedal **(25)**, (this will temporarily stop machine, if operator stays on machine for 30 seconds it will exit autonomous mode)
 - Pressing the Stop Switch **(T)** or the Play/Pause Switch **(V)**
 - A temporary resume area will be created for each of these situations (plan can resume playback from the location machine was stopped).
- NOTE:** The electromagnetic brake built into the drive wheel is engaged automatically when the Go Pedal is not pressed (or in autonomous mode when machine stops playback).
- 3 In the event of an emergency, to stop all machine functions immediately, press the Emergency Stop **(D)**.
- The display will state "Release the red emergency stop button to continue".
 - To reset the machine functions, rotate the emergency stop clockwise. **NOTE:** Machine steering still works with the Emergency Stop activated.
 - A temporary resume area will not be created if Emergency Stop is pressed (plan playback will have to begin at the plan's Start Point).



RECORDING PLANS FOR AUTONOMOUS MODE

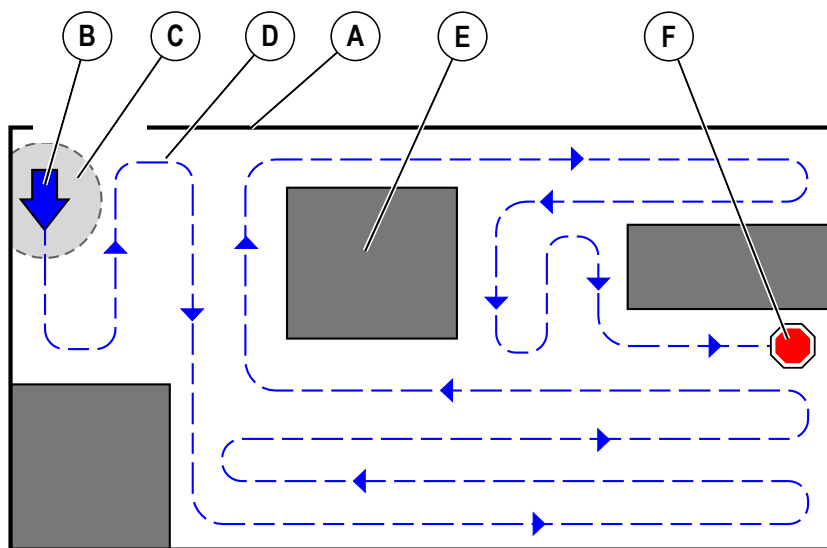
- There are two types of autonomous plans.
 - CopyCat™** – Machine will follow the same plan driven by the operator (default setting). The CopyCat Mode is used to stage scrubbing in hallways, aisles, and irregular-shaped areas. Indicator **(W1)** will be lit.
 - Fill-In** – Operator must drive the machine in a counter-clockwise plan around the perimeter of an area and the machine will clean the area contained within this closed plan (start and stop at the same point). The Fill-In Mode is used when scrubbing inside rooms or other confined areas. Indicator **(W2)** will be lit.
- Follow the instructions in [“Starting the Machine”](#) section.
- Decide where you want the plan to start “start point” and manually drive the machine to it for recording. See [“Tips for Choosing a Start Point”](#) and [“Tips for Recording a Plan”](#).
- See [“Recording CopyCat™ Plans”](#) on page 38 or [“Recording Fill-In Plans”](#) on page 40.



RECORD & PLAYBACK

COPYCAT PLAN

- A Map Area
- B Plan Start Point
- C Plan Start Area
- D Plan Route
- E Permanent Obstacle
- F Plan Stop Point

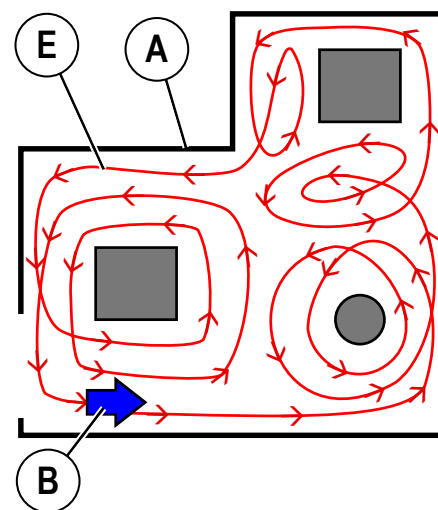
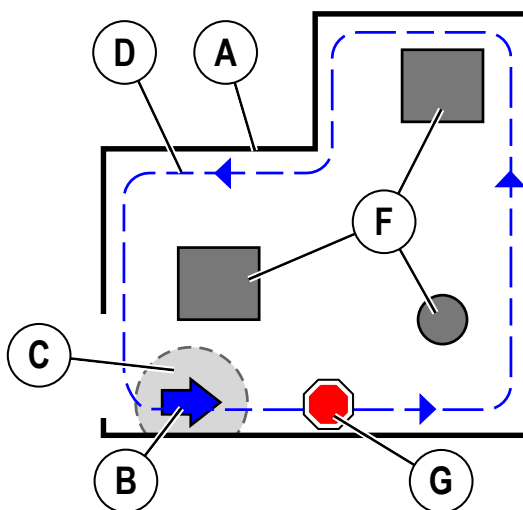
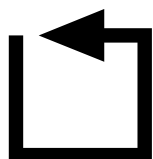


RECORD

PLAYBACK

FILL-IN PLAN

- A Map Area
- B Plan Start Point
- C Plan Start Area
- D Recorded Route
- E Playback Route
- F Permanent Obstacle
- G Plan Stop Point



RECORDING COPYCAT™ PLANS

- 1 Press Record Switch (U).
 - a. Highlight "Copycat" from menu.
 - b. Press Record Switch (U) to start recording.
 - c. Press One-Touch Scrub Switch (M) to turn scrubbing on/off where needed in the plan. While recording, the scrub settings can be adjusted as desired.
 - d. Begin to drive the machine along the plan route.
 - e. LED Status Bar (4) will emit a slow flashing green light.
- 2 Clean the area using the desired vacuum, solution, scrub and detergent settings.

- While recording CopyCat;

- a. Operate all of the scrub functions. Clean the floor as if in manual mode. See section "OPERATING THE MACHINE MANUAL MODE" for more information on adjusting any of the scrub settings. The machine will record every action of the operator including adjustments to scrub settings, use of the horn and remember the route traveled **See Figure 3-2.** **NOTE:** Horn will only be recorded if it's pressed while the machine is moving. Horn is not recorded if pressed while the machine is stopped. The machine will not record a full stop made by the operator while recording.
- b. The reverse switch is not selectable while recording.

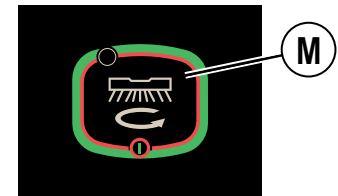
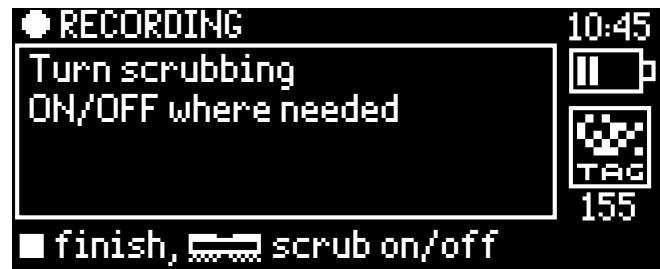
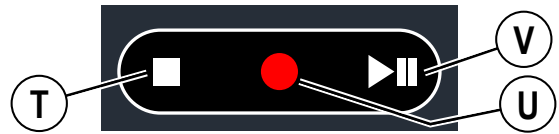
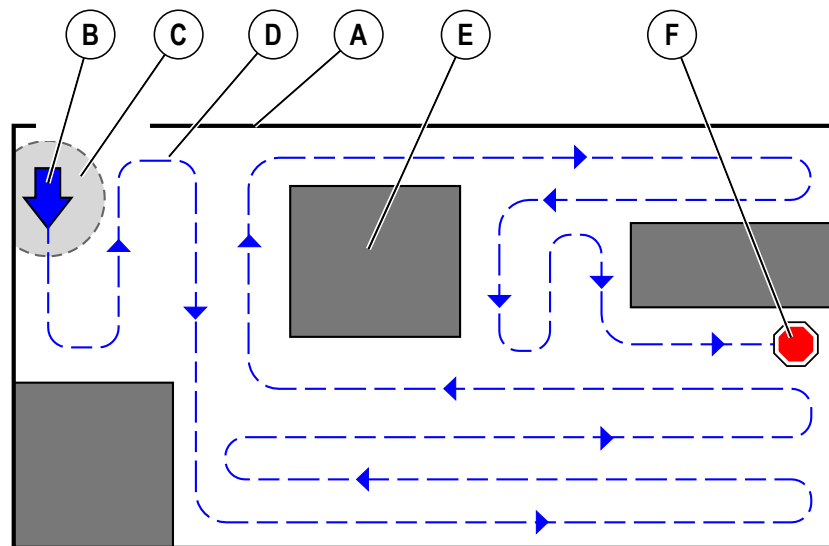


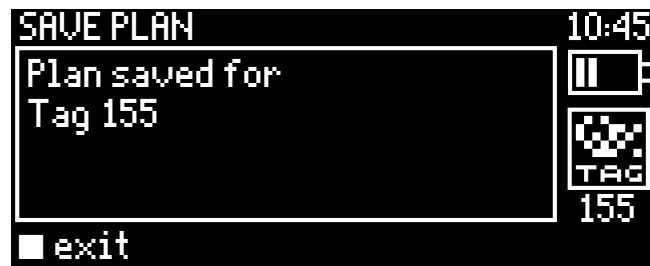
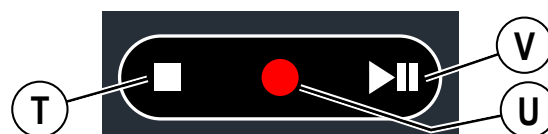
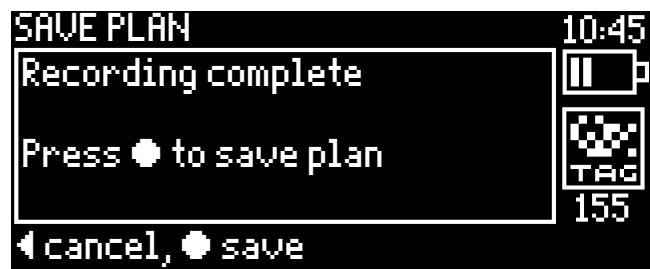
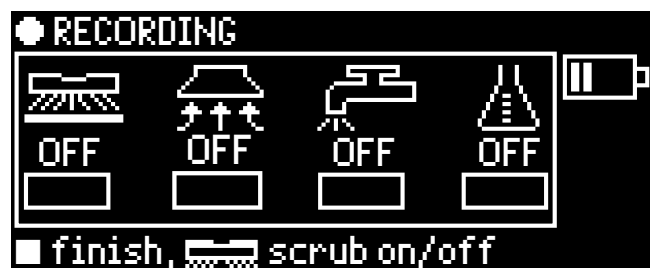
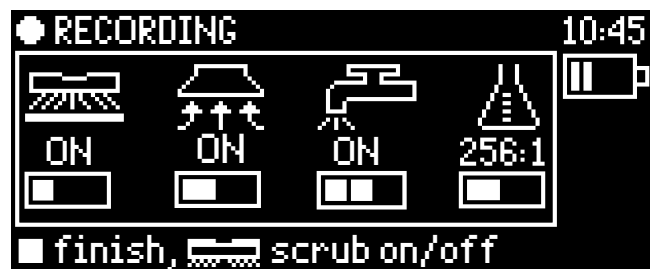
FIGURE 3-2

- A Map Area
- B Plan Start Point
- C Plan Start Area
- D Plan Route
- E Permanent Obstacle
- F Plan Stop Point



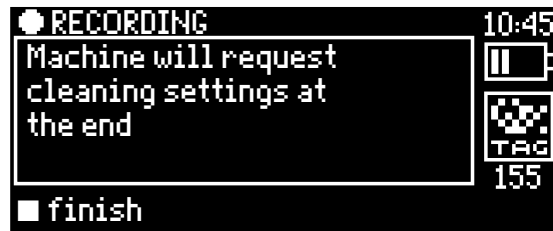
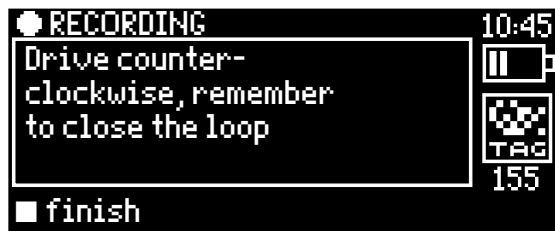
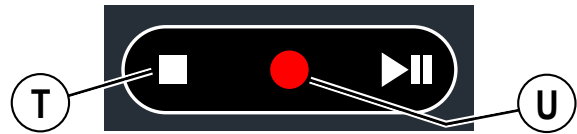
RECORDING COPYCAT™ PLANS - CONTINUED

- 3 When finished CopyCat recording, press the Stop Switch (T), to “finish” recording. Pressing the button brings up a menu with the options to save or cancel the plan.
 - a. Press Record Switch (U) to save plan.
 - b. Or press back arrow to cancel and continue recording.
- 4 While computer is compiling/saving the plan.
 - a. Display will indicate it is saving and show Spinning Arrows / Computer Processing Indicator (X30).
 - b. LED Status Bar will be blue with bouncing black bar.
 - c. Do not move machine while plan is being saved.
 - d. This may take several minutes.
- 5 Machine indicates if recording was successful or failed.
 - a. If plan saves successfully the screen will display; “Plan was saved for tag xxx”. Press back arrow switch when done to exit menu.
 - b. If plan fails to save the screen will display “Plan was not saved!”.
- 6 Machine LED Status Bar will change from green to OFF.



RECORDING FILL-IN PLANS

- 1 Press Record Switch (U).
 - a. Highlight "Fill-In" from menu.
 - b. Press Record Switch (U) to start recording.
 - c. Screen displays message to "Drive counterclockwise, remember to close the loop. Machine will request cleaning settings at the end."
 - d. LED Status Bar (4) will emit a slow flashing green light.
- 2 Drive the machine in a counter-clockwise path around the perimeter of the area to be cleaned. Start recording with the right side of the machine facing towards the wall.
- 3 Drive the machine around the perimeter of the area to be cleaned and drive back through the start area*, then continue along the plan another 25 feet (8 m) a second time until the machine automatically comes to a stop**. Machine will display message "Loop closed." See Figure 3-3A. NOTE: When the Fill-In plan is being played back the machine will use an algorithm to create a plan that covers the entire area and ends back at the start point. See Figure 3-3B.



* Operator will hear two beeps as machine is driven into a start area and one beep as it exits the start area.

** If the machine does not stop on it's own after 25 feet (8m) of overlap the operator can stop manually or drive a second loop.

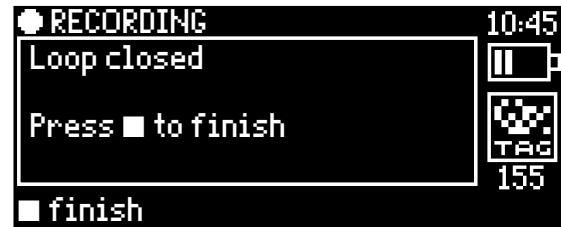


FIGURE 3-3A
RECORD

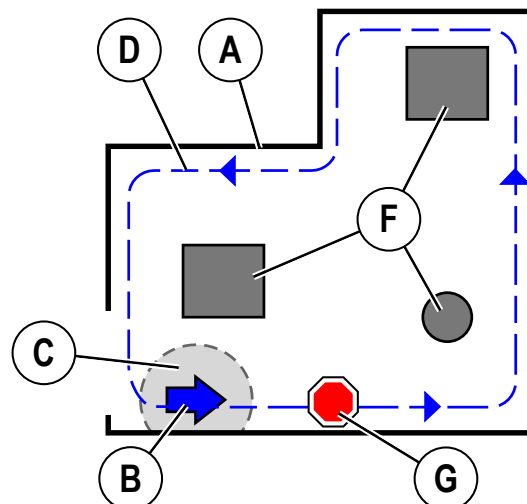
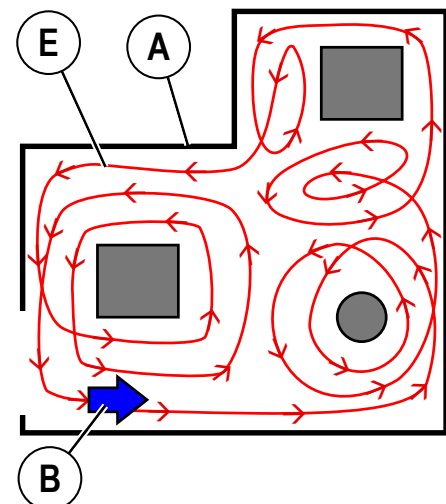


FIGURE 3-3B
PLAYBACK



- A Map Area
- B Plan Start Point
- C Plan Start Area
- D Recorded Route
- E Playback Route
- F Permanent Obstacle
- G Plan Stop Point

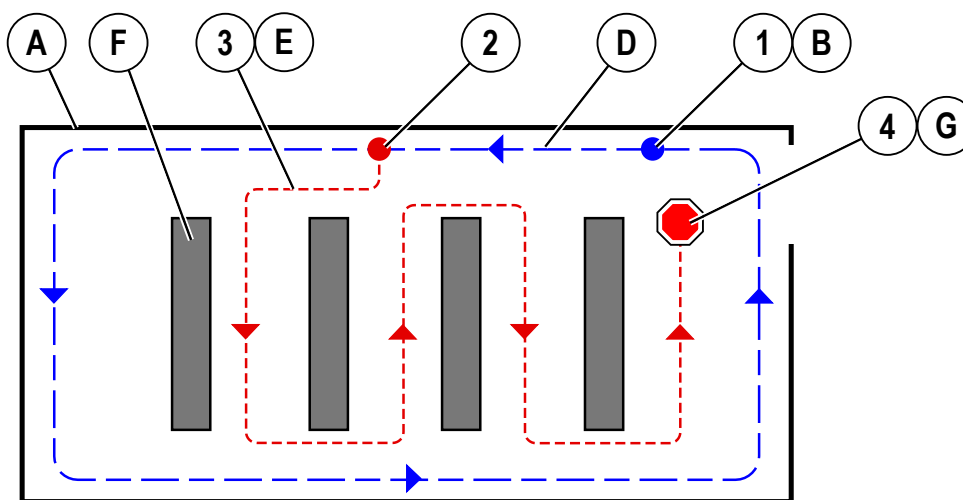
RECORDING FILL-IN PLANS - CONTINUED

4 After the first loop is recorded around the perimeter and closed, an additional route can be driven to show the machine the interior of the fill-in space and help it better map any exclusion zones. **See Figure 3-4.**

- 1 Step 1 = Create start point, record path around perimeter of area
- 2 Step 2 = Machine detects perimeter closure after additional 25' (8m) and stops
- 3 Step 3 = Drive machine into room and "map" around areas to be excluded
- 4 Step 4 = Adjust scrub settings, save plan

- A Map Area
- B Plan Start Point
- D Path around perimeter until closure
- E Path after closure, mapping
- F Permanent Obstacle
- G Plan Stop Point

FIGURE 3-4

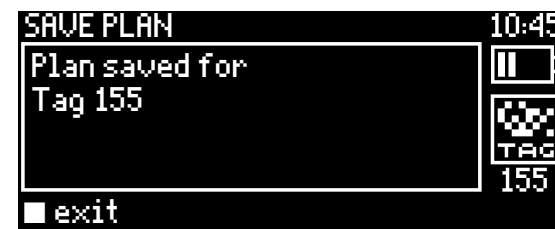
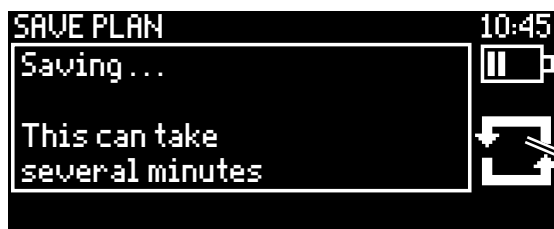
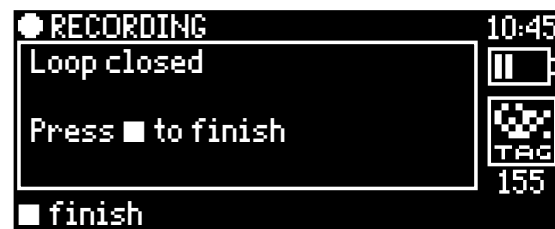


- 5 When finished Fill-In recording, press the Stop Switch (T) to finish recording.
- 6 Adjust the scrub settings to be used for the whole Fill-In plan*.
- 7 Press the Record Switch (U) to save the plan. Or choose to cancel the plan and press left arrow.
- 8 While computer is compiling/saving the plan.
 - a. Display will show Computer Processing Indicator (X30).
 - b. LED Status Bar will be blue with bouncing black bar.
 - c. Do not move machine while plan is being saved.
 - d. This may take several minutes.
- 9 Machine indicates if recording was successful or failed.
 - a. If plan saves successfully the machine will display a message "Plan saved for Tag xxx".
 - b. If plan fails to save the screen will display "Plan was not saved!".
- 10 Machine LED Status Bar will change from green to OFF.

*See section "[Operating the Machine Manual Mode](#)" for more information on adjusting

any of the scrub settings. Once the plan is saved these settings will be remembered and applied to the entire Fill-In plan upon playback.

NOTE: While recording the plan, the machine can be driven with the scrub deck in the up position and scrub off. At the end of the plan the scrub settings to be used upon playback must be set before saving the plan otherwise the machine will playback the plan with default scrub settings (scrub - 1/2, vacuum - 1/2, solution - 1/3 & detergent off).



RECORDING FOR AUTONOMOUS MODE - CONTINUED

WHILE RECORDING IN COPYCAT OR FILL-IN MODES...

Recording needs to be paused

- 1 If operator is interrupted during the recording process, release foot from Go Pedal to stop machine and step off the machine to stop all functions. If operator steps off the machine at any time during the record process the machine will stop moving but recording will be paused.
- 2 Remove the magnetic SmartKey and attend to other issues.
- 3 After returning, first replace the SmartKey then step back onto the machine. Press the Forward Arrow (**Q**) and resume recording.
NOTE: If operator steps back onto the machine before replacing the SmartKey, the screen will show No Key Indicator (**X19**) and exit out of recording without saving. Plan will need to be re-recorded.
NOTE: Operator must return prior to the machine entering Sleep Mode ("Inactive Time" is adjustable) in order to resume recording.

Recording needs to be canceled

- 1 If recording process needs to be stopped (to re-fill solution tank, empty recovery tank etc.) release foot from Go Pedal to stop machine movement and press the Stop Switch (**T**) to finish recording then press left arrow to cancel.
- 2 The machine will not remember where it left off recording and plan must be re-recorded. After emptying recovery tank, refilling solution etc., return to start point and re-record the plan.

TIPS FOR CHOOSING A START POINT

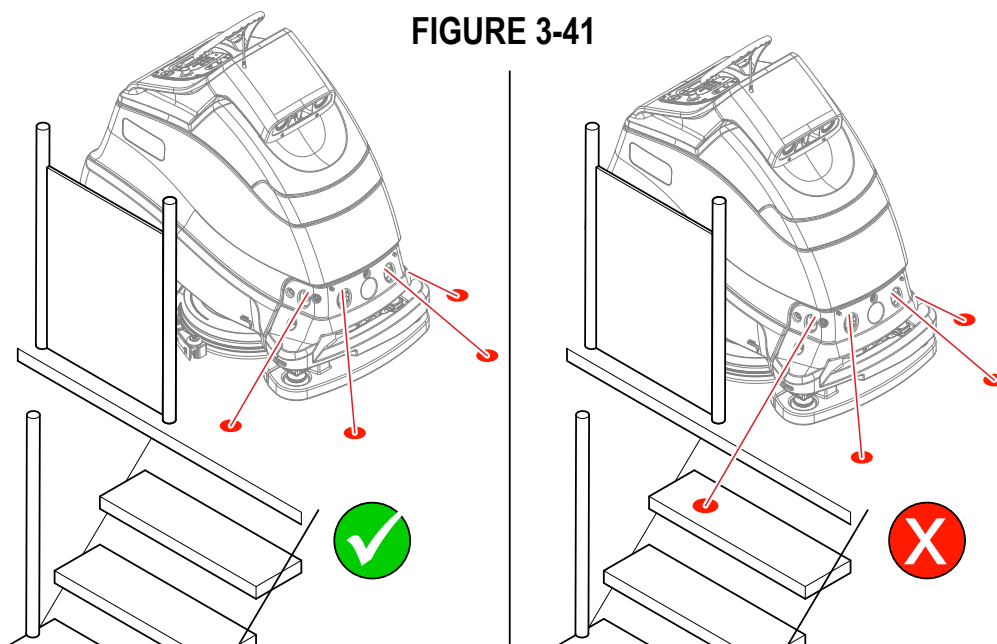
- Be mindful of where you start a plan so it's not in a busy or congested area, but also in a logical place to start cleaning. Start point should be in a location that's easy to remember and get to in the future since machine will need to be located there each time to start playback. Machine will return to the start point at the end of cleaning a Fill-In plan.
- Start position should be near a flat wall when and if possible. It is recommended starting with the right side of the machine next to a wall.
- Record plan with the left side of the machine facing into the room.
- Two plans cannot have the same start point. If two start points are close to each other the machine will playback the plan which has the start point nearest to the machine. Any two start points should be a minimum of 8 ft. (2.4m) apart. **NOTE:** Using a second location tag would allow for two plans to have the same start point.

RECORDING FOR AUTONOMOUS MODE - CONTINUED

TIPS FOR RECORDING A PLAN

- Do not record new plans during busy hours. For best results record the plan at a time when there aren't people walking around in the area, so that people and moving obstacles are not included in the saved plan.
- Keep all four laser spots on the ground: avoid holes, stairways and reflective surfaces. **See Figure 3-41.**
- Avoid sharp turns; keep them as smooth as possible.
- For CopyCat plans the start and end points do not need to be the same location.
- Be mindful of where you will end the plan (only for CopyCat) so that machine is not blocking a doorway or otherwise in the way when it comes to a stop at the end of the plan.
- CopyCat plans should not exceed 90 minutes of recording; longer plans may not save
- Fill-In plan must be a closed loop or it will fail to save. Do not cross over your own route. For example attempting to record a figure 8 plan will result in an error code.
- Fill-In plans must be recorded in a counter-clockwise direction. CopyCat plans can be recorded in any direction.
- When recording a Fill-In plan, make sure that the machine heading at the end of the path is aligned with the start heading (within 20 degrees) (**see Figures 3-5 & 3-6**) and not offset by more than about 1 foot. Note that after driving back through the start point you should continue driving for another 25' (8m) until the machine comes to a stop. This extra overlap helps tie the ends of the plan together.
- For Fill-In plans; if machine is not replaying the recorded plan correctly, re-record the plan this time recording two loops. When the machine stops on its own after recording the first loop plus 25' (8m), simply release and reapply the Go-Pedal (24) to resume recording the second loop. **See Figure 3-7. NOTE:** If the machine does not stop on its own after driving the additional 25' (8m) it is an indication that two loops should be driven to record the plan area.
- The machine's sensors can best detect obstacles within a recorded plan that are tall enough and thick enough (taller than 9" or thicker than half an inch). If obstacles exist that are shorter or thinner than this they should be removed from the plan area prior to recording the plan or place an object such as a tall garbage can in front of it to better record around.
- An exclusion zone can be created by using a tall garbage can for example placed over a floor outlet while recording. Once the recording is done the garbage can is removed and the area will be avoided during replay.

FIGURE 3-41



A Machine Direction at Plan Start

B Machine Direction at Plan Stop

FIGURE 3-5 Correct	FIGURE 3-6 Incorrect	FIGURE 3-7 Optional

RECORDING FOR AUTONOMOUS MODE - CONTINUED

INFORMATION INCLUDED IN A PLAN

- Saved plan guides machine movements during autonomous operation.
- Machine will follow exact route recorded (CopyCat plans only), avoiding known obstacles identified on plan.
- Machine will drive around new obstacles detected but not recorded.
- Machine will not record the speed or stops and starts the operator performs while recording. The machine will determine the speed it uses to playback the plan, ignoring anytime the operator stopped the machine while recording. Speed will be reduced when cleaning along a wall or around an obstacle.

DELETE A PLAN

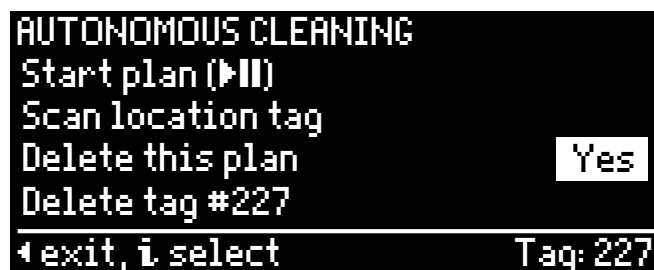
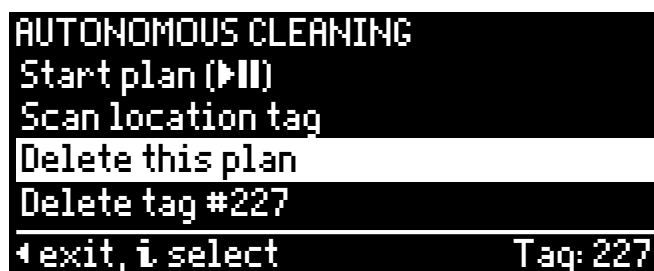
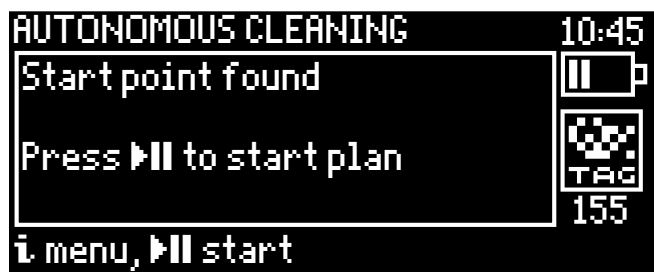
1 Cancel Current Recording:

- During recording press Stop Switch (T) at any time to "finish" the plan and then press Back Arrow to "cancel" (delete) the current plan being recorded.

2 Delete Existing Plan:

- Scan the location tag that is associated with the plan that needs to be deleted.
- Drive machine to the start point of the plan. **NOTE:** Plans can only be deleted from their start point or resume point.
- Press Autonomous Help Screen Switch (S) to enter menu, highlight "Delete this plan" then press *i* (information switch) for select. Then use the up or down arrow key to highlight "Yes" and press information switch to delete the plan. **NOTE:** The magnetic SmartKey must have access to delete plans. By default the "User" (blue) key does not have access to delete plans.

Delete Plan - Must be at Start Point of Plan



PLAYBACK OF RECORDED PLAN, AUTONOMOUS MODE

Once the operator has recorded a plan in an area playback is possible.

- 1 Follow the steps under [“Starting the Machine”](#). Drive machine to the start area of a recorded plan.
- 2 Machine will indicate it has a viable cleaning plan for the area in which the machine is currently located. Signal is audible and visible.
 - a. When within 6 ft. (2 m) of a start point for a recorded plan machine will emit two beeps. When driving through a start area machine will emit one beep as it drives out of the start area.
 - b. The display will indicate “Start point found” and (S1) will flash.
- 3 Scrub settings;
 - a. Machine will scrub with the scrub settings used while recording the plan.
- 4 Press the Play/Pause Switch (V). Display will request user to remove the key and step off of the machine. Machine will also blink the LED (A1) below the SmartKey Reader (A) to indicate operator must remove the magnetic key from the machine before playback can begin.
- 5 Remove the magnetic SmartKey from the machine.
- 6 Step off of the machine.
- 7 At the start of playback the horn will sound for two seconds, LED bar will turn blue and then machine will begin scrubbing.
- 8 While the machine is cleaning in autonomous mode the following will be observed;
 - a. Display will show; AUTONOMOUS CLEANING, graph with percentage of plan complete and machine icon along with Advancing Lines/time remaining, alternating every three seconds with the scrub settings.
 - b. LED Status Bar (4) will be slow flashing blue. While executing a turn the LED Status Bar will flash yellow on either side to indicate the direction of the turn. LED Status Bar will change to chasing red if someone walks in front of the machine or encounters an unmapped obstruction.
 - c. If desired an optional audible “Autonomy beep” can be emitted continuously while machine is in playback.
- 9 When machine successfully finishes cleaning the recorded plan;
 - a. Scrub brushes and solution flow will stop and the scrub deck will raise up. Machine will continue to travel a short distance to pick up remaining water.
 - b. The squeegee will raise up after a brief delay with the scrub deck and the vacuum will stop after an additional delay (this is to allow any remaining water to be picked up without turning the vacuum back on).
 - c. Display indicates the plan finished successfully. Magnetic SmartKey will need to be put on machine to continue.
 - d. After a set time of being idle the machine will enter a sleep mode to save battery power.

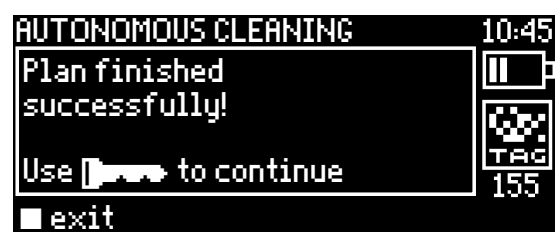
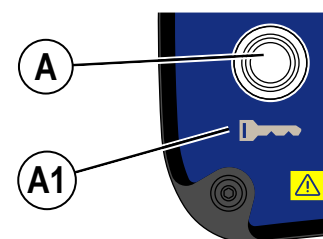
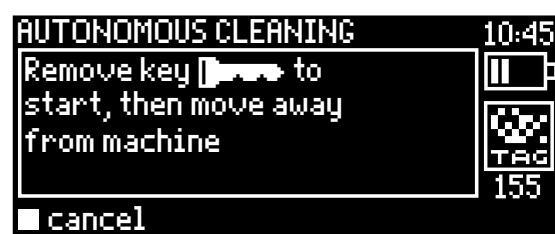
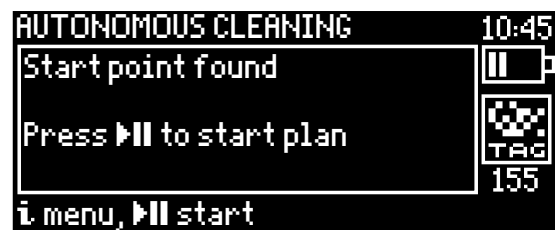
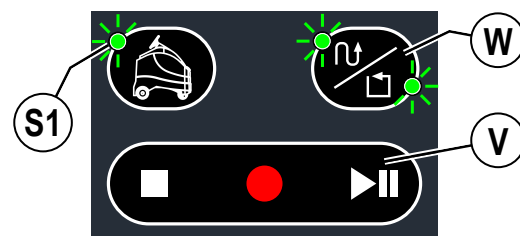
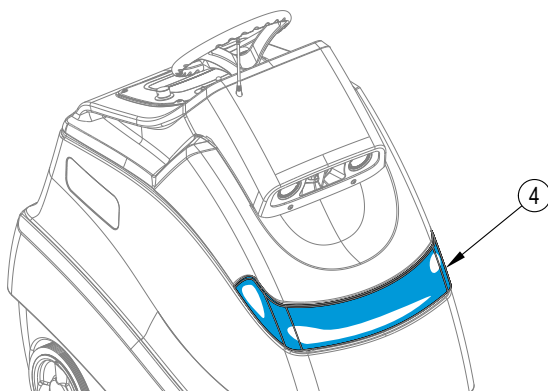


FIGURE 3-8



PLAYBACK OF RECORDED PLAN, AUTONOMOUS MODE - CONTINUED

CONTROL PANEL INPUTS WHILE IN PLAYBACK MODE

- If the Stop Switch (**T**) is pressed the machine will stop and go into manual mode.
- If the Pause Switch (**V**) is pressed the machine will pause playback. Place the SmartKey back on the reader and press Pause Switch (**V**) again, then remove SmartKey to resume playback.
- If the Emergency Stop (**D**) is pressed the machine will stop immediately and go into manual mode.
- The Power Switch (**B**) and Horn (**C**) will function the same as in manual mode.
- All other switches (and speed control knob) are “locked out” pressing them will have no effect.

WHILE IN PLAYBACK MODE...

Operator needs to interrupt autonomy to Take-Over Cleaning

- 1 The operator can simply step onto the machine while the machine is cleaning in autonomous mode.
- 2 Machine stops/pauses project – lifts scrub deck, stops solution/detergent flow, travels a bit further to vacuum water, lifts squeegee/stops vac.
- 3 Operator inserts SmartKey.
- 4 Machine signals that operator now has control of machine by lighting Manual Operation Indicator (**H**).
- 5 Operator can now drive/operate machine as needed in manual mode.

Playback needs to be paused/resumed

- 1 If autonomous scrubbing needs to be interrupted during the playback of a plan (to re-fill solution tank, empty recovery tank etc.) press the Play/Pause Switch (**V**) to stop machine movement and stop all functions. The machine will remember where it left off playback and create a temporary “resume area”. Identify this location with a flag or marker to easily return here and resume playback.
- 2 Go empty recovery tank, refill solution etc.
- 3 After returning to where the playback was paused, the machine will beep twice and display RESUME AREA as it enters the “resume area”. Press the Play/Pause Switch (**V**) to resume and finish cleaning the plan.

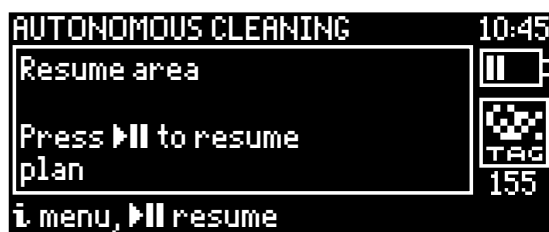


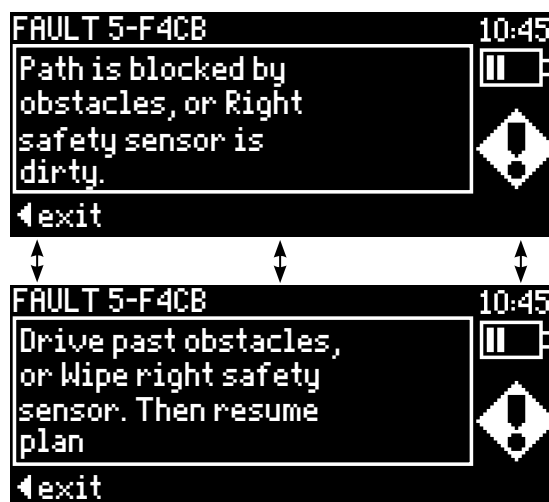
FIGURE 3-9



PLAYBACK OF RECORDED PLAN, AUTONOMOUS MODE - CONTINUED

Machine Encounters an Issue While Cleaning in Autonomous Mode

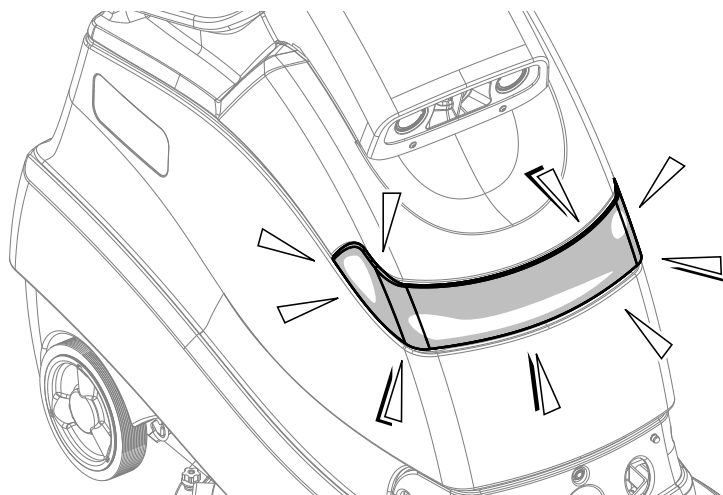
- 1 While successfully cleaning in autonomous mode, the machine may encounter any one of the scenarios listed below;
 - a. Machine is blocked – CANNOT plan around obstacle(s)
 - b. Machine needs to rescan Location Tag
 - c. Battery level low
 - d. Solution tank empty
 - e. Recovery tank full
 - f. Person continuously disturbing machine – preventing passage
 - g. Person steps onto machine for longer than 30 seconds
 - h. Sensors blocked
 - i. Machine impacted/hit by another vehicle/person
 - j. Machine system failure
 - k. Critical fault code present
- 2 In all cases the machine stops moving, the scrub deck stops and raises to the vac only height and the vacuum will run briefly until it times out. Then all functions turn off.
- 3 Operator must return to the machine to clear/eliminate error (example below). SmartKey must be placed on reader to access menu or restart.



LED STATUS BAR OPERATION

Machine Action	LED Response
• Manual Mode	- Light Bar off (lights up white with blue on the sides only while scanning for a location tag). - Options include (see "Information Menu Display" to change) "Always On" (white light) "Always Off"
• Recording	Slow Flashing Green
• Compiling Plan	Solid Blue with bouncing Black bar
• Autonomous Mode	Slow Flashing Blue
• Machine Error	Flashing Red
• Obstacle Detected	Chasing Red or Orange (starting in center and moving to sides) - Options include (see "Information Menu Display" to change) Red Orange
• Turning	Side LEDs flash yellow
• Charging Batteries	Light Bar will "fill" with advancing colors as follows (red, orange, yellow, green and solid green) from discharged to fully charged see "Charging Batteries" section.

FIGURE 3-10



SPEAKER OPERATION

Speaker Audible Alerts Sound	Description	Mode	Sound Description
Horn	Operator activates by pressing Horn Switch (C).	Manual	Standard Horn
Reverse	Slow beep when moving in reverse	Manual	Standard back-up alarm sound
Scan Successful	Scan of location tag was successful	Manual	Two note ascending tone
Object Detection	Alerts person to move out of way	Autonomous	Four beeps changing tone repeating
Machine Error	Machine stops, playback cannot continue	Autonomous	Longer low tone 3 seconds repeating
Autonomous Operation (Optional)	Alerts person in area of scrubber Volume is adjustable between OFF, 1, 2, & 3. Default setting is OFF.	Autonomous	Standard back-up alarm sound
Enter Recorded Plan Start Area	Machine recognizes it is driving into the start area of a plan	Autonomous	Two beeps higher tone
Leave Recorded Plan Start Area	Machine recognizes it is driving out of the start area of a plan	Autonomous	One beep lower tone
Plan Saved Successfully	After recording a plan, machine indicates plan has been saved successfully	Autonomous	Three note ascending tone
Playback to Begin	Alerts anyone in the area that machine is about to start moving	Autonomous	Two second beep

OPERATING THE MACHINE MANUAL MODE

WARNING!

Be sure you understand the operator controls and their functions.

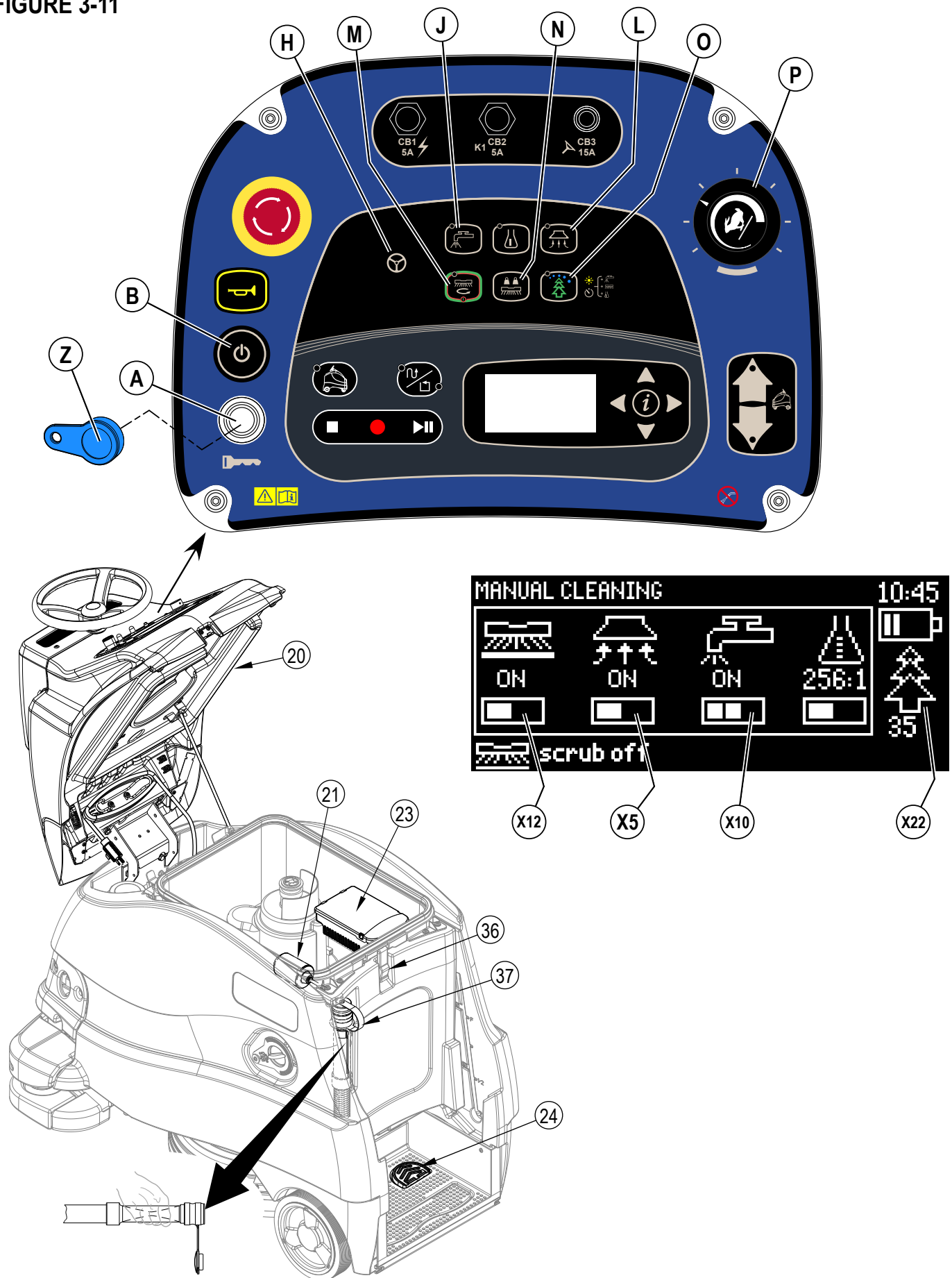
While on ramps or inclines, avoid sudden stops. Avoid abrupt sharp turns. Use low speed down ramps.

- 1 Follow the instructions in "Starting the Machine" section and drive the machine to the start point for cleaning.
- 2 Press and hold the Solution Switch (**J**) to pre-wet the brush or pad, solution will be dispensed at the HIGH rate while the switch is held.
NOTE: This will help prevent scarring of the floor surface when starting to scrub with dry brushes. This can only be done prior to pressing the One-Touch Scrub Switch (**M**). Additionally when the machine starts scrubbing the solution will flow at the High rate for 2 seconds to flood the floor.
- 3 Press the One-Touch Scrub ON Switch (**M**) once for Regular Scrub. Press the Extra Pressure Switch (**N**) once for Heavy Scrub. The solution flow has settings that coincide with the scrub pressure, it will increase and decrease along with the scrub pressure.
NOTE: The solution flow rate can also be increased or decreased independently of the scrub pressure by pressing the Solution Flow Adjustment Switch (**J**), observe the Solution Flow Rate Bar Graph (**X10**) (see Control Panel). Any subsequent scrub pressure adjustments will reset the solution flow rate to default.
- 4 When the One-Touch Scrub ON Switch (**M**) is selected, the brushes and squeegee are automatically lowered to the floor. The scrub, solution, vacuum and detergent systems are all automatically enabled and will start when the Go Pedal (**24**) is activated. Any individual system can be adjusted or turned OFF or ON by simply pressing its switch at any time during scrubbing.
Scrub Pressure: Each press of the Extra Brush Pressure Switch (**N**) will change between REGULAR pressure and HEAVY pressure (shown on the display (**X12**)). The scrub system can only be turned OFF by pressing the One-Touch Scrub Switch (**M**).
Solution: The solution flow rate can be changed independently of the scrub pressure by pressing the Solution Switch (**J**). Each press of the switch will cycle between LOW, MEDIUM, HIGH, OFF and back to LOW. The setting is shown on the display (**X10**).
Vacuum: The vacuum level can be changed independently. The default setting is REGULAR mode. Each press of the Vacuum Switch (**L**) will cycle between QUIET, OFF and REGULAR. The setting is shown on the display (**X5**).
NOTE: To pick up solution without scrubbing, press the Vacuum Switch (**L**) while in transport mode. This will cause the squeegee to lower and the vac motor to turn ON at the REGULAR level.
Detergent: See "Detergent System Preparation and Use (EcoFlex)" for more detailed information regarding the adjustment and use of the detergent system.
- 5a **Daily Scrub:** Begin scrubbing by driving the machine forward in a straight line at a normal walking speed and overlap each path by 2-3 inches (50-75 mm). Adjust the machine speed and scrub parameters when necessary according to the condition of the floor.
- 5b **Floor Finish Removal (REV model only):** Ensure there is a red pad attached directly to the fixed pad driver and that the maroon SPP pad is not attached to the fixed pad driver. Adjust the scrub parameters as follows: Adjust the machine speed potentiometer to a slow scrub speed approximated by that shown in Figure 3-11 (**P**). Adjust the solution flow rate to low, the scrub pressure to high and turn detergent off. The vacuum power setting can be set to either quiet or regular mode. Floor finish removal should be done in manual mode only.
- 6 Press the Burst of Power Switch (**O**) to temporarily (1 minute) engage the high detergent strength, extra scrub pressure, full vacuum power and increase the solution flow rate to the next available level. The Burst of Power Indicator (**X22**) will display along with a 60 second countdown timer, after which all scrub parameters will return to their previous state.
- 7 When scrubbing, check behind the machine occasionally to see that all of the used solution is being picked up. If there is water trailing the machine, you may be dispensing too much solution, the recovery tank may be full, or the squeegee tool may require adjustment.
- 8 The recovery tank has a Tank Full Switch (**21**) that causes ALL systems to turn OFF except the drive system when the recovery tank is full. When this switch is activated, the recovery tank must be emptied. The machine will not pick up water or scrub with the switch activated.
NOTE: Scrub, solution and detergent indicators vanish and the Recovery Tank Full Indicator (**X16**) appears on the Display Panel when the switch is activated.
- 9 When the operator wants to stop scrubbing:
 Press the One-Touch Scrub Switch (**M**) once. This will automatically stop the scrub brushes and solution flow and the scrub deck will raise up. The squeegee will raise up after a brief delay with the scrub deck and the vacuum will stop after an additional delay (this is to allow any remaining water to be picked up without turning the vacuum back on) if the vacuum switch is pressed during this time delay the vacuum will turn off.
- 10 Drive the machine to a designated waste water "DISPOSAL SITE" and empty the recovery tank. To empty, pull the Recovery Tank Drain Hose (**37**) from its rear storage area, then unscrew the cap (hold the end of the hose above the water level in the tank to avoid sudden, uncontrolled flow of waste water). The drain hose can be squeezed to regulate the flow. Unlatch (**36**) and lift open the Recovery Tank Cover (**20**) to inspect and empty the Debris Catch Tray (**23**) in the recovery tank. Refill the solution tank and continue scrubbing.

NOTE: Make sure the Recovery Tank Cover (**20**) and the Recovery Tank Drain Hose (**37**) cap are properly seated or the machine will not pick-up water correctly.

When the batteries require recharging the Fault Indicator (**X14**) will come on along with a message stating low battery, the scrub brushes and solution flow will stop and the scrub deck will raise up. The squeegee will raise up after a brief delay and the vacuum will stop after an additional delay. Transport the machine to a service area and recharge the batteries according to the instructions in the Charging Gel/AGM (VRLA) Batteries section of this manual.

FIGURE 3-11



AFTER USE

- 1 When finished scrubbing, press the One-Touch Scrub Switch **(M)**, this will automatically raise, retract and stop all the machine systems (brush, squeegee, vacuum, solution and detergent). Drive the machine to a service area for daily maintenance and review of other needed service upkeep.
- 2 To empty the solution tank;
 - Solution tank only needs to be emptied if detergent was mixed in the tank and machine will not be used for a while.
 - Drive the machine over a designated "DISPOSAL SITE" and open the Solution Drain Valve **(8)**.
 - The tank can also be drained by closing the Solution Shutoff Valve **(34)** and removing the cap from the Solution Filter **(33)**, then open the Solution Shutoff Valve to drain the solution out through the filter.
 - Rinse the tank with clean water if detergent was used in the tank.
- 3 To empty the recovery tank;
 - Pull the Recovery Tank Drain Hose **(37)** from its storage area.
 - Direct the hose to a designated "DISPOSAL SITE" and unscrew the cap (hold the end of the hose above the water level in the tank to avoid sudden, uncontrolled flow of waste water). The Recovery Tank Drain Hose can be squeezed to regulate the flow.
 - Unlatch **(36)** and lift open the Recovery Tank Cover **(20)** set the prop rod **(39)**.
 - Empty and rinse the Debris Catch Tray **(23)** in the recovery tank.
 - Thoroughly rinse the recovery tank with clean water, see *CLEANING RECOVERY TANK* section.
- 4 Inspect the squeegee and drain hoses; replace if kinked or damaged.
- 5 Remove the brush or pad holder. Rinse it in warm water and hang up to dry.
- 6 Remove the squeegee, rinse it with warm water and hang it up to dry. Inspect the squeegee blades for wear or tears.
- 7 Clean the machine using a damp cloth and where needed use a mild detergent. Do not use a spray hose to clean the exterior of the machine to prevent water ingress into sensitive electronics.
- 8 Check the maintenance schedule below and perform any required maintenance before storage.
- 9 Store the machine indoors in a clean dry place. Keep from freezing. Leave the tanks open to help prevent odors.
- 10 Turn the machine off by pressing the Power Switch **(B)** and then remove the magnetic SmartKey.
- 11 Batteries are one of the most expensive replacement items on this machine. To protect your investment and to get as many cycles from the batteries as possible, remember the following:
 - When installing batteries make certain the machine and charger are programed for the correct battery type.
 - Batteries will last longer if they are kept fully charged.
 - Batteries will prematurely fail if stored in a discharged state.
 - Battery chargers will not over or undercharge the batteries.
 - Every day after use, the battery charger must be plugged in and the charger must be allowed to run through a full charging sequence to fully charge the batteries. This may take 8-12 hours depending on the battery status.
 - Always have the charger plugged into an AC outlet if the machine will not be used for a longer period of time to keep the battery(s) charged.

MAINTENANCE

MAINTENANCE SCHEDULE

MAINTENANCE ITEM	Daily	Weekly	Monthly	Yearly	As needed only
Charge Batteries	X				
Check/Clean Tanks & Hoses	X				
Check/Clean the Brushes/Pads	X				
Check/Clean the Squeegee	X				
Remove any debris attached to the rear wheels	X				
Clean Squeegee's Front Roller Wheels (10) verify they rotate freely	X				
Check/Clean Vacuum Motor Fan Inlet Screen (28)	X				
Empty/Clean Debris Catch Tray (23) in Recovery Tank	X				
Clean 3-D Vision Sensor lenses see "CLEAN SENSOR LENSES"					X
Clean Drop-Off Sensors (4) lenses see "CLEAN SENSOR LENSES"					X
Clean 2D Mapping Sensor lens see "CLEAN SENSOR LENSES"					X
Inspect Scrub Housing Skirt		X			
Inspect and clean Solution Filter (33)		X			
Purge Detergent System		X			
Lubrication of Machine			X		
* Check Carbon Brushes				X	

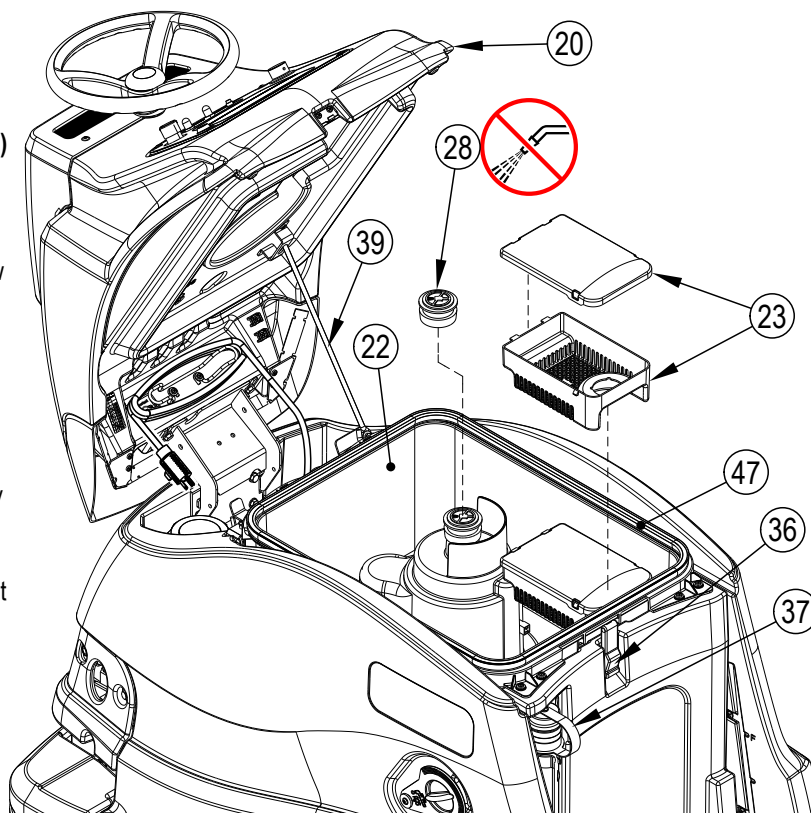
* Have an Authorized Nilfisk Service Center check the vacuum motor carbon motor brushes after 1200 operating hours (replace motor after 2000 recovery hours).

NOTE: Refer to the Service Manual for more detail on maintenance and service repairs.

FIGURE 4-1

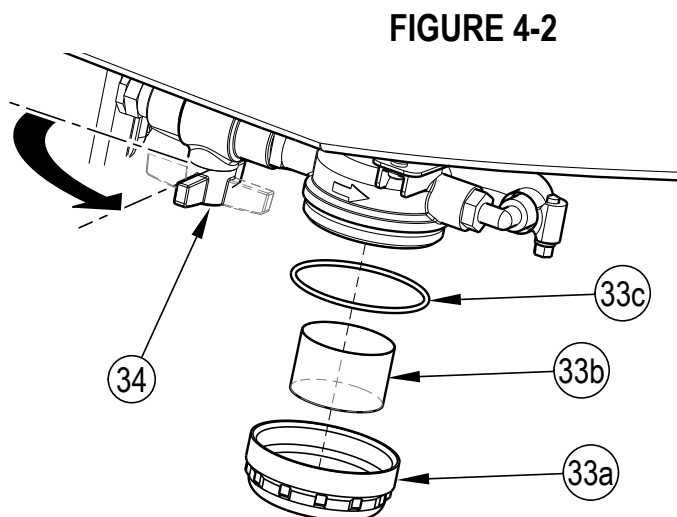
CLEANING RECOVERY TANK

- 1 Drive the machine to the appointed disposal area.
- 2 Ensure that the machine is off and the Magnetic SmartKey (Z) is removed.
- 3 **See Figure 4-1.** Pull the Recovery Tank Drain Hose (37) from its storage area.
- 4 Direct the hose to a designated "DISPOSAL SITE" and unscrew the cap (hold the end of the hose above the water level in the tank to avoid sudden, uncontrolled flow of waste water). The Recovery Tank Drain Hose can be squeezed to regulate the flow.
- 5 Unlatch (36) and lift open the Recovery Tank Cover (20) set the prop rod (39).
- 6 Rinse the recovery tank out thoroughly to remove any and all debris from the tank. To clean out the recovery tank leave the drain hose open to a floor drain and spray the inside of the tank clean with a hose. A hose with a spray attachment can be used to spray out the recovery tank but should not be directed to the vacuum motor inlet at the center of the tank. Do not allow sprayed water to splash outside of tank or into the vacuum motor inlet.
NOTE: The spray hose should not be used to clean the exterior of the machine near the operator control panel and sensors to prevent water ingress into sensitive electronics.
- 7 Remove the Debris Catch Tray (23) from the recovery tank. Empty and rinse the debris catch tray then reinstall
- 8 Remove any debris that has gathered on the recovery vacuum inlet screen (28). Remove the screen and rinse then reinstall.
- 9 Check the condition of the tank cover gasket (47) and the area it seats against. They should be clean to create a good seal.
NOTE: The Gasket (47) allows the creation of a vacuum in the tank, which is necessary to suck up the recovery water.
- 10 Close and latch the recovery tank cover.



CLEANING SOLUTION FILTER

- 1 Drive the machine to the appointed disposal area.
- 2 Ensure that the machine is off and the Magnetic SmartKey (Z) is removed.
- 3 **See Figure 4-2.** Close the Solution Shutoff Valve (34).
- 4 Unscrew the solution Filter Cover (33a). There will likely still be some solution in the line that will spill out.
- 5 Clean the filter cover and Screen (33b).
- 6 Reinstall the screen and cover, ensure Gasket (33c) is in place.
- 7 Open the Solution Shutoff Valve (34).



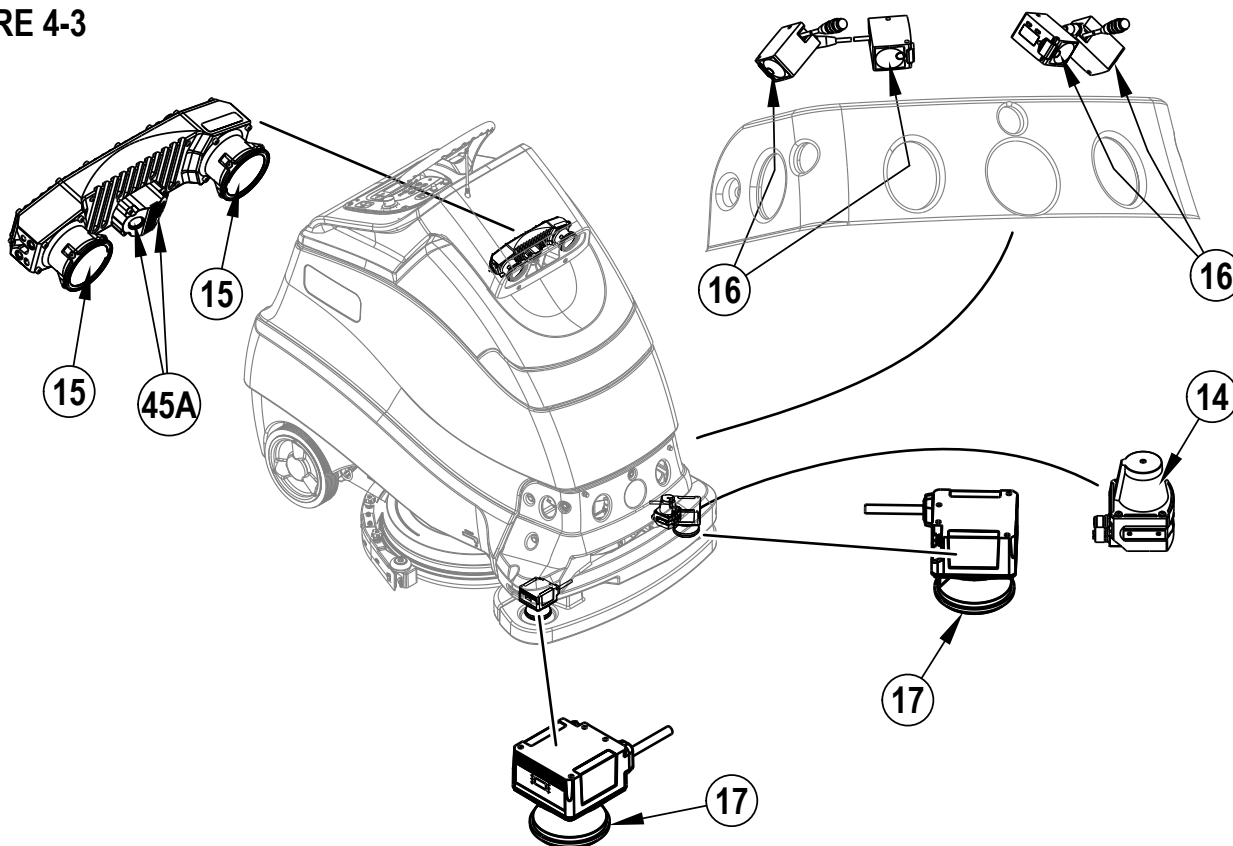
CLEAN SENSOR LENSES

CAUTION!

Do not use any harsh cleaning detergents or abrasive cleaning agents on the sensor lenses or damage may occur. Only clean the lenses as needed to reduce the opportunity of scratching them.

- 1 **See Figure 4-3.**
 - Clean 3-D Vision Sensor lenses (15) and Infrared source lenses (45A) using an optical grade microfiber cloth dampened with lens cleaning solution.
 - Clean all Drop-Off Sensor lenses (16) using an optical grade microfiber cloth dampened with lens cleaning solution.
 - Clean all Safety Sensor lenses (17) using an optical grade microfiber cloth dampened with lens cleaning solution.
 - Clean 2D Mapping Sensor lens (14) using an optical grade microfiber cloth dampened with lens cleaning solution.

FIGURE 4-3



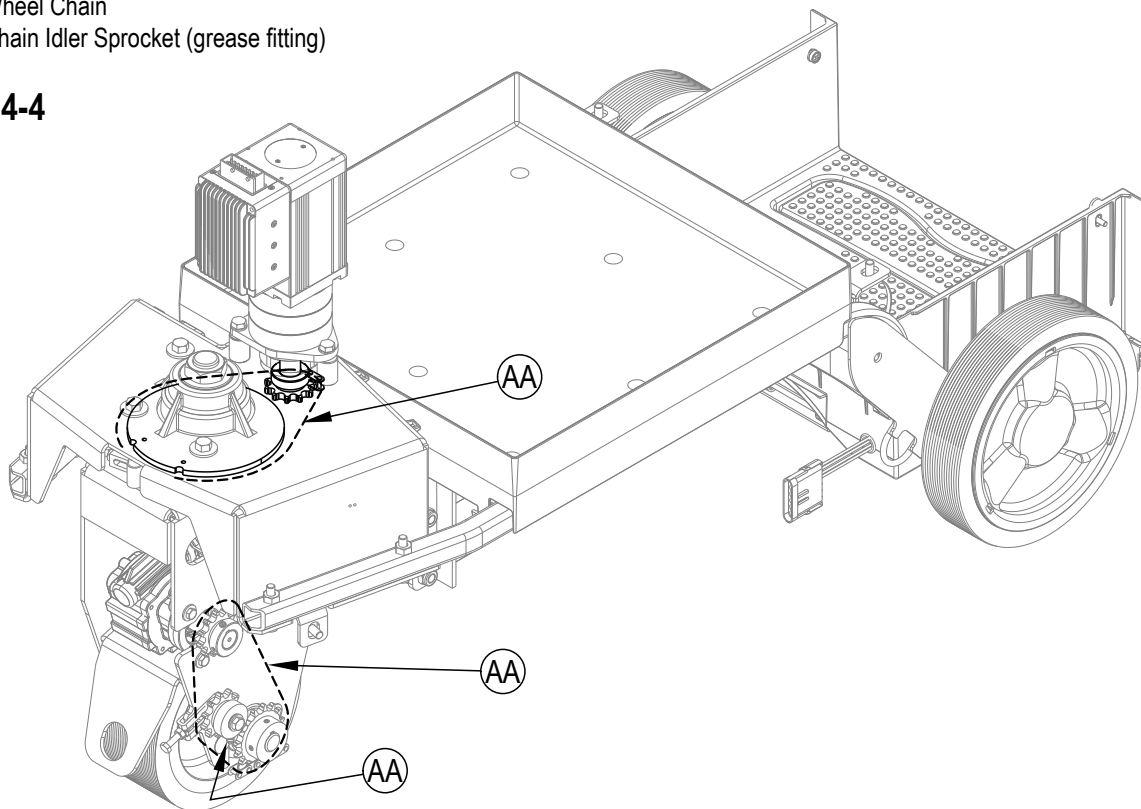
LUBRICATING THE MACHINE

Apply grease to (or grease fitting locations) (AA):

Use grease type Lubriplate® 730-2 or equivalent

- Steering Chain
- Drive Wheel Chain
- Drive Chain Idler Sprocket (grease fitting)

FIGURE 4-4



ELECTROMAGNETIC BRAKE

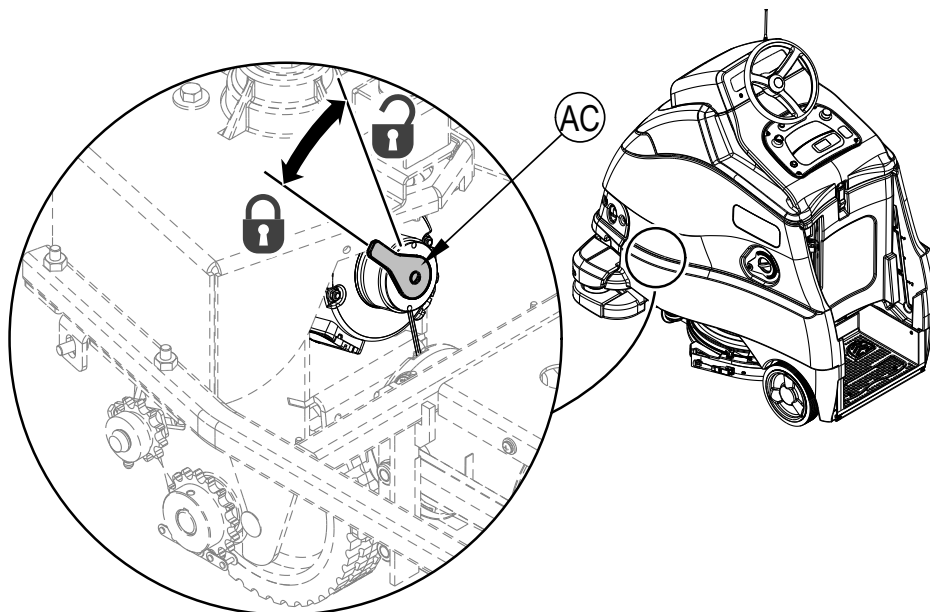
See Figure 4-5. The drive wheel motor has a built in electromagnetic brake that is engaged whenever the machine Power Switch (**B**) is OFF or the Go Pedal (**24**) is not being pressed, machine in neutral. This brake can be manually overridden if necessary by reaching up around the back of the front drive wheel and rotating the Brake Arm (**AC**) as shown. This should only be done in the event the machine needs to be pushed or pulled. Remember to re-engage the brake arm after the machine is moved.

CAUTION!

Disconnect the batteries before reaching into this area and rotating the brake arm. Severe injury could occur if steering components suddenly move.

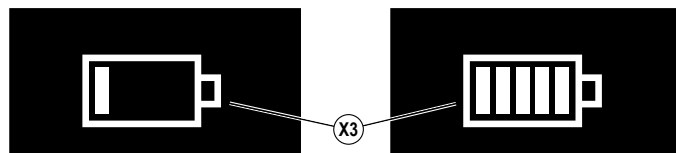
IMPORTANT: The steering is controlled electronically rather than by mechanical linkage. This means that whenever the power is off the machine cannot be steered using the steering wheel.

FIGURE 4-5



CHARGING GEL/AGM (VRLA) BATTERIES

Charge the batteries each time the machine is used or when the Battery Indicator **(X3)** is reading less than full.



⚠ WARNING!

Charge batteries in a well-ventilated area. If battery acid makes contact with your skin, flush the affected area with water for 5 minutes and seek medical attention.

Do not smoke while servicing the batteries.

When Servicing Batteries...

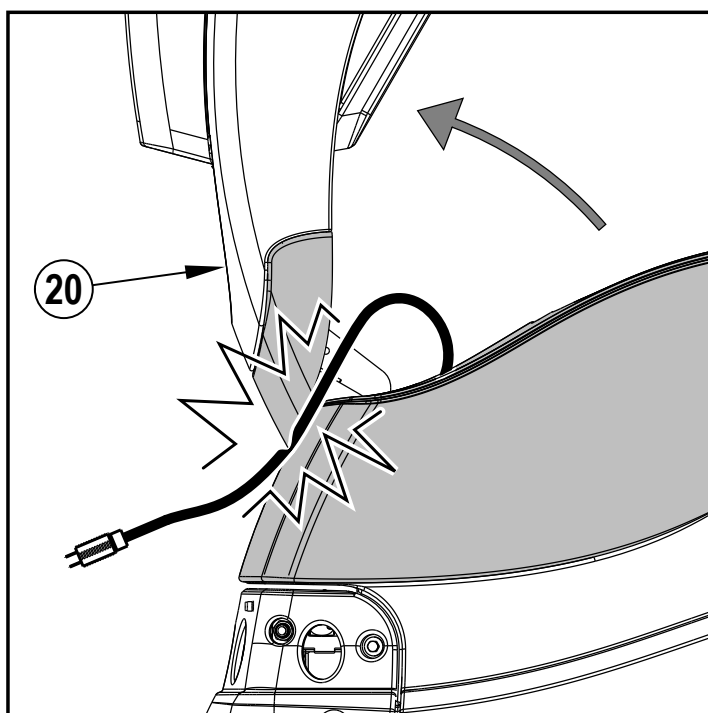
- * Remove all jewelry
- * Do not smoke
- * Wear safety glasses, rubber gloves and a rubber apron
- * Work in a well-ventilated area
- * Do not allow tools to touch more than one battery terminal at a time
- * ALWAYS disconnect the negative (ground) cable first when replacing batteries to prevent sparks.
- * ALWAYS connect the negative cable last when installing batteries.

⚠ CAUTION!

Your valve regulated lead acid (VRLA) battery will deliver superior performance and life ONLY IF IT IS RECHARGED PROPERLY! Under or overcharging will shorten battery life and limit performance. Be sure to FOLLOW PROPER CHARGING INSTRUCTIONS! DO NOT ATTEMPT TO OPEN THIS BATTERY! If a VRLA battery is opened, it loses its pressure and the plates become oxygen contaminated. THE WARRANTY WILL BE VOIDED IF THE BATTERY IS OPENED.

⚠ CAUTION!

When the Control Panel Housing **(20)** is opened it creates a pinch point between the LED lens and the solution tank. Do not route the power cord through this area or the cord will be pinched and may be damaged.



CHARGING GEL/AGM (VRLA) BATTERIES - CONTINUED

The machine shipped with an onboard battery charger. To begin charging do the following:

- 1 Turn the machine off at the Power Switch (B).
- 2 See Figures 4-6 & 4-7. Open the Control Panel Housing (20) set the Prop Rod (39).
- 3 Empty the Recovery Tank (22) using the Recovery Tank Drain Hose (37). Tip the Recovery Tank (22) back for proper ventilation using the Recovery Tank Lift Handles (27).
- 4 Unwind the electrical cord for the onboard charger near the front of the machine and plug it into a properly grounded outlet.
 - If you must use an extension cord, only use one that is 14 gauge or heavier.
 - Only plug one machine in to a power circuit to avoid tripping the circuit breaker.
- 5 Refer to the charger's OEM product manual for more detailed operating instructions.

NOTE: While AC power is applied to the onboard charger all machine functions are disabled.

- 6 The Battery Charge Status Indicator (X3) will begin showing the batteries' state of charge. This indicates that the charging cycle has begun. As the charging cycle continues, the battery charge level will fill in. Each of the five bars within the icon will flash and then become solid. When complete the entire battery icon will flash. The Display (X) will also show battery voltage and percent of charge (X47).
- 7 The LED status bar (4) will also display the state of charge, using advancing colors from red to green see Figure 4-8.
- 8 When the Battery Charge Status Indicator (X3) is completely filled and status bar is solid green, the machine senses fully charged batteries, however the charging process may not be complete. Rely on the status lights on the Charger (31) (and its OEM manual) to verify when the batteries are completely charged. This may take several hours depending upon the condition of the batteries before charging.
- 9 After charging is complete unplug the charger and wind up the Cord (40). Wait at least 10 seconds before turning on the machine after unplugging the charger.

IMPORTANT: Make sure you have an appropriate charger for use on Gel cell batteries. Use only "voltage-regulated" or "voltage-limited" chargers.

FIGURE 4-7

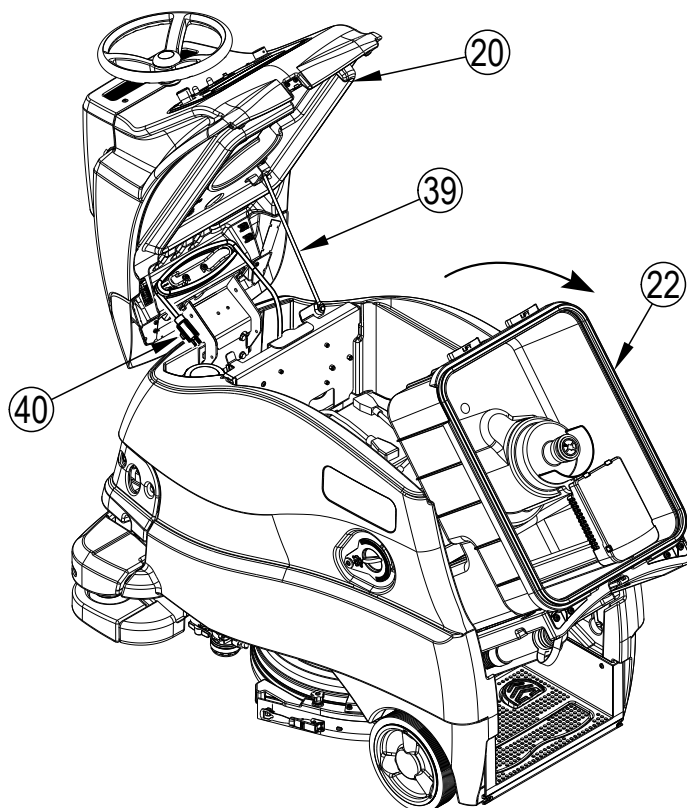
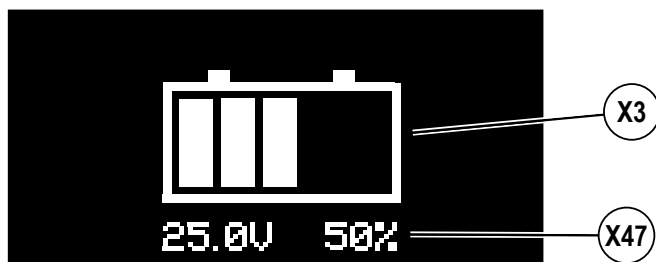
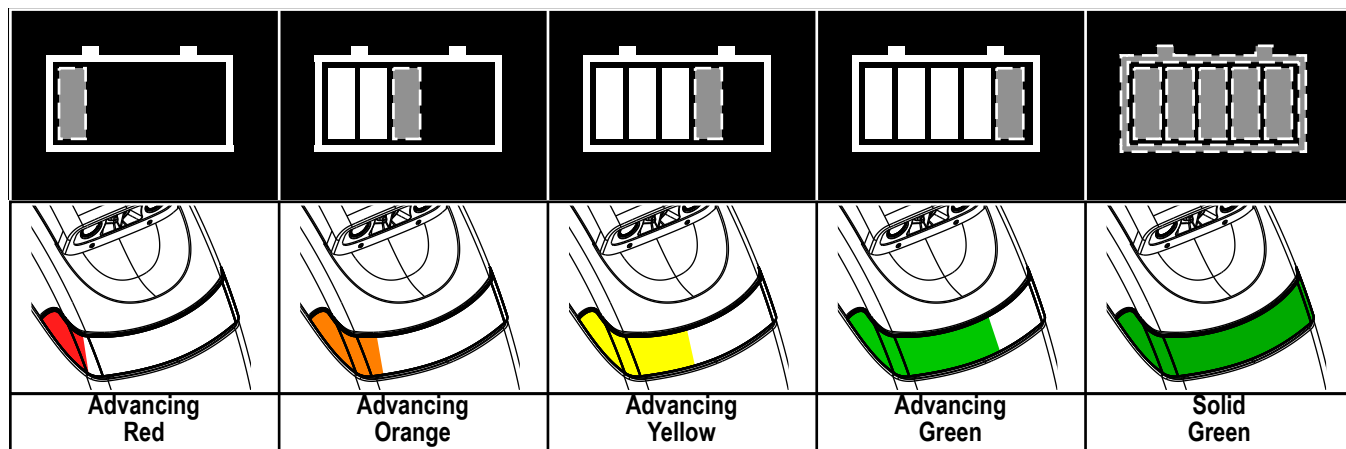


FIGURE 4-6



Standard constant current or taper current chargers **MUST NOT** be used. A temperature-sensing charger is recommended, as manual adjustments are never accurate and will damage any VRLA battery.

FIGURE 4-8



SQUEEGEE MAINTENANCE

If the squeegee leaves narrow streaks or water, the blades may be dirty or damaged. Remove the squeegee, rinse it under warm water and inspect the blades. Reverse/flip or replace the blades if they are cut, torn, wavy or worn.

To Reverse or Replace the Rear Squeegee Wiping Blade...

- 1 See Figure 4-9. Raise the deck and squeegee assembly off the floor, then unsnap the Rear Squeegee Blade Removal Latch (23).
- 2 Remove the Tension Strap (AA).
- 3 Slip the rear blade (AB) off the alignment pins.
- 4 The squeegee blade has 4 working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all 4 edges are nicked, torn or worn to a large radius.
- 5 Install the blade, following the steps in reverse order and adjust the squeegee tilt if necessary.

To Reverse or Replace the Front Squeegee Blade...

- 1 Raise the squeegee off the floor, then rotate the squeegee towards the outside of the machine to access. Disconnect the squeegee hose (AD) from the squeegee. Squeeze the back of the Squeegee Mount Bracket (AE) to open the bracket and pull the squeegee assembly off the machine.
- 2 Loosen the four Squeegee Cover Knobs (12). Then lift the Squeegee Cover (AF) off of the Squeegee Casting (AG).
- 3 Slip the front blade (AH) off the alignment pins.
- 4 The squeegee blade has 4 working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all 4 edges are nicked, torn or worn to a large radius.
- 5 Install the blade, following the steps in reverse order and adjust the squeegee tilt if necessary.

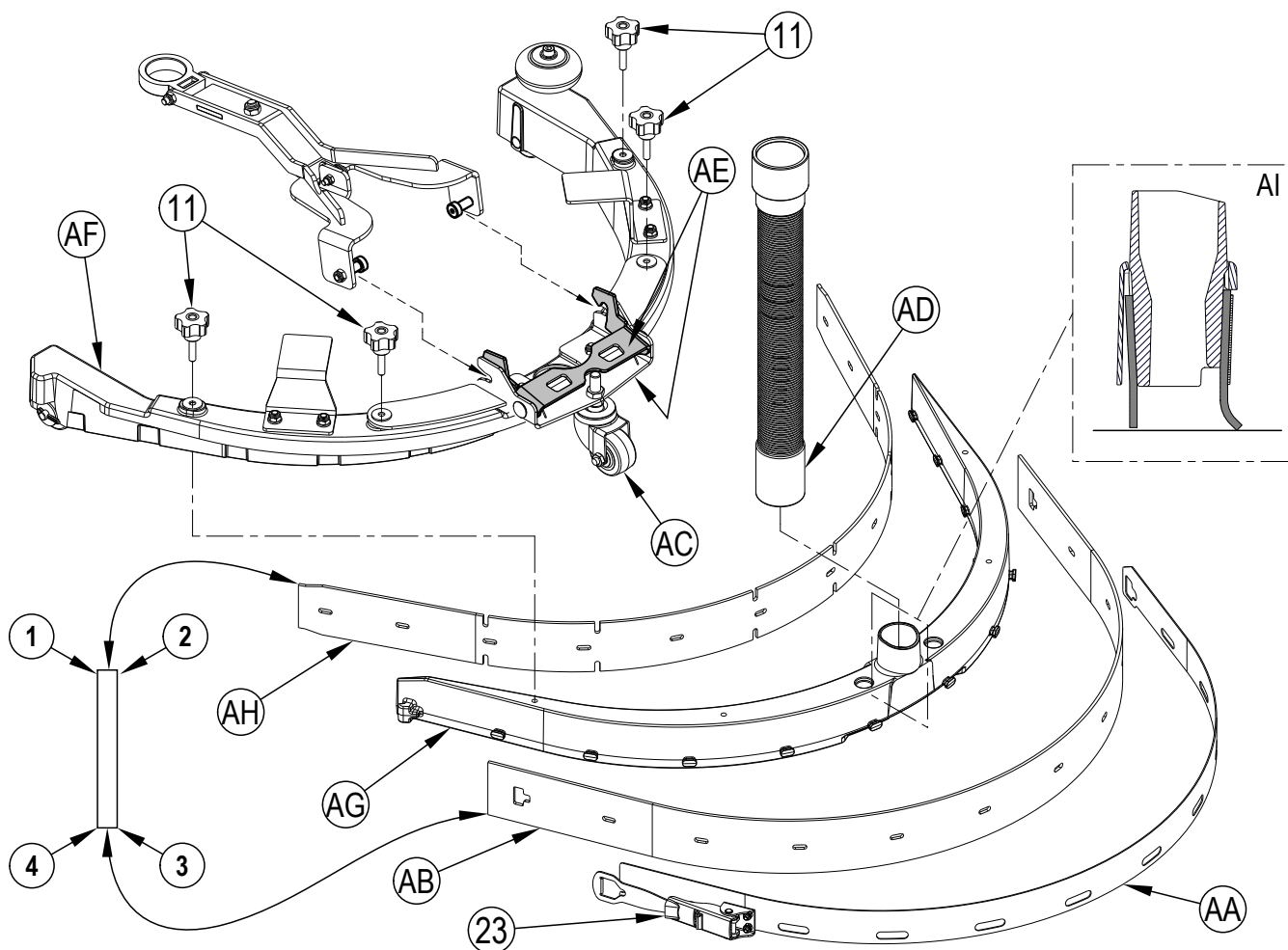
SQUEEGEE ADJUSTMENT

There is only one squeegee assembly adjustment possible, tilt.

Adjust the squeegee tilt if the squeegee is not wiping the floor dry.

- 1 Park the machine on a flat, even surface and lower the squeegee. Then drive the machine forward enough to have the squeegee blades fold over to the rear.
- 2 Adjust the squeegee tilt using the Rear Caster Wheel (AC) so that the rear squeegee blade touches the floor evenly across its entire width and is bent over slightly as shown in the squeegee cross section (AI).

FIGURE 4-9



TROUBLESHOOTING

GENERAL MACHINE TROUBLESHOOTING

Problem	Possible Cause	Remedy
Poor water pick-up	Vacuum hose not connected to the squeegee assembly	Connect vacuum hose to squeegee assembly
	Worn or torn squeegee blades	Reverse or replace
	Squeegee out of adjustment	Adjust so blades touch floor evenly across entire width
	Recovery tank full	Empty recovery tank
	Recovery Tank Drain Hose (37) leak	Secure drain hose cap or replace
	Recovery Tank Gasket (47) leak	Seat gasket properly / Replace gasket
	Debris caught in Squeegee (11)	Clean squeegee assembly
	Recovery Hose between squeegee and recovery tank clogged	Remove debris
	Using too much solution	Reduce flow via control panel solution switch
	Vacuum OFF or set to quiet mode	Turn vacuum ON or set vacuum to high
Poor scrubbing performance	Worn brush or pad	Replace brush or pad
	Wrong brush or pad type	Consult Nilfisk
	Wrong cleaning detergent	Consult Nilfisk
	Moving machine too fast	Slow down
	Not using enough scrub pressure	Increase scrub pressure
	Not using enough solution	Increase solution flow
Inadequate or no solution flow	Solution tank empty	Fill solution tank
	Solution filter (33), lines or valves clogged	Clean solution filter and flush lines
	Solution Shutoff Valve (34) closed	Open solution shutoff valve
	Solution Solenoid Valve (32) plugged or defective	Clean or replace valve
	Solution pump (35) air locked	(contact Nilfisk Authorized Service Center)
Solution tank empty Indicator (X23) appears when there is solution in the tank	No solution flow	See Problem "Inadequate or no solution flow" check remedies for no solution flow.
	Solution sensor (flow meter) failed	Change menu Option "Ignore water meter?" to Yes, to use machine until sensor can be fixed. (contact Nilfisk Authorized Service Center)
Machine does not power ON	Machine Battery Connector (43) disconnected	Reconnect battery connectors
	Tripped 5 Amp circuit breaker (E)	Check for electrical short circuit & reset
	Blown Main Fuse 100 Amp (42)	Replace Main Fuse 100 Amp
	Charger Interlock engaged	Unplug Charger
No FWD/REV wheel drive	A direction has not been selected	Press (Q) to select Forward direction or press (R) to select Reverse direction.
	Speed Adjustment Knob (P) rotated to none	Rotate Speed Adjustment Knob (P) clockwise
	Emergency Stop (D) activated, display will indicate "Release the red emergency stop button to continue." along with Fault Indicator (X14)	Reset the Emergency Stop
	Drive system speed controller	Check error fault codes (contact Nilfisk Authorized Service Center)
No Detergent Flow	Empty Detergent Cartridge (3)	Fill detergent cartridge
	Plugged or kinked detergent flow line	Purge system, straighten lines to remove any kinks
	Detergent pump	Check pump, wiring and lines
Magnetic SmartKey Errors	No Key Indicator (X19). -No Magnetic SmartKey is present on the SmartKey Reader (A).	Place an appropriate SmartKey onto the SmartKey Reader.
	Key Read Error Indicator (X20). - Magnetic SmartKey present on the SmartKey Reader (A) cannot be read.	Clean both the SmartKey and the SmartKey Reader using a clean cloth. Depress the SmartKey between your thumb and forefinger to insure free movement of the magnet.
	Restricted User Key Indicator (X21). -Magnetic SmartKey present on the SmartKey Reader (A) is not programmed to be used with this machine.	Place a SmartKey that has been programmed to be used with this machine onto the SmartKey Reader.

TROUBLESHOOTING - CONTINUED

AUTONOMOUS MODE TROUBLESHOOTING

Problem	Possible Cause	Remedy
Autonomy Error code present (5-XXXX)	Defined by error code	Review Fault Code Display table and follow Corrective Action
Machine will not recognize a location tag	Room is too dark for machine to "see" the location tag	Turn on more ambient light in the room or shine a flashlight on the location tag
Machine driving erratic (stopping frequently when there is no obstacle) or not driving	Dirty lenses on 3-D Vision Sensor (45) or 2D Mapping Sensor (14)	Clean all of the sensor lenses (see "Clean Sensor Lenses")
	Scratched lens on 3-D Vision Sensor (45) or 2D Mapping Sensor (14)	Severe scratch may require component (sensor) replacement (contact Nilfisk Authorized Service Center)
	Debris on rear wheel(s) interfering with sensors	Remove any debris (tape, hair etc.) from the rear wheels. Debris attached to the wheel can impact the encoder plate (slotted plate on machine side of wheel) or impact sensor performance.
Machine will not record a plan	Location tag position has not been set	Move machine to a Location Tag and Add Location Tag Position
	Wrong key or key permissions	Use Yellow Supervisor key or change User options to allow Blue User key to record plans
Machine begins to save a plan but will not save	Plan failure	Power machine OFF/ON then re-record plan
	Fill-In plan area too large (>115' x 115' / 35 x 35 m)	Re-record area, break up large areas into two or more separate plans.
Machine will not start playback of a plan	Machine not within a start area or resume area of a recorded plan	Drive machine to the start area of a plan (audible cue of two beeps upon entering start area). Display will indicate "Start point found" or "Resume area".
	Plan wasn't recorded using the Location tag which is currently active	If using multiple Location tags, ensure the plan you want to playback is associated to the last scanned Location tag.
	Key not removed from the machine	Remove key from machine
	Squeegee is rotated too far and triggering sensor	Rotate squeegee to be directly behind scrub deck then attempt playback
Plan playback not as expected	The Location Tag has been moved	Move the Location Tag back to its original position or delete and re-record plans associated to the Location Tag.
	Fill-In plan did not properly record	Re-record Fill-In plan making sure to drive the additional 25' along the perimeter after passing through the start point.
	Not enough environmental information to record a Fill-In plan.	Re-record Fill-In plan this time recording two loops around the perimeter of the area to be cleaned. See page 43
	Fill-In plan area too large (>115' x 115' / 35 x 35 m)	Re-record area, break up large areas into two or more separate plans.
	Operator understanding of Fill-In playback	The path the machine uses for Fill-In may not be what the operator expects. This isn't a problem as machine will determine best path to clean the entire plan area.
Plan playback in unexpected area (area with no recorded plans)	Plan shift	• If current plan previously played back successfully – Choose "Scan Location tag" from Autonomous Help Screen then re-scan Location tag and replay plan
		• If current plan never played back successfully - Re-record plan

FAULT CODE DISPLAY

Any fault codes detected by the controllers will be displayed on the control panel display as they occur. If more than one fault exists, the display will sequence through the fault codes. The fault code will display across the top of the screen.

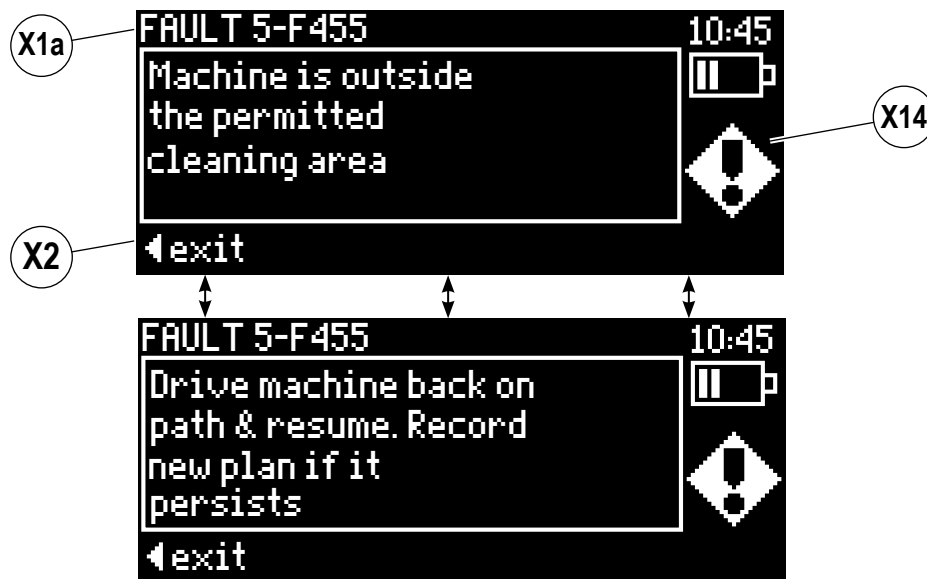
Fault codes are displayed as follows;

- Fault Code (**X1a**) will appear in the Display Header (**X1**)
- Brief description of the error will appear in the center of the screen (some descriptions will have two screens of information that will toggle every four seconds)
- The Fault Indicator will appear on the right of the screen
- For non-critical faults the operator can exit the fault screen (shown in the Display Footer (**X2**)), for critical faults the technician can navigate to the menu to troubleshoot the error.

X1a Active Fault Code

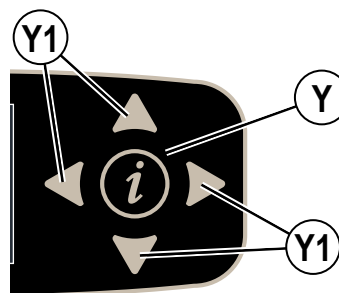
X2 Display Footer

X14 Fault Indicator



FAULT CODE HISTORY

Every fault code that occurs is recorded by the machine and kept in a history log. **See Figures 5-1 – 5-3.** To view the fault history press the Information Switch (Y) to bring up the Main Menu. Use the four Navigation Arrows (Y1) (up, down & left) to move through the menu and the back arrow to exit the menu.



Scroll down to Faults, Information Switch to select.

FIGURE 5-1

```
MAIN MENU
Hours
Log a Problem
Software Update
Faults
←exit, i select
```

Scroll down to Fault History, Information Switch to select.

FIGURE 5-2

```
FAULTS
Active Faults
Fault History 3
Clear History
Clear Active Faults
←back, i select
```

A list of faults is displayed along with the date and timestamp and the name of the fault, left arrow to back out of the menu.

FIGURE 5-3

```
FAULT HISTORY
5-E602 2020/03/11
Drop-Off Calibration
5-F293 2020/03/11
Software Reset
←back, ↕ scroll
```

SPECIFICATIONS

ACCESSORIES / OPTIONS

In addition to the standard components, the machine can be equipped with the following accessories/options, according to the machine specific use:

Disc Machines

- Brushes with harder or softer bristles
- Pads with more or less abrasiveness

REV Machines

- Pads with more or less abrasiveness
- SPP pads for finish removal

For further information about the above-mentioned accessories, contact an authorized Retailer.

MATERIAL COMPOSITION AND RECYCLABILITY

Material Composition and Recyclability		
Type	% of machine weight	% recyclable
Aluminum	1%	100%
Electrical / motors / engines - misc.	24%	80%
Ferrous metals	35%	100%
Harnesses / cables	2%	90%
Liquids	0%	0%
Plastic - non-recyclable	1%	0%
Plastic - recyclable	8%	100%
Polyethylene	26%	100%
Rubber	3%	100%

SOLUTION FLOW RATES

Manual Mode	Flow Rates At Full Manual Speed*		
	1 bar	2 bars	3 bars
20" Disc	0.16 GPM / 0.6 liters/minute	0.35 GPM / 1.3 liters/minute	0.50 GPM / 1.9 liters/minute
20" REV	0.13 GPM / 0.5 liters/minute	0.18 GPM / 0.7 liters/minute	0.23 GPM / 0.9 liters/minute

Autonomous Mode	Flow Rates At Full Autonomous Speed*		
	1 bar	2 bars	3 bars
20" Disc	0.11 GPM / 0.4 liters/minute	0.23 GPM / 0.9 liters/minute	0.33 GPM / 1.3 liters/minute
20" REV	0.09 GPM / 0.3 liters/minute	0.12 GPM / 0.5 liters/minute	0.15 GPM / 0.6 liters/minute

* Flow rates are proportional to speed

TECHNICAL SPECIFICATIONS

(AS INSTALLED AND TESTED ON THE UNIT)

Model		Nilfisk Liberty SC50 (X20D) Disc	Nilfisk Liberty SC50 (X20R) REV
Model No.		56104502 56104506 / 56104508	56104503 56104507 / 56104509
Voltage, Batteries	V	24V	24V
Battery Capacity (max)	Ah	255	255
Protection Grade		IPX4	IPX4
Sound Pressure Level IEC 60335-2-72: 2002 Amend. 1:2005, ISO 11203, ISO 3744	dB(A)/20μPa	63	63
Sound Pressure level - KpA (IEC 60335-2-72, ISO 11203) Uncertainty	dB(A)	3.0	3.0
Gross Vehicle Weight*	lbs / kg	1057 / 479	1068 / 484
Transportation Weight**	lbs / kg	756.9 / 343.3	765.5 / 347.2
Maximum Wheel Floor Loading – Manual (center front)	psi / kg/cm ²	196.8 / 13.8	196.8 / 13.8
Maximum Wheel Floor Loading – Manual (right rear)	psi / kg/cm ²	141.9 / 10.0	141.9 / 10.0
Maximum Wheel Floor Loading – Manual (left rear)	psi / kg/cm ²	146.3 / 10.3	146.3 / 10.3
Maximum Wheel Floor Loading – Autonomous (center front)	psi / kg/cm ²	214.7 / 15.1	214.7 / 15.1
Maximum Wheel Floor Loading – Autonomous (right rear)	psi / kg/cm ²	100.3 / 7.1	100.3 / 7.1
Maximum Wheel Floor Loading – Autonomous (left rear)	psi / kg/cm ²	98.6 / 6.9	98.6 / 6.9
Vibrations at the Hand Controls (ISO 5349-1)	m/s ²	0.17	0.17
Vibrations for the Whole Body (ISO 2631-1)	m/s ²	0.01	0.01
Gradeability – Manual Transport		15% (8.53°)	
Gradeability – Manual Cleaning		9% (5.14°)	
Gradeability - Autonomous		2% (1.15°)	
Machine Length	inch / cm	53.3 / 135.5	
Machine Height (top of steering wheel)	inch / cm	54.9 / 139.4	
Machine Width	inch / cm	30.0 / 76.3	
Machine Width with Squeegee	inch / cm	30.2 / 76.7	
Minimum Aisle Turn Width - Manual	inch / cm	62.7 / 159.2	
Solution Tank Capacity	Gallon / L	15 / 57	
Recovery Tank Capacity	Gallon / L	14 / 53	
Transport Speed – Manual (Fwd. Maximum)	mph / kph	3.1 / 5.0	
Transport Speed – Manual (Rev. Maximum)	mph / kph	1.62 / 2.6	
Transport Speed – Autonomous (Fwd. Maximum)	mph / kph	2.35 / 3.8	
Battery Compartment Size (approximate)			
Height (maximum)	inch / cm	12.25 / 31.115	
Width (maximum)	inch / cm	18.5 / 46.99	
Length (maximum)	inch / cm	18 / 45.72	
Scrub brush size			
Brush / Pad Diameter – (Quantity of 1)	inch / cm	20 / 50.8	
Scrub Brush Speed	RPM	157	2250 RPM – ¼ orbits & macro of 10-30 RPM
Cleaning Path Width (scrubbing path)	inch / cm	20 / 50.8	20 / 50.8

*Gross Vehicle Weight: Standard machine without options, full solution tank and empty recovery tank, with removable scrub brushes, batteries installed and 165 lb / 75 kg operator.

**Transportation Weight: Standard machine without options, empty solution and recovery tanks, with batteries installed and no operator.

GLOSSARY

<u>Glossary of Terms</u>	
<u>Term</u>	<u>Description</u>
CopyCat™	Type of plan in which the operator drives the exact route that the machine will use each time to clean the area.
Exclusion Zone	Area where the machine will not scrub.
Fill-In	Type of plan in which the operator records the outside perimeter of an area to be cleaned and the machine determines the exact route to take to clean the area.
Location Tag	Printed sign with a visual pattern designed for detection by machines. 3-D Vision Sensor and Location Tag detection software recognize the tags. Location Tags identify the set of saved plans available to the machine. 587 unique patterns (ID #'s).
Location Tag Position	Specific point on the map the machine uses to orient itself in the room
Path	The route the machine will travel while cleaning.
Plan	Recorded cleaning path, which includes the route the machine will travel and desired scrub settings.
Scan	Machine using it's 3-D Vision Sensor to view and identify a location tag

9435 Winnetka Ave North
Minneapolis, MN 55445
www.advance-us.com
Phone: 800-989-2235
Fax: 800-989-6566
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