INSULATING FOOTWEAR

workMaster™
by RESPIREX

THE WORKMASTER™ STORY

THE HIGHEST SPECIFICATIONS

Our category leading dielectric footwear is used globally to protect high voltage workers and our Hazmax™ boots are used wherever people work with dangerous or aggressive chemicals.

We have developed a new compound, **Cryolite** – a lightweight, environmentally friendly material for boots used in agriculture, food processing and general industry. Additionally our new **Cryotuff** compound delivers durable cut resistant footwear for longer life in tough environments. **Cryotuff** boots include a blown mid-sole for reduced weight and greater cushioning to reduce wearer fatigue.

Workmaster™ boots are manufactured at our automated state of the art footwear factory based in Reigate (in the United Kingdom). The injection moulding manufacturing process guarantees a seamless, leak-free construction. This modern high-volume production facility enables the manufacture of different types and styles of boots within the same operating run, giving the flexibility to meet rapidly changing market demands.

With an in-house UKAS accredited materials testing laboratory we are able to perform a range of chemical permeation and physical testing to European, American and international standards. We have extensive chemical permeation data for our Hazmax™ boots, but if you need data for a different chemical (or boot) please get in touch.

Workmaster™ is a division of Respirex™, a leading supplier of personal protective solutions, specialising in the design and manufacture of high-performance chemical, particulate and respiratory protective clothing.

www.respirexinternational.com

WHY USE DIELECTRIC BOOTS?

HIGH-VOLTAGE RISKS

Electrical power plays an important role in modern society. We take it for granted and rarely think that it is dangerous, but contact with electric current can cause serious injury and or death. Protection from accidental contact with live equipment and conductors is important for those exposed to electrocution risk.

WHAT ARE DIELECTRIC BOOTS?

Dielectric (or insulating) boots are used where there is a risk of electric shock from high voltages. They provide protection because their insulating properties stop electric current from being grounded. High voltage electric current can stop the heart or produce fatal burns.

Dielectric boots are used for working on live power or in the area of live power, as current can jump large distances, especially in wet or damp conditions. There have also been fatalities caused by digging in locations where power cables are buried underground and the cable has been inadvertently cut by a drill, shovel, or with a mole.

WHAT IS SPECIAL ABOUT WORKMASTER™ DIELECTRIC BOOTS?

- They are seamless, fully waterproof and their performance is not affected if they get wet
- Unlike leather boots, the performance of Workmaster™ dielectric boots is not compromised by perspiration
- The wearer is always protected, unlike dielectric matting, which the user can step off unintentionally
- At 5kV (the test voltage for live working at 1kV), alternating current can jump 40mm, which is greater than the depth of a typical safety shoe sole
- Every single boot is electrically tested before it leaves the factory, ensuring the highest quality & safety
- Boots are available tested against AC or DC voltages, depending on the customer requirement

APPLICATIONS

- Power generation and distribution
- Electrified transport systems such as the Railways
- Utility companies who run the risk of cutting electric cables whilst digging or moling
- Power sub-stations were the current can jump distances (e.g. Hospitals and Shipping)
- Wind Farms
- Electric and hybrid vehicle construction, maintenance and recovery

N.B. *Dielectric boots (as with any other item of high voltage PPE) should be used with a second barrier in case one barrier fails, typically this would be a dielectric glove.*

WHAT ABOUT THE TECHNICAL DETAILS?

INSULATING (DIELECTRIC) FOOTWEAR FOR LIVE WORKING

EN 50321-1:2018 is the new standard for insulating footwear for live working and was published earlier this year, it replaces EN 50321:1999 and is currently out for approval as an IEC standard which will make it a global standard, not just European.

The main changes in the 2018 revision are the introduction of four new classes (see below) for working up to 36 KV (the old standard only went up to Class 0 - 1 KV). Boots are now tested by filling with water instead of ball bearings to simulate water or perspiration potentiality wicking up the lining and creating a flash over. There is also now an electrical test after perforation of the sole by a nail, to ensure boots still give electrical protection after perforation. Even non-metallic perforation inserts can allow water to pass through them so will allow an electrical current to pass when the sole is punctured. The table below lists the classes and the test requirements:

	Maximum Working Voltage	Withstand Test Voltage	Leakage Current Test Voltage	Maximum Leakage Current
Class 00	**500V**	5kV	2.5kV	3mA
Class 0	**1kV**	10kV	5kV	5mA (8 mA)
Class 1	**7.5kV**	20kV	10kV	10mA (16 mA)
Class 2	**17.5kV**	30kV	20kV	18mA
Class 3	**26.5kV**	40kV	30kV	20mA
Class 4	**36kV**	50kV	40kV	24mA

(Overboot requirements are in brackets where they are different to knee high boots)

The new standard also includes requirements for DC current; all boots used for DC must be tested for DC according to the new standard and this is available as an option (contact us for details).

RE-TESTING DIELECTRIC FOOTWEAR

Not many people are aware that Annex B2 of the standard for dielectric footwear - EN 50321:2000 (Electrically insulating footwear for working on low voltage installations), requires that all approved dielectric footwear is re-tested every year. This is why Workmaster™ boots have a space to record periodic inspection testing next to the CE markings on the boot. This requirement applies to all CE marked dielectric footwear from every manufacturer - if boots are not re-tested then they are effectively no-longer compliant to the standard.

Dielectric boots under test at the Workmaster™ boot factory

WHY IS LEATHER FOOTWEAR NOT SUITABLE FOR LIVE WORKING?

The standards that currently relate to footwear for live working are ASTM F1117 in the USA and EN 50321-1:2018 in Europe which is set to become an IEC (International Electrotechnical Commission) standard, making it applicable globally. Both these standards test the footwear by filling it with water and immersing in water to a set depth from the top of the boot depending on the test Voltage. A test voltage is applied and the current passing through the boot is measured. A gap is left between the water surface and the top of the footwear to insure that when the test voltage is applied, current cannot arc over the top of the footwear (as at high voltages current can jump surprisingly large distances). At 5 KV, the Class 0 test Voltage for live working at up to 1000V, the gap from the water surface to the top of the boot is specified at 40 mm inside and outside the boot, for Class 1 (with a 10kV test voltage) this gap is increased to 70 mm.

For this reason footwear with just an insulating sole cannot be used, as soles on most Industrial boots are not 40 to 70 mm (1.5 to 2.75 inches) thick.

If the upper of the footwear is leather then when leather gets wet it will conduct electricity. This applies even to waterproof leather, as this relies on a thin coating of Polyurethane over the leather which can be easily damaged during normal use/wear.

Even in dry conditions the leather will become wet due to perspiration. A typical foot perspires at a rate of 13 grams of water per hour so the leather will quickly become electrically conductive. This means that for waterproof leather footwear, the electrical insulation on the upper is reliant on a very thin layer of Polyurethane (typically 0.1 mm or less). For comparison, the wall thickness of an insulating boot is specified at > 2.5 mm. It is for this reason that both live working standards fill the footwear with water to perform the test, to ensure the footwear maintains its protection even in wet and humid conditions.

We firmly believe that only footwear that passes either EN 50321-1:2018 or ASTM F1117 should be used for live working. Leather Footwear will not pass these standards.

There are 2 reasons:

1. Electricity can jump around an insulating sole
2. Leather and some other upper materials will conduct electricity once they have absorbed perspiration or water from environment.

Standards such as ASTM F 2413 and pr EN 50321-2 are test procedures for testing Insulating soles and are not suitable for certifying footwear for live working.

For live working specify footwear that is certified to EN 50321-1: 2018 or ASTM F1117. An important part of conformance to the live working standard is that **all** footwear is electrically tested to the relevant class before it leaves the factory. The class of footwear required will be determined by the working Voltage (see the table below). If the risk is from direct rather than alternating current then specify that a DC test is performed on the footwear by the manufacturer.

	Working Voltage	Routine test Voltage	Water level from the top of the boot	Withstand test (destructive)
Class 0	Up to 1 kV	5 kV	40 mm	10 KV
Class 1	Up to7 .5 kV	10 kV	70 mm	20 KV
Class 2	Up to 17.5 kV	20 kV	90 mm	30 KV
Class 3	Up to 26.5 kV	30 kV	120 mm	40 KV
Class 4	UP to 36.5 kV	40 kV	130 mm	50 KV

THE SCIENCE OF SLIP

There are two slip resistance tests specified in EN ISO 20345:2011 (with the method described in EN13287); the first is soapy water (Sodium Lauryl Suphate solution) on a ceramic tile. If the footwear passes this test then the boot can be marked **SRA**. The second is oil (Glycerol) on a steel plate, if the boot passes this test then it can be marked **SRB**. If a boot passes both the SRA and SRB test then it can be marked **SRC**.

There is a common misunderstanding that SRC is the best for slip resistance - this is not the case! Since the introduction of slip testing, accidents caused by slips have not reduced; this is because to pass the slip requirements on oily steel manufacturers have to sacrifice some slip performance in water, but most slip accidents occur where water is the contaminant (over 95%).

The SRB test (oil on steel) has a very low pass/fail limit and the error in measurement is +/- 50%. The pass value is so low that the probability of a fall in this environment is still high. Because of this it is expected that in the next revision of EN ISO 20345 the SRB test will be significantly changed and SRC removed.

The Workmaster™ vulcanised rubber sole produces very high levels of slip resistance with soapy water on a ceramic tile, and these test results have been confirmed during customer wear tests. Due to the performance characteristics of the sole material, boots with our vulcanised rubber sole also achieve a pass on the SRB (oil on steel test), **without compromising SRA performance** and are marked SRC.

BENEFITS OF A VULCANISED RUBBER SOLE

Over 30% of industrial accidents result from slips, trips and falls - as Workmaster™ boots are frequently used in environments where there are liquids present a slip resistant sole is crucial, which is why we provide the option of a high-performance vulcanised rubber sole on our boots.

This provides a number of important benefits:

- Slip resistance is twice that required by EN 13287 SRA and SATRA TM144 standards
- Grip is 30% better than with a conventional safety boot sole
- Wear resistance is 2 to 3 times that of conventional soles
- Non marking vulcanised nitrile rubber compound
- The sole is resistant to fuel and oil
- Greater cut resistance than conventional soles
- Resistant to hot contact for 60 seconds at 300^{0}C
- Cold insulation

OUR BOOT FEATURES

All of our boots are approved to either EN ISO 20345:2011 or EN ISO 20347:2012 depending on their application. These icons are used throughout the catalogue to highlight the specific features and benefits of each boot.

SB Category Safety Boot

Complies with the requirements for safety footwear in EN ISO 20345:2011.

O4 Category Occupational Footwear

Complies with the requirements for occupational footwear in EN ISO 20347:2012.

Toecap

Epoxy coated steel toecap fitted tested for 200J impact resistance and 15kN compression.

Energy Absorbing Heel

Provides a minimum of 20J cushioning at the heel, reducing the risk of fatigue and injury to joints and spine.

Boot Marking: E

Fuel and Oil Resistant

The outer sole is resistant to oil, ensuring the working life of the boot won't be compromised if used in oily environments. The test involves immersion in oil for 22 hours after which the sole is checked for excessive swelling, shrinkage or increased hardness.

Boot Marking: FO

Hot Contact

The sole has been tested for contact with a hot metal surface at 300°C for 60 seconds.

Boot Marking: HRO

Cold Insulation

The thermal insulation properties of the boot ensure that the temperature decrease inside a boot at 23°C when placed in a cold chamber at -17°C is less than 10°C after 30 minutes when measured at the upper surface of the insole.

Boot Marking: CI

Slip Resistant SRA

Tested and approved for resistance to slip on a ceramic tile floor coated with a dilute soap solution of sodium lauryl sulphate (NaLS). The test measures forward slip on the heel and with the boot flat to the floor.

Boot Marking: SRA

Slip Resistant SRC

Tested and approved for resistance to slip on a ceramic tile floor coated with a dilute soap solution of sodium lauryl sulphate (NaLS) [SRA] **and** Slip resistance on steel floor with glycerol [SRB]. The tests measure forward slip on the heel and with the boot flat to the floor.

Boot Marking: SRC

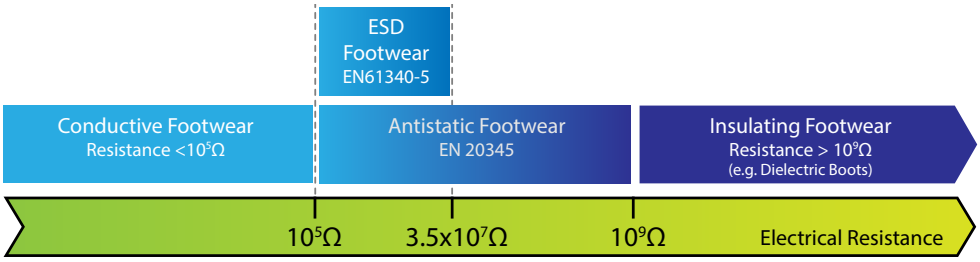
Live Working

Dielectric boots that comply with the EN50321 standard for electrically insulating footwear.

Boot Marking: Double Triangle

INSULATING, ANTISTATIC AND ESD FOOTWEAR

According to EN 20345: 2011, a shoe or boot is considered to be **antistatic** if its' measured electrical contact resistance falls between **100 kΩ** (10^5 ohms) and **1 GΩ** (10^9 ohms). With a lower resistance, a shoe or boot is considered to be conductive and at higher values, to be **insulating**. This 100kΩ to 1GΩ range is regarded a sensible compromise for general safety footwear, giving protection from electrostatic build up and protection from electrical shocks at lower voltages. For **Electro-Static Discharge (ESD)** footwear, which us used in potentially explosive atmospheres and in the production of sensitive electronic components and devices, the lower limit of electrical resistance is **100 kΩ** (the same as for antistatic footwear) and the upper limit is **35 MΩ** (3.5 x 10^7 ohms).



CLASS 3

26.5kV
Maximum Working Voltge

30kV
Test Voltage

DIELECTRIC HV3+ BOOTS

A Class 3 AC (EN 50321-1:2018) electrically insulating dielectric boot with an integral steel toe cap. The Workmaster™ Dielectric HV3+ boot allows high voltage live working at up to 26.5kV with every boot tested at 30kV.

- Lightweight design for increased wearer comfort
- Low temperature flexibility down to -40ºC
- Durable, slip resistant vulcanised rubber sole for maximum grip
- Energy absorbing tunnel system in heel and ergonomic cushioning insole (removable and machine washable) for greater wearer comfort
- Cold insulation to EN ISO 20345
- High-visibility green HV3 compound shaft
- Meets the requirements of ASTM 1117 (20kV) and ASTM 2413
- Also available in a moulded sole version (without fuel & oil resistance, resistance to hot contact of the sole - see HV3)

Part No. B01703/[EU Size]

DIELECTRIC HV3 BOOTS

A Class 3 AC (EN 50321-1:2018) electrically insulating dielectric boot with an integral steel toe cap. The Workmaster™ Dielectric HV3 boot allows high voltage live working at up to 26.5kV with every boot tested at 30kV.

- Lightweight design for increased wearer comfort
- Low temperature flexibility down to -40ºC
- Energy absorbing tunnel system in heel and ergonomic cushioning insole (removable and machine washable) for greater wearer comfort
- High-visibility green HV3 compound shaft
- Meets the requirements of ASTM 1117 (20kV) and ASTM F2413

Part No. B01703/[EU Size]

DIELECTRIC HV3 MAXI OVERBOOT

A Class 3 (EN 50321-1:2018) electrically insulating dielectric overboot approved to current European standards. The Respirex dielectric boot provides protection of up to 26.5kV over the complete boot.

- Ingenious rear entry design ensures the boot is quick and easy to fit and remove
- Ideal for personnel who have to continually enter and exit high voltage areas
- Light weight
- Fluorescent green colour
- Seamless construction
- Kick off lug
- REACH Compliant

Part No. B01170/[M, L, or XL]

CLASS 2

17.5kV
Maximum Working Voltge

20kV
Test Voltage

DIELECTRIC BOOTS

An electrically insulating Class 2 AC or DC (EN 50321-1:2018) dielectric boot with an integral steel toe cap and vulcanised rubber sole for superior slip resistance. The Workmaster Dielectric boot provides high voltage protection of up to 20kV over the complete boot for over 8 hours, and 35kV over the sole for 3 minutes. This high voltage boot is suitable for use by electricians, utility engineers and live working up to 17kV.

- Every boot tested to 20kV (AC testing as standard, DC testing available on request)
- Leakage current less than 5mA at 5kV and less than 18mA at 20kV
- Meets the requirements of ASTM 1117 (20kV) and ASTM 2413
- Blue vulcanised rubber sole for maximum grip - 30% better than a conventional safety boot sole
- Slip resistance performance twice that required by SATRA TM144 standard
- Two to three times the wear resistance of conventional soles

Part No. B00950/[EU Size]

DIELECTRIC COMPACT OVERBOOT

A Class 2 (EN 50321-1:2018) electrically insulating dielectric overboot the Workmaster™ Compact dielectric boot is designed to be worn over safety shoes and trainers and allows live working to 17.5kV with every boot tested to 20kV.

- Yellow dielectric compound shaft
- Single piece injection moulded construction with integral moulded fastener ensures there are no seams or mounting/fastener holes to leak
- No metal fasteners or components used in the construction
- Slip resistant sole in blue dielectric compound
- Fuel and oil resistant sole
- Meets the requirements of ASTM 1117 (20kV)

Part No. B01180/[M, L, or XL]

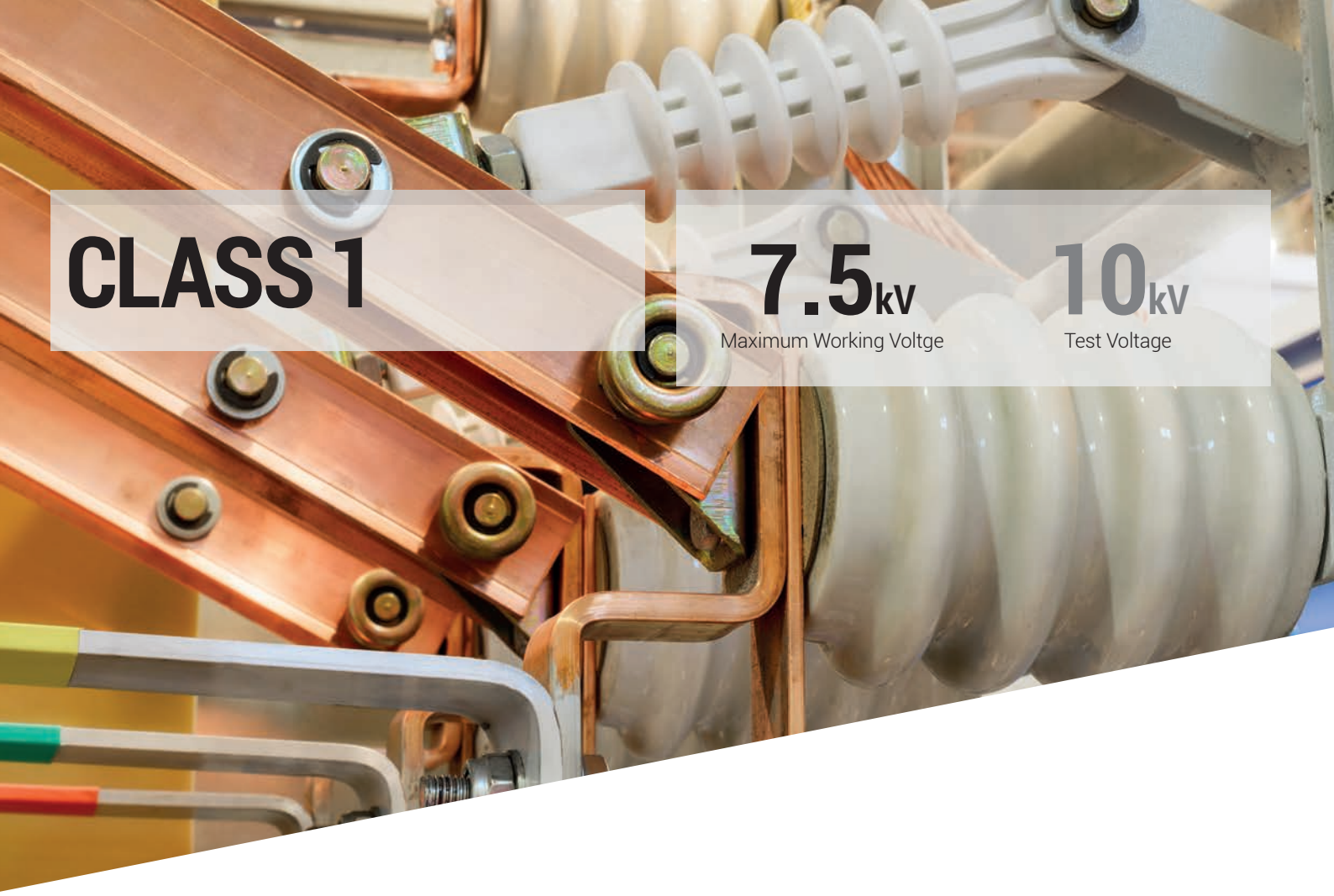
OVERBOOT STYLES

COMPACT OVERBOOTS

- Designed for safety shoes/trainers
- Opens and fastens at the front
- Moulded high-grip sole (SRC)
- Fuel & oil resistant sole (FO)

MAXI OVERBOOTS

- Designed for safety boots
- Opens at the rear, fastens at the front
- Moulded sole (HV3) or vulcanised rubber sole (Dielectric & Foodmax LV)
- Fuel & oil resistant sole (FO)
- Sole resistant to hot contact - 300°C for 60 seconds (HRO)



CLASS 1

7.5kV
Maximum Working Voltge

10kV
Test Voltage

DIELECTRIC MAXI OVERBOOT

A Class 1 (EN 50321-1:2018) electrically insulating dielectric overboot with a vulcanised rubber sole for superior slip resistance. The Workmaster™ maxi dielectric overboot is designed to be worn over safety boots and allows live working at up to 7.5kV with every boot tested to 10kV.

- Ingenious rear entry design ensures the boot is quick and easy to fit and remove over conventional safety boots
- Blue vulcanised rubber sole for maximum grip - 30% better than a conventional safety boot sole
- Slip resistance performance twice that required by SATRA TM144 standard
- Two to three times the wear resistance of conventional soles
- Fuel and oil resistant sole
- Greater cut resistance than conventional soles
- Resistance to hot contact 60 seconds 300°C
- Meets the requirements of ASTM 1117 (20kV)

Part No. B01170/[M, L, or XL]

CLASS 0

1 kV
Maximum Working Voltge

5 kV
Test Voltage

FOODMAX LV

Designed for abattoir use the Foodmax LV combines all the features of the standard Foodmax boot with electrical protection to EN 50321-1:2018 Class 0 to protect workers in areas where electrical stunning equipment is used.

- White or blue chemically resistant compound shaft
- Superb low temperature flexibility down to -40ºC
- Cold insulation to EN ISO 20345
- Cut resistant shaft to EN388 Class 4 (requirement 2.5)
- Excellent resistance to oil and animal fats
- Vulcanised rubber sole for maximum grip - 30% better than a conventional safety boot sole
- Slip resistance performance twice that required by SATRA TM144 standard
- Two to three times the wear resistance of conventional soles
- Fuel and oil resistant
- Greater cut resistance than conventional soles
- Suitable for live working at up to 1kV with every boot tested to 5kV

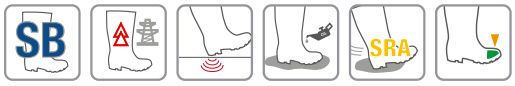
Part No. B01223/[EU Size] (white), B01223/B/[EU Size] (blue)

DIELECTRIC N BOOT

A Class 0 electrically insulating dielectric boot with an integral steel toe cap and Nitrile/PVC sole. The Respirex Dielectric N boot has a maximum working voltage rating of 1kV.

- Cleated outsole for maximum grip
- Slip resistance to EN 13287 SRA and SATRA TM144
- Fuel and oil resistant sole
- Non-wicking knitted nylon lining
- Moisture absorbing insole (removable and machine washable)

Part No. ?/[EU Size]



FOODMAX LV MAXI OVERBOOT

An electrically insulating overboot designed for use in the food industry and approved to current European standards. The Foodmax LV overboot provides protection of up to 20kV over the complete boot for over three minutes.

- Ingenious rear entry design ensures the boot is quick and easy to fit and remove
- Superb low temperature flexibility down to -40°C
- Resistant to chemicals commonly used in the food processing industry
- Ideal for personnel who have to continually enter and exit hazardous areas
- Cut and abrasion resistant
- Slip resistant sole
- Fuel and oil resistant
- Seamless construction

Part No. ?/[M, L, or XL]

workMaster™
by RESPIREX

FIND OUT MORE

For more details on our range of specialist protective footwear visit our website:

www.workmasterboots.com