

APPLICATION

The Continuous Effluent Decontamination (CED) system is designed to decontaminate biologically hazardous waste. As the waste flows through the CED system at a constant flow rate, the waste is heated to the set point temperature. The waste remains at the set point long enough to be decontaminated. To assure decontamination is achieved, the temperature is continuously monitored, and a stable flow rate is maintained during the process.

DESCRIPTION

The CED system is heated by steam, and consists of a tank module, and a decontamination module. The tank module is designed to collect and store the waste water to optimize the use of the decontamination module. The tank is manufactured of American Iron and Steel Institute (AISI) 316L stainless steel. The tank operates at atmospheric pressure, and is equipped with a vent line. The vent line has a filter to assure the sterility of the air vented to the room. The filter is continuously heated to 176°F (80°C) by electrical heating elements. The tank module also includes a prefilter for screening solids larger than 1.2 mm in diameter. The vent filter, the tank, and the prefilter system are automatically steam sterilizable in place. The tank is also equipped with inspection ports. The entire system is equipped with inlets and outlets for circulation of a CIP (Clean-In-Place) media.

The decontamination module consists of a pump assembly (two centrifugal pumps in series), and heat exchanger systems designed for heating the water up to the decontamination temperature, and cooling it down after decontamination. Heat exchangers are the tube-in-shell type manufactured of AISI 316L stainless steel. The decontamination section has two temperature probes placed



(Typical only - some details may vary.)

at the beginning and the end of the decontamination section to assure the required temperature has been reached for the required pipe length.

After the decontamination section, the waste water is directed to drain or to a return loop circulating the water back to the decontamination module inlet. When directed to drain, the decontamination waste water is cooled to 140°F (60°C) by cooling heat exchangers before discharge. When directed to the return loop, the waste water is cooled back to its inlet temperature in order to maintain stable temperature control of

The Selections Checked Below Apply To This Equipment

**CED SYSTEM
 (LITERS/HR)**

- 300 / 79 gal.
- 500 / 132 gal.
- 1,000 / 264 gal.
- 2,000 / 528 gal.
- 3,000 / 793 gal.

CONTROL

- Allen-Bradley PLC
- Siemens PLC

**BUFFER TANK CAPACITY:
 STANDARD**

- 1,000 liters

OPTIONAL BUFFER TANK SIZES

- 2,000 liters / 528 gal.
- 3,000 liters / 793 gal.- 8,000 liters / 2,113gal.*

*These Buffer Tanks can be customized according to Customer needs.

OPTIONS

- Second Inlet Pre-filter for Buffer Tank
- Six Channel Paperless Recorder
- Magnetic Agitator for Buffer Tank
- Solid Waste Separator
- Solid Waste Separator Platform
- Start-Up and Operator Training for the CED System
- Sterile Air Compressor
- CPU Upgrade for Ethernet Connection
- Dual Operator Panel
- Spare Parts Kit
- Spare Pump
- Tank Size Upgrade 1000L = > 2000L (PED)
- Tank Size Upgrade 1000L = > 2000L (ASME/CRN)
- Room Leak Indicator and Alarm
- CIP Skid for CED Cleaning in Place

Item _____

Location(s) _____

the decontamination module. The return loop is always used at system start-up until the required decontamination temperature is reached.

The CED unit has several modes of operation. The modes are: normal mode, automated self test mode, automated steam sterilization mode, clean-in-place (CIP) mode, and the service mode.

- **Normal mode** automatically controls the CED unit during its normal operation. Waste water is collected in the tank and is then pumped to the decontamination module. There are four configurable action levels in the tank. When the *start* level is reached, the water is pumped to the decontamination module until the *stop* level is reached. Two other action levels are meant for shutting the system down in case of excessive effluent rates (*high*) and protecting the pumps and the optional agitator against damages caused by running them dry, without water. The waste water is decontaminated in the decontamination module.
- **Automated self-test mode** is designed to ensure the CED unit is operating effectively before effluent is decontaminated. Each time the system is started after a period of shut down, or after an alarm condition, it tests for correct operation of the vent filter, pumps, heater, coolers, and the integrity of the valve assembly forming the contamination barrier toward effluent drainage. The normal decontamination operation cannot start unless the self-test has first been successfully performed.
- **Automated steam sterilization mode** is designed for the CED unit to be separately steam sterilized. The default sterilization temperature is 252°F (122°C). The desired steam sterilization process is initiated by the operator from the operator interface panel. The sterilizable sections are:
 1. The inlet prefilter, including the pipe from filter to tank.
 2. The vent filter line and vent filter.
 3. The effluent tank.
 4. Decontamination module including all its piping, valves, and heat exchangers.

The decontamination module is sterilized with hot water circulating at 252°F (122°C), not with steam.

Sectional sterilization is a safety feature. In the event of a maintenance operation, the system is isolated for sterilization sequence by automatic valves. This avoids the problem of draining and disposing of contaminated effluent before service work can start, and assures that service work can be performed safely and quickly.

- The CED unit can be combined with a CIP system to allow for periodic cleaning in place of system internals. This system is safely interlocked with the control system. CIP cannot proceed unless a full sterilization cycle has been performed. As with sterilization, sections of the CED system can be cleaned in place. This allows for the flexibility of cleaning parts of the system (for example, prior to service work) without fully draining the system.
- **Service mode** provides the operator with I/O test and calibration features. A password is needed to enter the service mode.

STANDARDS

The CED system is designed and manufactured to meet the applicable sections of the following European Union directives:

- Machine Directive 89/392/EC
- Low Voltage Directive 73/23/EC
- Electro Magnetic Compatibility 89/336/EC
- **Pressure Equipment Directive 97/23/EC**

The following common standards were used during the design, manufacturing and testing of the unit:

- **Pressure Vessel:** ASME (American Society of Mechanical Engineers with National Board registration)
- **Pressure Vessel:** PED (Pressure Equipment Directive)
- **Electricity:** IEC 204 (International Electric Code)
- **CSA/UL** (for USA/Canada)
- **Software Design:** GAMP (Good Automated Manufacturing Practice)

FEATURES

Tank storage capacity: 1,000 liters / 264 gal. - 8,000 liters / 2113 gal.

Collection tank and piping: fabricated from AISI 316L.

Decontamination capacities: 300-3,000 liters/hour. (The capacity of the system is based on the computer's estimated waste water flow according to the calculation attached to the specification in the quotation package.)

The **effluents** are filtered through a 1.2 mm screen to remove large soil materials before entering the CED system.

CED control uses commercially available Programmable Logic Controller (PLC).

Password protection restricts access of unauthorized users to critical operational modes.

Basic Documentation Package is included with the CED system. The Basic Documentation Package provides sufficient data to assist the owner in the development of validation procedures, and final validation of the equipment.

Factory Acceptance Test (FAT) is an integral part of the equipment qualification to ensure quality and enhance



validatability. The FAT procedure is scheduled for up to three days at the STERIS Finn-Aqua factory with Customer attendance at the FAT with a maximum of three individuals. The intent of the FAT is to challenge the unit to ensure that it functions as intended. The owner validates the equipment after installation on-site for review and acceptance by a local governing body. The products and services presented by STERIS are made available to assist and simplify the owner in this validation process. Validation requirements remain the sole responsibility of the owner. The STERIS Finn-Aqua FAT procedure consists of an Installation Qualification (IQ) and Operational Qualification (OQ).

The Installation Qualification (IQ) is performed to verify the physical aspects of the system have been manufactured in accordance with applicable design drawings and specifications. The following actions are performed during IQ:

- Evaluate the adherence to STERIS Finn-Aqua mechanical and electrical design documents such as equipment drawings, P&ID with parts lists, electrical schematic with parts list, cabling drawing, and control panel layout drawing.
- **Control system hardware acceptance test** includes the recording of the program version. CPU clock accuracy test includes the recording of the program version. CPU clock accuracy test, 24V DC supply test, and loop tests include analog and digital input and output modules.
- **Calibration** of process instruments in accordance to international traceable standard.

The Operation Qualification (OQ) is performed to test the unit's functionality and guarantee it's functioning according to the specification. The following procedures are completed during the testing process:

- Prerequisite procedures.
- Verification that utility connections are properly installed and adjusted.
- System settings and adjustments.
- Power break tests.
- Alarm tests.
- Control system access tests.
- User abort and interlock tests.
- Process tests.

OPTIONS

- Second Inlet Pre-filter for Buffer Tank
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- Solid Waste Separator
- Solid Waste Separator Platform
- Sterile Air Compressor
- CPU Upgrade for Ethernet Connection
- Dual Operator Platform
- Spare Parts Kit
- Spare Pump
- Tank Size Upgrade 1000L=>2000L (PED)
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- Room Leak Indicator and Alarm
- CIP Skid for CED Cleaning in Place



UTILITY CONSUMPTIONS

The capacity of the system is based on the Customer's estimated waste water flows according to the calculation attached to the specification in the quotation package.

CONTROLS

CED control uses commercially available Programmable Logic Controller (PLC). The control system consists of either the Allen-Bradley or the Siemens PLC with an operator interface. The control system hardware required transformer(s), fuses, etc., are mounted within an integral control cabinet. The electrical and mechanical designs of the unit, relative to the PLC functions, are in accordance with general fail-safe principles. This principle ensures that in a situation where a mechanical failure of a component or loop fault would occur, the CED would be automatically controlled to a safe state by the PLC. The PLC monitors and automatically controls all process operations and functions. The control system consists of the following main components: CPU module, I/O modules, and operator interface. All parts of the control system are Allen-Bradley or Siemens products, depending on client's choice of control system brand. All modules are properly insulated against electrical and magnetic disturbances. Control system hardware is installed into a 10-slot rack providing at least one free slot for future expansion, if required.



The operator interface is user friendly and easy to operate. All functions are logically grouped in menus and sub-menus to help the user navigate the screen structure with the following main menus: Decontamination, Configure, Calibration, and Service.

The password protection provides restricted access of unauthorized users to critical operational modes. Access levels are available for the operator, supervisor, and service level groups:

- **Operator Level:** Allows the operator to start the process and view process parameters.
- **Supervisor Level:** Allows the supervisor to configure the process, start the process, view the process parameters, and edit process parameters.
- **Service Level:** Allows the service person to configure the process, start the process, view the process parameters, calibrate instruments, activate/deactivate inputs and outputs and change the passwords for the other levels.

The alarms are designed to identify possible disturbances and deviations within the process. In a situation where an alarm is active, the control system automatically displays it on the operator interface via the alarm screen(s). All active alarms remain on the operator interface alarm screen until the situation has been appropriately acknowledged, resolved, and reset. Alarm conditions are communicated to the operator by:

- **Text** visually displayed on the operator interface alarm screen, which will flash (blink on/off) until the alarm is acknowledged.
- **Audible alarm** (buzzer) is active until the alarm-acknowledged button is pressed.
- **Common alarm** relay output is provided for the Customer remote monitoring purposes.

Alarms are categorized as Aborting, Holding, or Informative, depending on the severity of the malfunction.

SAFETY FEATURES

In addition to the safety related sterilization, CIP and test functions, the CED unit has the following built in safety features:

- **Hard wired circuit** for closing the outlet valves if low temperatures are detected in the decontamination zone.
- **Additional pressure transmitter** for monitoring the integrity of the contamination barrier valve.
- **Automatic sequence** for decontaminating the barrier valve in case of valve leakage.
- **Critical valves** between the process zones equipped with position switches for immediate alarm function.
- **Level switch and alarm** for prefilter blockage indication.
- **Heated vent filter housing** to prevent bacteria growth.
- **Pipe connections** either welded or compressed fitted to prevent leakage.
- **Splash-proof full paneling** for protecting the operator.
- **CED system** is designed to overcome effluent blockages via settlement or precipitation with continuous operation and smooth internal steel surfaces.
- To ensure that only fully decontaminated effluent leaves the CED system, a barrier area of four valves is provided after



- the decontamination zone. The valves are provided with integrity monitoring (via a pressure transmitter). Should a leak occur in the barrier valve, the system alarms and the other valves in the barrier maintain a seal on the system. The valve area can be automatically sterilized and the valve repaired/replaced without having to drain the system.
- The CED unit is provided with two pumps installed in specific areas. At any one time, only one pump is required to operate the system. In the event of a pump failure, the system alarms and automatically switches to the second pump so that decontamination continues. At an appropriate time, the pump area can be isolated and sterilization may be performed using the other pump. Afterward, the failed pump can be removed and repaired/replaced without having to drain the system.



- In the unlikely event of a system leak, the decontamination module is provided with an integral drip tray. This is designed to slope to one corner of the tray where a level sensor is located. Thus, small quantities of water can be detected by the level sensor. In the event of a leak, the system alarms and shuts down. Steam sterilization of the system can then proceed and the source of the leak dealt with. For safety, the drip tray is sized for twice the volume of the waste water in the decontamination module.
- **Decontamination module** is contained within stainless-steel panels. This is splash-proof (from inside to outside) and provides protection for personnel. Windows are provided in the panels to allow for visual inspection of the system without opening the panels. The electrical enclosure is isolated from the decontamination unit. Thus, it can be opened for service without risk to personnel.
- **Operator interface panel** can be located adjacent to the cabinet or remotely from the unit. The operator interface can be fitted in a position that most suits each Customer.

CONSTRUCTION

The mechanical construction of the CED system is comprised of the buffer tank, piping systems, and frame assembly. It is designed and built as a self-standing unit. Single point utility connections are provided. The proven design methods described in the following sections have resulted in an extremely reliable unit with exceptional safety, superior temperature distribution, and ease of service and installation.

Buffer Tank

The buffer tank is fabricated from AISI 316L stainless steel.

Piping

Piping is constructed from welded AISI 316L pipes utilizing compression fittings or welded connections.

1. Automatic orbital welding techniques are used wherever technically possible according to the detailed Weld Procedure Specifications (WPS). Argon S of 99.998% purity is used as protective inert gas.
2. Each piping weld zone is individually pickled and passivated.

Frame and Paneling

1. The frame is a fully welded structure fabricated from square profile AISI 304 stainless steel. Lifting lugs are provided.
2. The decontamination module is covered by brush finished AISI 304 stainless-steel panels. The panels have hinged and gasketed doors and windows for visual inspection.

PREVENTIVE MAINTENANCE

A global network of skilled service specialists can provide periodic inspections and adjustments to help ensure low-cost peak performance. STERIS can provide information regarding annual maintenance agreements.

The base language of this document is ENGLISH. Any translations must be made from the base language document.

UTILITY REQUIREMENTS

UTILITY	CODE	CONNECTION	PARAMETERS	QUALITY
Effluent Inlet	020	Pipe DN80	Gravity Flow	N/A
Steam	040	Flange	87-116 psi 6-8 bar	Saturated
Steam Condensate	046	Flange	Back Pressure < 30% of steam pressure	N/A
Compressed Air	051	Thread	73-116 psi, 5-8 bar	Dry, oil-free air
Cooling Water	013/014	Metric G-thread	43-87 psi 3-6 bar inlet; 28 psi < 2 bar difference to outlet; 50-60°F (10-15°C) inlet < 140°F (60°C) outlet	Hardness to be 5-7 dH 89-125 ppm
Drain	060	Open (atmospheric break)	Gravity discharge	N/A
Electricity	090	Terminals	3 phase, 50 Hz 380-415 VAC or 60 Hz 208-600 VAC	N/A

Refer to the Following Equipment Drawings for Installation Details

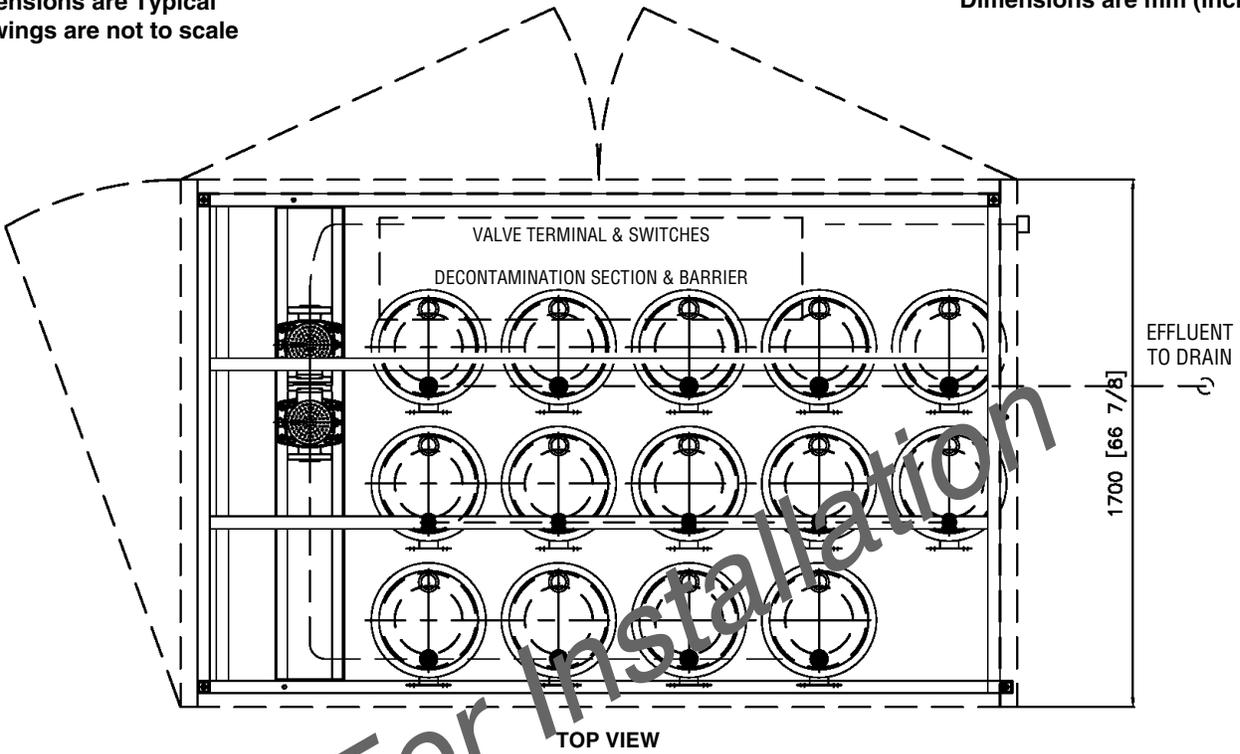
Equipment Drawing Number	Equipment Drawing Title
326734	EQUIPMENT AND INSTALLATION DRAWING CED-UNIT 300-CED MASTER
326735	EQUIPMENT AND INSTALLATION DRAWING CED-UNIT 500-CED MASTER
326736	EQUIPMENT AND INSTALLATION DRAWING CED-UNIT 1000-CED MASTER
330844	EQUIPMENT AND INSTALLATION DRAWING CED-UNIT 2000-CED MASTER
330847	EQUIPMENT AND INSTALLATION DRAWING CED-UNIT 3000-CED MASTER

CONTINUOUS EFFLUENT DECONTAMINATION SYSTEM

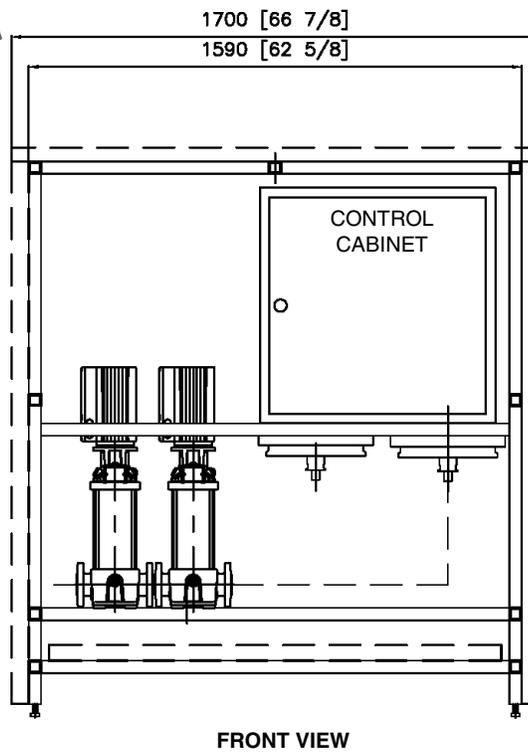
3000 CED Unit shown - Customer must refer to equipment drawings for installation details

Dimensions are Typical
Drawings are not to scale

Dimensions are mm (inches)



Not For Installation

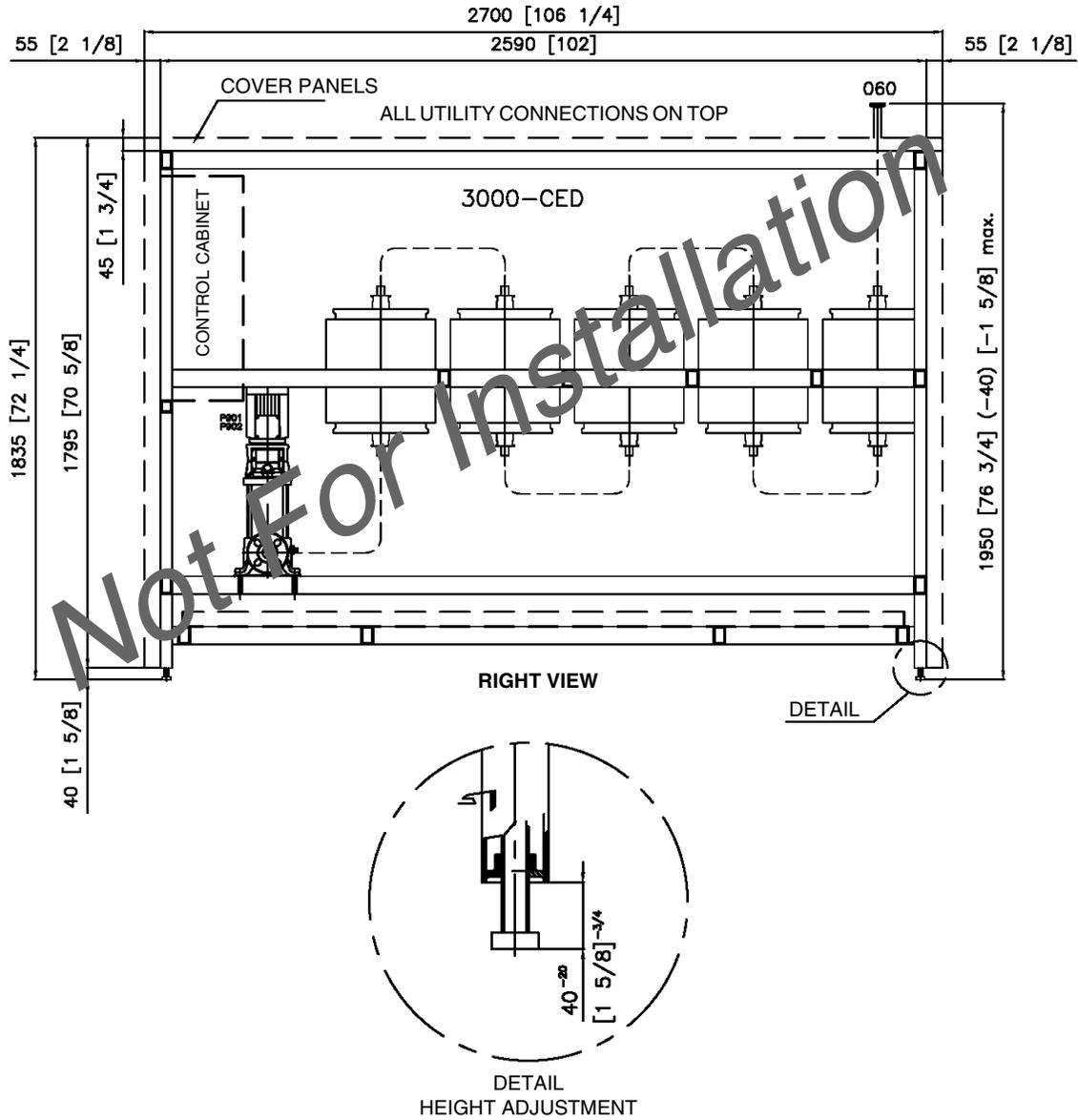


CONTINUOUS EFFLUENT DECONTAMINATION SYSTEM

3000 CED Unit shown - Customer must refer to equipment drawings for installation details

Dimensions are Typical
Drawings are not to scale

Dimensions are mm (inches)



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