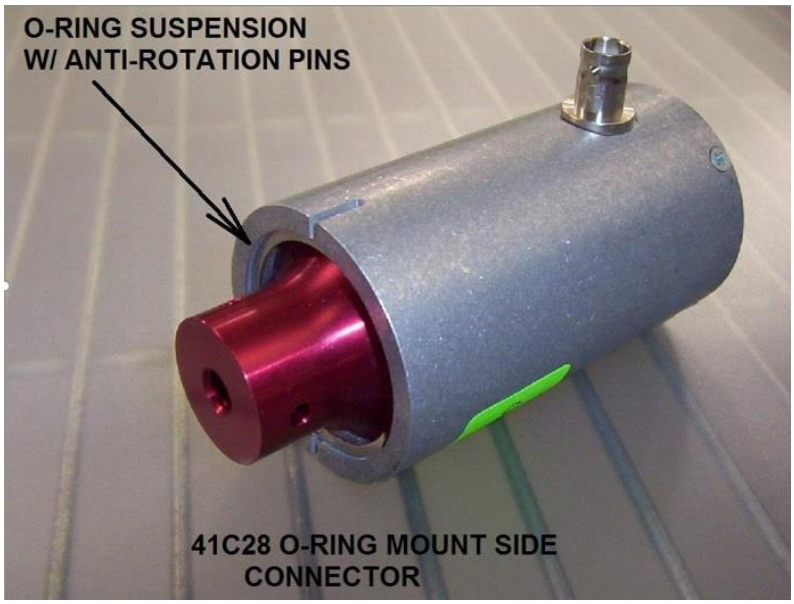
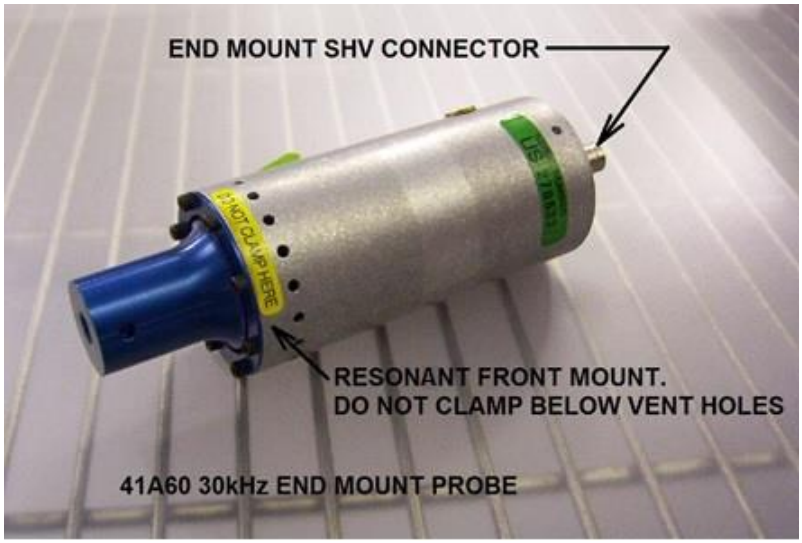
Installation Guidelines for Dukane Probes Used in Automation

Dukane makes a wide variety of ultrasonic probes for use in automated machinery. These probes are used in welding, staking, embedding, and cutting applications.

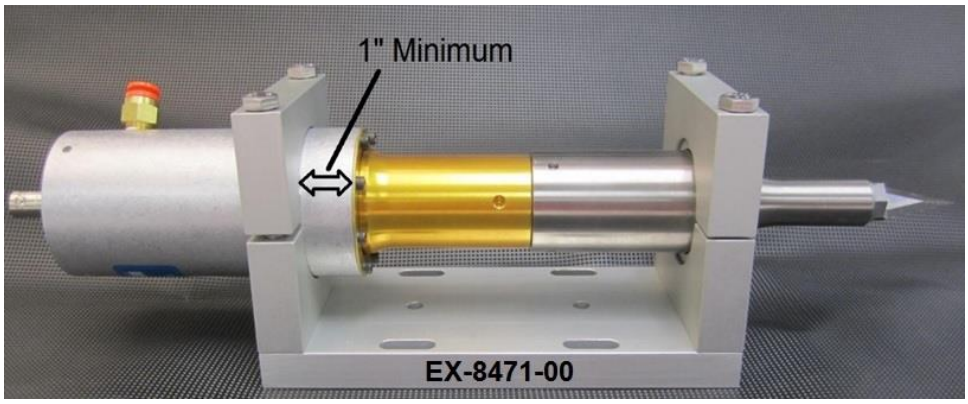
1) O-Ring suspension probes: The traditional type of probe construction is O-ring suspension. The vibrating front slug, which connects to the tooling, is suspended in the housing using 2 or more O-rings. There are several advantages to this mount. The most important is a small amount of compliance that allows the horn to self-level against the part. Secondly, the O-rings absorb vibration generated in the transducer which makes for quiet and efficient operation. Less frictional heat is generated and the probe generally draws less power in operation. Because there is an O-ring between the vibrating transducer and the housing, vibration is virtually isolated from the housing. Even though the vibration is isolated, Dukane recommends that the small Mini 20kHz, 30kHz and 40kHz probes not be clamped tightly in the front 1" (25mm) of the housing. (Standard 20kHz O-ring probes can be clamped in the front since they have extra material in the housing specifically for this purpose.) This inherent compliance between the internal transducer and the housing can be a limitation when the precise position of the tooling (horn) must be maintained. For instance, if small stakes or pads must be welded, the horn may slide off the post or pad producing a weak or cosmetically unattractive weld. In this situation, a "resonant" or "solid" mount probe is recommended.



2) Resonant, Solid, Rigid, and Diaphragm suspension probes: This design uses a variety of techniques to connect the vibrating internal transducer (with attached horn) to the mounting housing. The result is the transducer and attached horn are essentially held concentric to the outside housing. This construction prevents the horn tip from shifting off the parts to be welded, which is a significant advantage in many applications. This advantage over O-ring mount probes comes with some caveats. Because it is impossible to completely isolate the vibrating transducer from the "ideally" stationary housing, some residual vibration will be transmitted into the housing. If the housing is clamped near the front, where the transducer is bolted or clamped, vibration will be transferred into the mount. This results in heat, friction, noise and increased power draw. The extent of these undesirable characteristics depends upon the clamp force, operating frequency, application power draw,

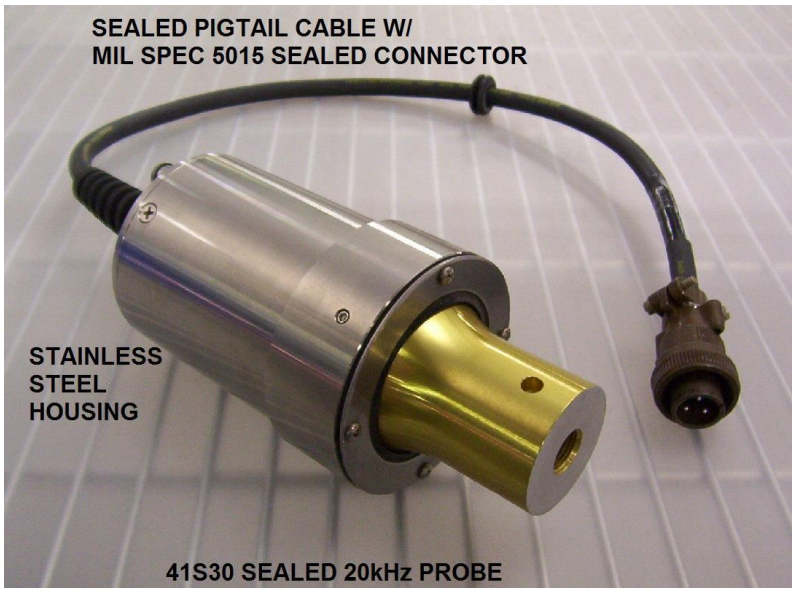


welding pressure and design of the interface. Because of these concerns, DO NOT clamp within 1" (25mm) of the front of the housing. This will not be a problem if you secure the probe near the back of the housing.



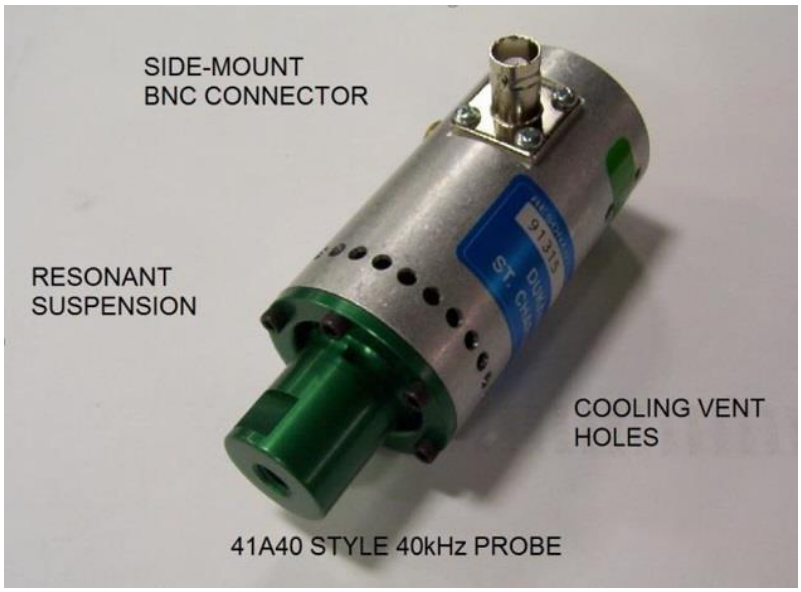
3) Use of boosters: The use of a booster between the horn and transducer can be of benefit, even though it does add more length and increase costs. A booster can be used to increase the amplitude of the welding stack which is vital for fast, attractive welds. Using a booster reduces the stress on the horn and promotes long horn life. If a probe/booster mount is used, the second mounting surface increases tooling stack rigidity. This can allow an O-ring suspension transducer to be used on tight tolerance weld points. A booster will also aid (and may be required for) operation of large, heavy compound horns. For more information on boosters and Dukane's open probe mount, see Application Note AN504.

4) Sealed probes: Dukane makes sealed versions of both O-ring and resonant suspension probes. In all cases, probes are constructed of materials such as Stainless steel, Anodized aluminum and Titanium which are corrosion-resistant. These probes are rated to a minimum of IP65 and are splash and dust proof. When used in a moist environment, clamps should be of the same material as the probe and booster clamping ring to prevent galvanic corrosion. O-rings and various food-safe sealants are used to permit use in dairies, food plants, packaging, and container-sealing applications. Some cleaning solutions are highly caustic and may still cause corrosion and loss of water-tight properties over prolonged use. Sufficient cooling is mandatory to prevent overheating. These Probes are sealed. If the cooling air is below the dew point, the temperature difference between the heated inside of the probe and a cold outside environment may cause unwanted condensation inside the probe.



Because of the requirement for watertight operation, the preferred cable connection is either a sealed "pigtail" cable gland or O-ring sealed connector on the housing itself. Dukane prefers a pigtail solution due to mechanical space considerations. Under no circumstances should SHV or BNC coaxial connectors be used unless they are specifically designed for water-tight operation. It should be noted that standard coaxial connectors are not moisture resistant.

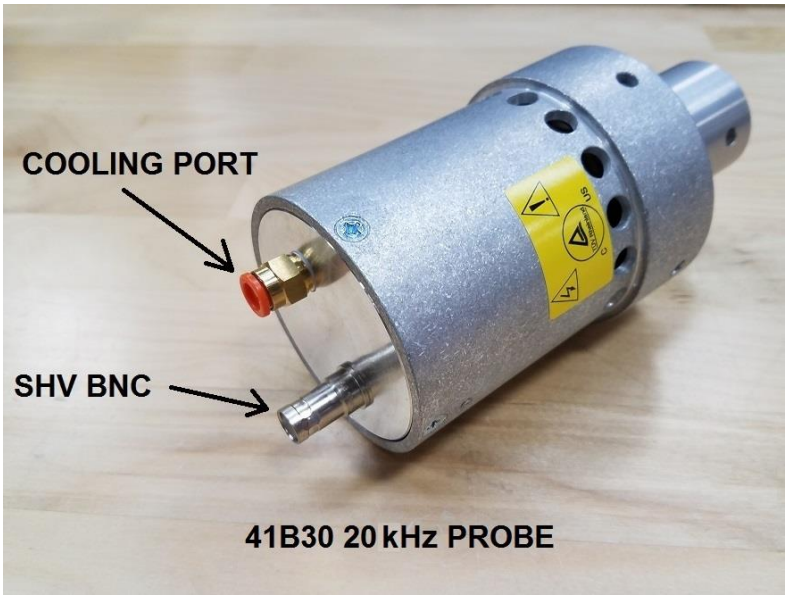
5) Ultrasound Connections: There are a variety of cable configurations available on Dukane probes. The pigtail cable described above is commonly used in food processing and packaging. In open factory machinery, it is more common to attach an electrical connector directly to the top or side of the probe housing and then plug a coaxial cable into it. End Mount probes have the connector on the back end of the probe housing. Side Mount probes have the connector on the side of the round housing, near the back due to internal space constraints. Dukane uses 3 different connectors. Most 40kHz and 50kHz probes use male BNC coaxial connectors. High power 40kHz, 30kHz, 20kHz and 15kHz probes use male SHV (Safe High Voltage) coaxial connectors. Although BNC and SHV connectors look similar, they are NOT intermixable. Both types have ¼ turn quick-connect female receptacles on the connecting cables. It is CRITICAL that the cable receptacles be fully inserted and turned to "lock" into position on the two tabs on the probe. Failure to fully seat the connector will result in intermittent power delivery, arcing, probe or generator overload and eventual failure. It is important that the ultrasound cable be supported and strain-relieved so no twisting or pulling is induced on the connection. These connectors are NOT designed for severe vibration or mechanical loading. They are designed for easy connection, common availability, reliable operation and safe conduction of high voltages. Dukane also uses the common 3 pin 5015 series screw-on mil-spec connector. These connectors are almost exclusively used on sealed probes. They have superior sealing and mechanical properties to SHV and BNC connectors. Due to the size and expense, these connectors are only used when moister resistance is required.



6) Cabling: The following guidelines apply to all probe applications. Coaxial cable should be used for all ultrasound connections. SHV and BNC connectors are designed to use coaxial cable, so it is the preferred connector. Dukane uses both commercially available and proprietary products for our cables. The following cabling precautions must be taken when probes are subject to constant movement:

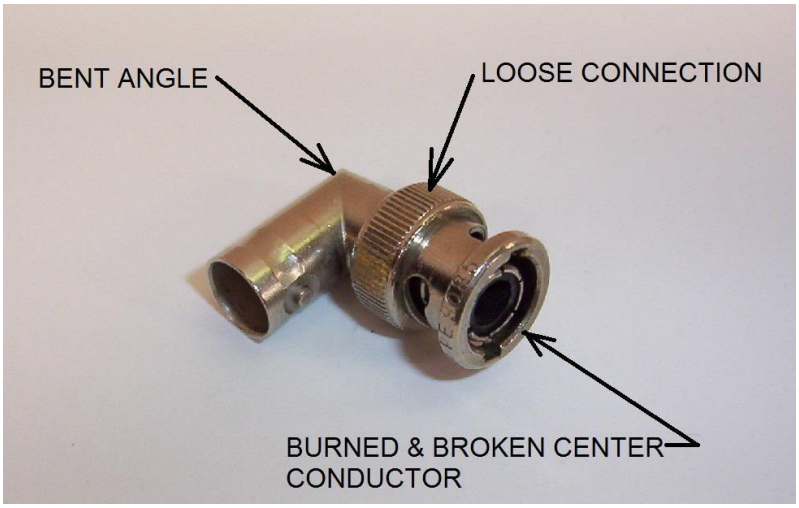
a) Carefully route cables to prevent chaffing and rubbing on equipment.

b) Do not bend cable too tightly. Insufficient bend radius will cause the outside braided shield to disintegrate on the coaxial cable. Once that occurs, loss of power and possible probe or generator damage could occur.

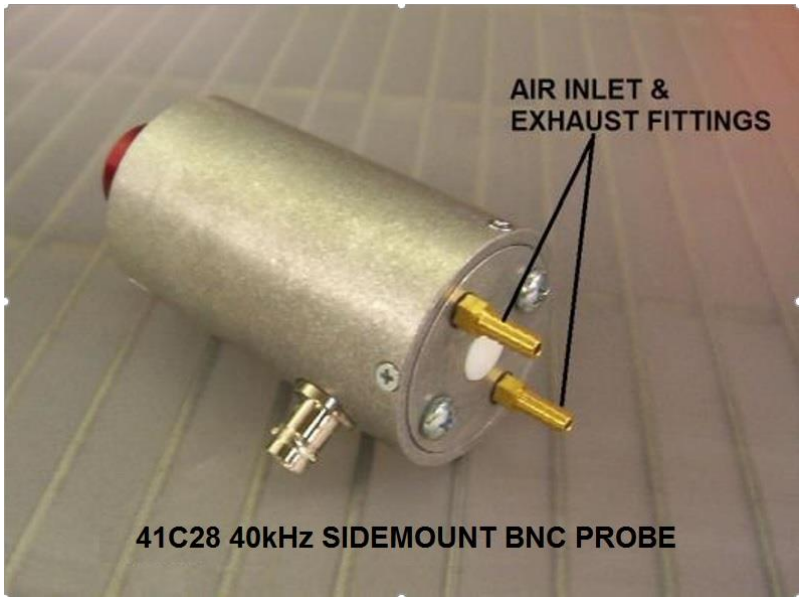


Minimum Bend radii:	Standard 200-479/615/416/1322 cable	6” (150 mm) min. radius
	Hi-Flex 200-1668/1669/1253 cable	3” (75 mm) min radius
	15K Hi-Power 200-1289 cable	12” (300 mm) min. radius

c) Support the cable end to avoid stress on the connector ends. Ideally, the cable should be secured to a member at the probe mount or even the probe housing itself so that the connector is not subject to twisting, pulling and side-forces. In cases where this is impossible, allow generous cable slack. Periodic inspection maintenance is crucial in these cases. Worn locking tabs on the BNC connectors, loose receptacle to connector contact, bent center pin and dark black residue on the inside of the connector are all signs of impending cable or probe failure. Note: Dark staining on the OUTSIDE of the connectors may be normal silver tarnish and is not harmful.

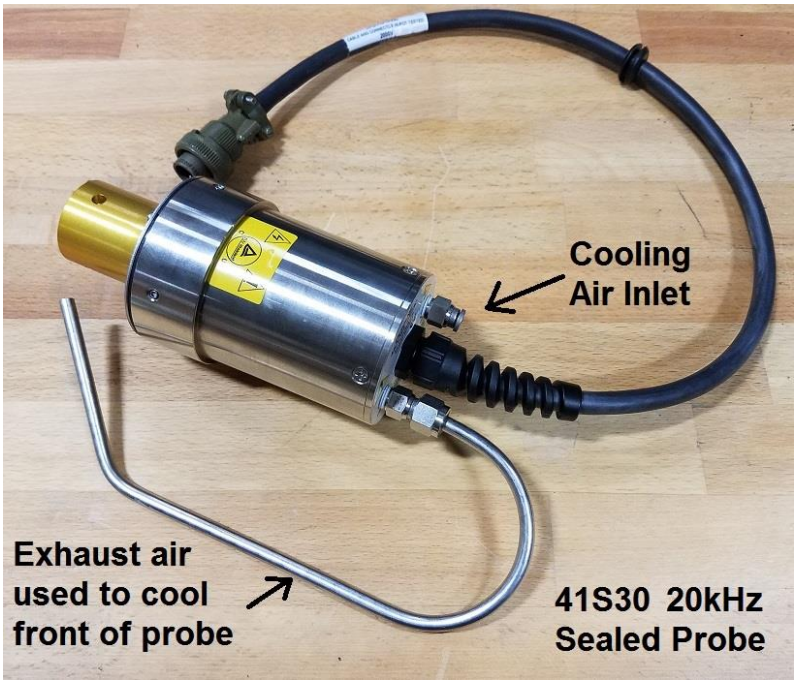


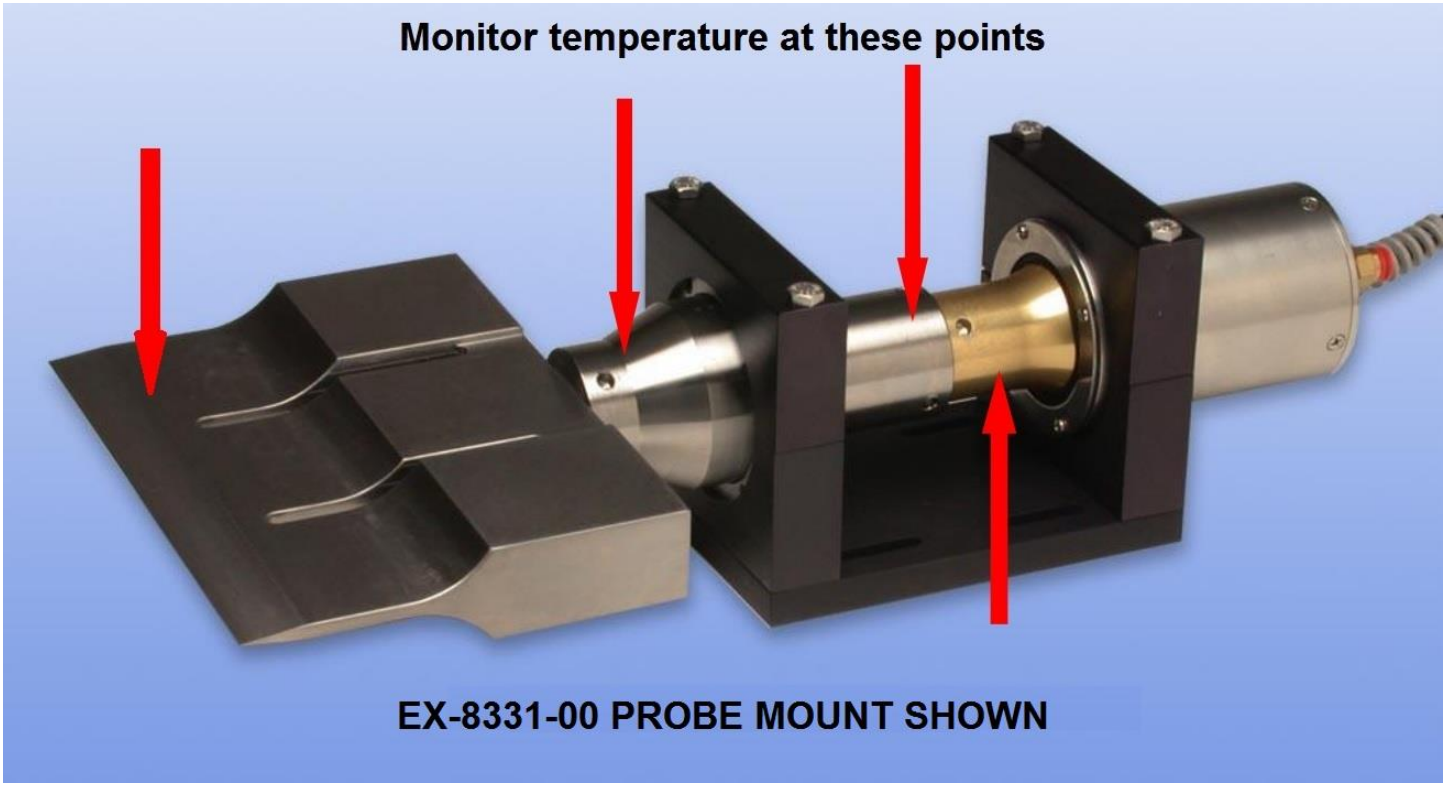
d) Use of additional coaxial adapters between cables and probes: Ideally there should be a direct connection between the ultrasound cable and the machine probe. Dukane discourages the use of 90 degree or in-line coaxial adapters on machine probe systems. These connectors are designed for stationary applications. They can be useful on the GENERATOR side of the cable when installed in a confined space, however they present special problems when used on the probe side of the cable. The most important consideration is the ability of the adapter fitting to rotate. While this feature can be useful when routing the cable, these adapters are not designed for CONSTANT rotation! When used on automated machinery and allowed to rotate every cycle, wear causes the center conductor to lose connection and arc. This will damage the probe and possibly the generator. Additionally, these adapters are fragile and upon impact, can be bent or smashed on machine supports. While generally not recommended, if required due to space constraints, the cable must be strain relieved to prevent adaptor rotation as outlined in section “c” above.



7) **Cooling**: Ultrasonic probes are electrical devices and as such dissipate energy as heat. Heat is also generated at the plastic work face to weld the part and conducts up the horn tip into the transducer. Excessive heat can shift the probe operating frequency which will result in generator overloading. In extreme cases, the internal ceramics will crack, rendering the probe useless. All Dukane probes have provision for cooling air. Many models have radial cooling holes in the housing to permit air flow past the ceramics. The basic rule is that at no time should any part of the Probe, booster or Horn exceed 110 degrees F (43 degrees C). This would equate to being too hot to touch, when monitoring the

surface temperature in between cycles (power off). While cooling may not be necessary in low power, light duty cycle applications, it is critical to assess the operational temperature when used in a production environment, to ensure the temperature will not exceed 110 degrees during daily operation. Cooling is accomplished by piping cooling air into one of the cooling fittings on the transducer, blowing air directly on the outside of the transducer surface (as shown right) or onto the horn tips. In extreme cases vortex air chillers may be necessary to cool the front of the transducer, booster and horn. Cooling air entering the transducer must be clean and dry, as it is blowing directly on electrical components. When using multiple probes, cooling air should be plumbed directly from a manifold to each transducer. Do not daisy chain air plumbing from one probe to the next. It is acceptable to plumb exhaust air from the transducer to cool the booster and horn.





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