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안전성 요약

정부 및 해당 지역의 안전성 요건 숙지 및 준수

전기 및 감전 위험



많은 전기 설비 전반에 걸쳐 잠재적으로 매우 위험한 전기가 흐릅니다.

전기 또는 전자 장비 관리를 실시하기 전에는 항상 전원을 분리하고 관련 안전 절차를 수행하십시오. 일부 전기 장비(예: 전해 콘덴서, UPS 배터리 등)의 경우 주 외부 전원이 분리된 후에도 고압 전기 에너지가 남아 있습니다. 장비에 작업을 실시하기 전에 외부 전원을 분리하거나 장비를 끄거나 남아 있는 전기 에너지를 지면으로 방출하십시오(해당하는 경우).

시스템의 전기 문제 해결 시 전력 사용이 필요한 경우, 먼저 위험한 영역에 있는 모든 직원에게 해당 장비가 식별 표시되었거나 전원 컨트롤 지점에 지원 담당자가 배치되었음을 알리십시오.

안전 장치 변경 관련 위험

전기 및 컨트롤 시스템의 개조 또는 변경을 시도하는 경우 장비가 손상되어 작동하지 못하게 될 수 있습니다. 또한 장비의 개조 또는 변경 시, 관리 직원 또는 방문자가 심각한 부상을 입을 수 있습니다.

시스템의 어떠한 안전 장치도 간과하는 일이 없도록 하십시오. 안전 장치에는 퓨즈, 안전 스위치 및 회로 차단기도 포함됩니다. 이러한 장치에서 오작동이 발생하는 경우 반드시 올바른 수리 및 교체 절차를 따라야 합니다.

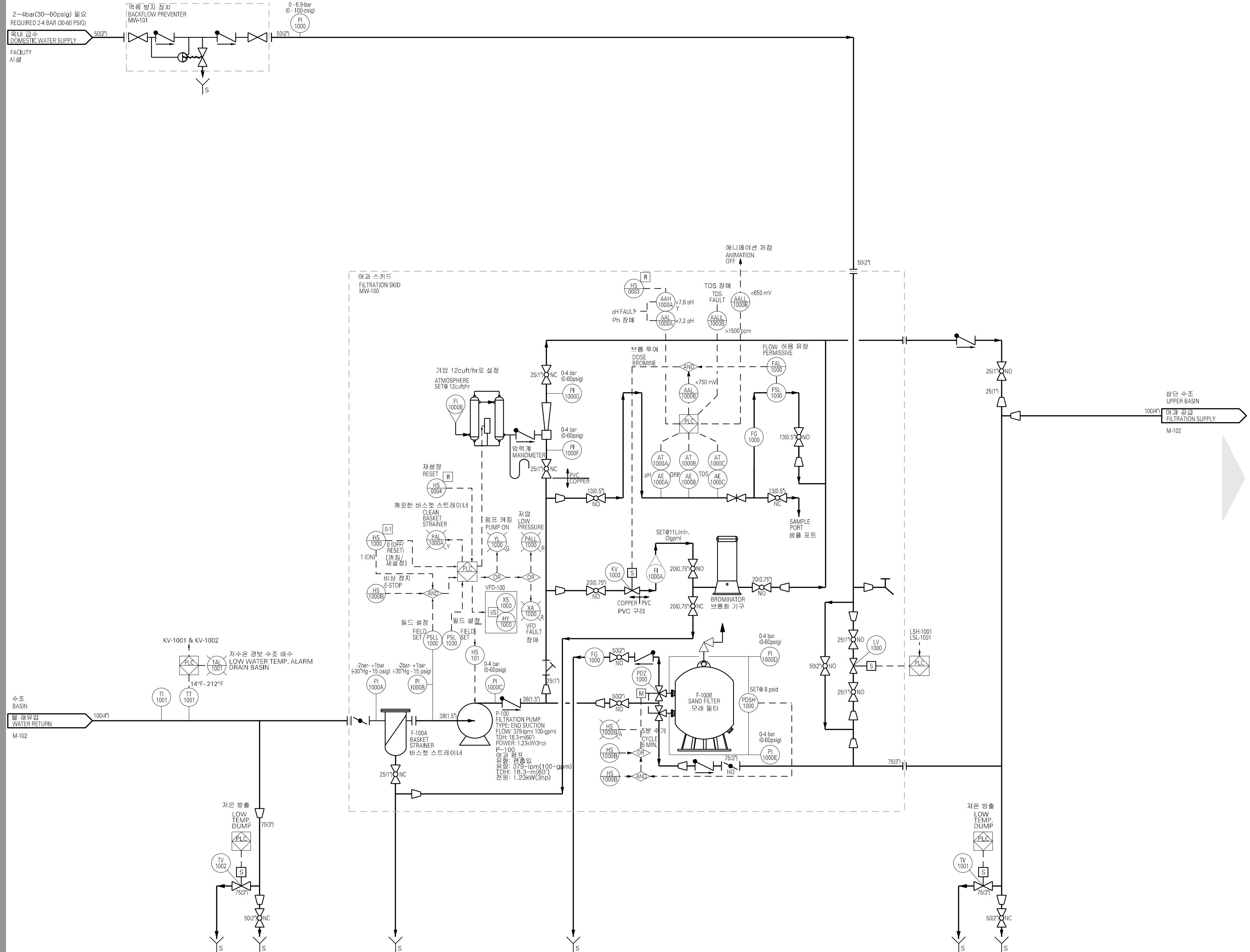
소생 기법 숙지

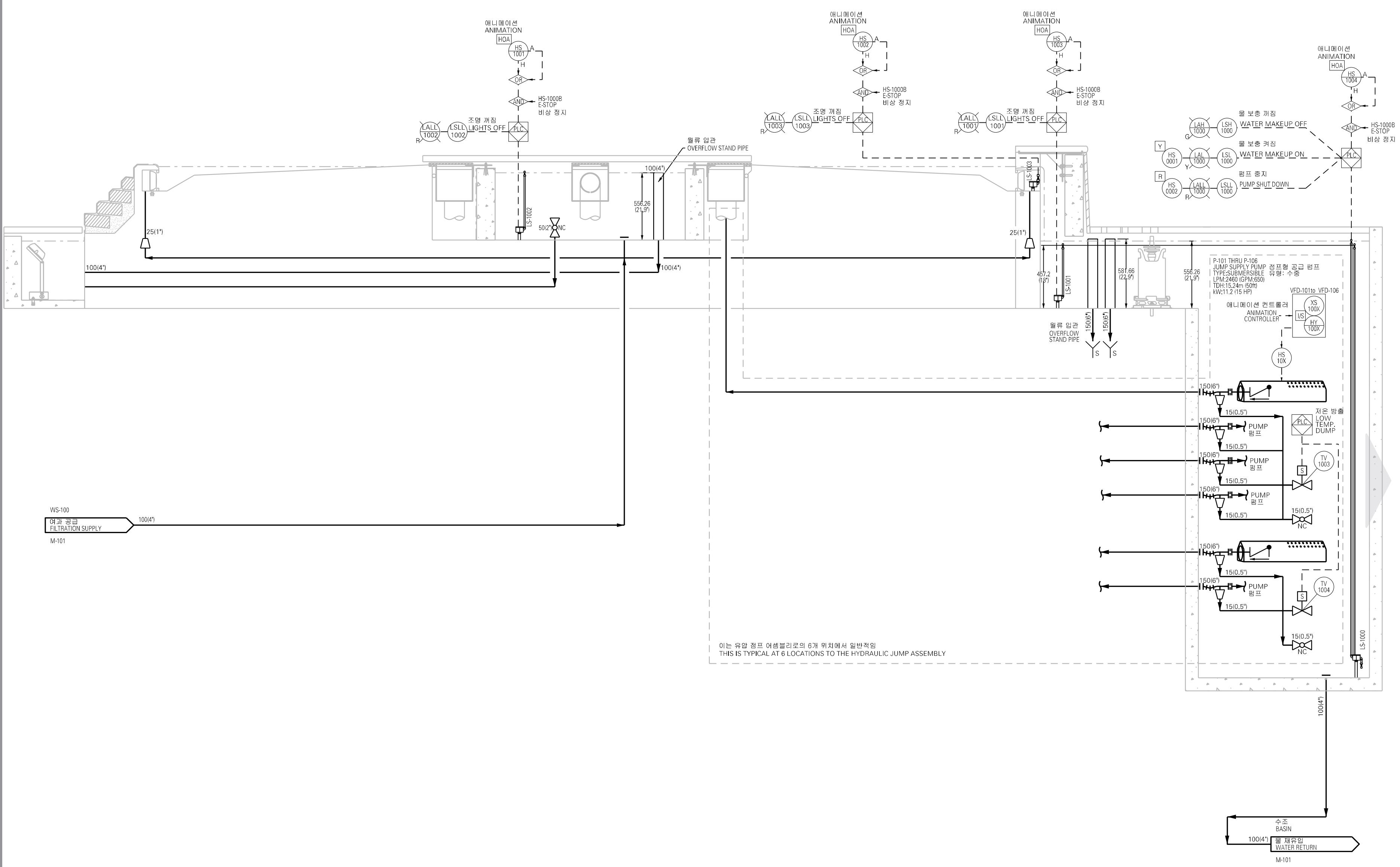
고압을 다루거나 고압 근처에서 작업하는 직원들은 최신 소생 기법에 대해 숙지해야 합니다. 필요 시 직원들이 심폐 소생술(CPR)을 수행할 수 있도록 하는 것이 좋습니다.

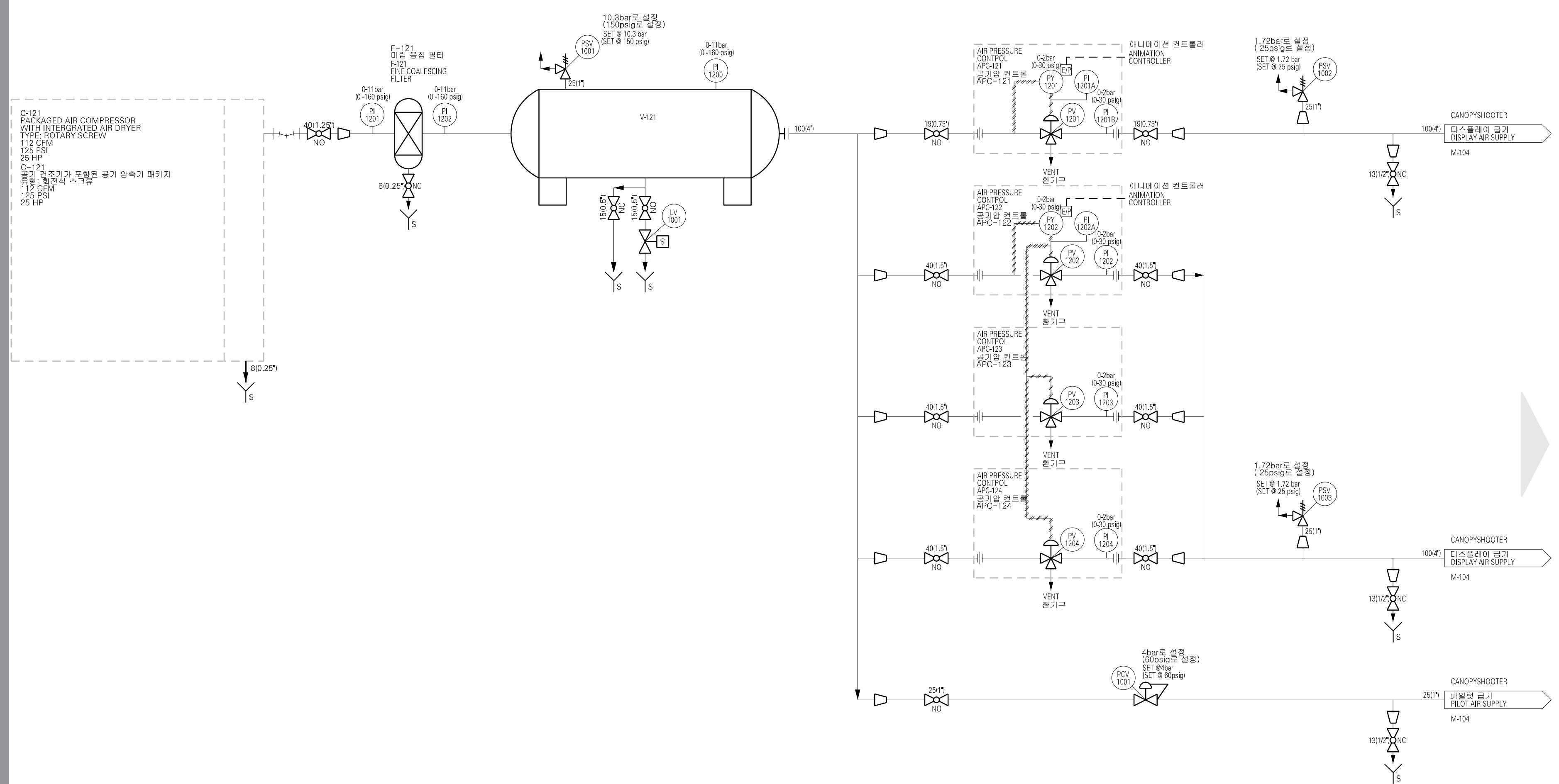
비상 장비 위치

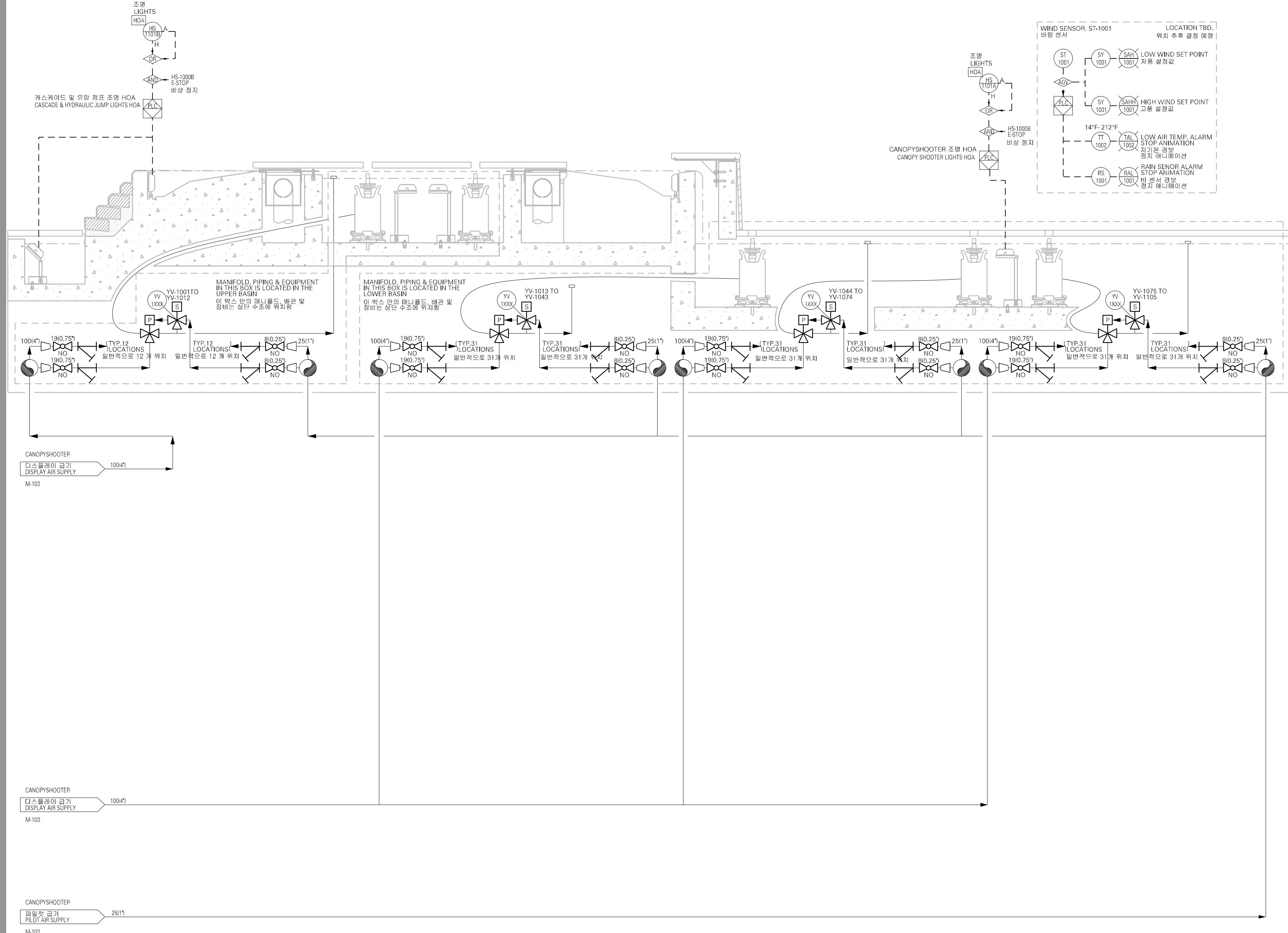
관리자는 비상 장비를 관리할 책임이 있으며 모든 비상 장비의 위치와 관련된 사항에 대한 연락을 받아야 합니다.











워터 디스플레이

WaterIris™

검사 및 관리 일정

일일 작업

개구부에 잔여물이 있는지 확인하십시오.

월별 작업

WaterIris에 대해 관리 쇼를 실행하십시오.

검사 및 관리 절차

노즐 개구부 세척 절차

노즐 개구부 안에 잔여물이 있으면 비금속(예: 플라스틱) 나이프로 오물과 잔여물을 제거하십시오.



노즐 개구부에 영구적이고 복구할 수 없는 손상을 가할 수 있으므로 개구부 세척 시 모서리가 날카롭거나 거친 기구를 사용하지 마십시오. 개구부 위 덮개판에 흠집 또는 함몰이 있거나 개구부 안에 잔여물이 있으면 워터 시트 모양이 손상될 수 있습니다.

문제 해결

문제	가능한 원인	해결 조치
개별 워터 시트가 일정하지 않습니다.	개구부에 잔여물이 있습니다.	비금속(예: 플라스틱) 나이프로 개구부에서 잔여물을 모두 제거하십시오.
	덮개판이 평평하지 않습니다.	덮개판을 검사하고 필요 시 평탄화 장비를 조절하십시오.
	개구부가 너무 넓거나 너무 좁습니다.	개구부를 검사하고 필요 시 덮개판을 조절하십시오.
개별 워터 시트가 너무 느리거나 너무 빠릅니다.	공급 펌프 작동 속도가 너무 느리거나 빠릅니다.	VFD(가변 주파수 드라이브) 상태를 확인하십시오.



워터 디스플레이

CanopyShooterTM

검사 및 관리 일정

일일 작업

CanopyShooter 내부 또는 근처에서 발견된 모든 잔여물을 제거하십시오.

연례 작업

y-스트레이너를 세척하십시오.

검사 및 관리 절차

파일럿 밸브와 주 밸브 모두를 백만 주기 또는 5년마다 재조립하십시오.

문제 해결

문제	가능한 원인	해결 조치
기기가 물을 뿐지 않습니다.	솔레노이드 코일이 연결되지 않았습니다.	솔레노이드 코일을 기기에 다시 설치하고 고정 클립으로 고정하십시오.
	솔레노이드 코일이 손상 또는 절단되었습니다.	솔레노이드 코일을 교체하십시오.
	솔레노이드 코일에 전기 신호가 없습니다.	메신저 박스 문제 해결을 참조하십시오.
	파일럿 밸브에 압력이 없습니다.	신속 차단 매니폴드가 올바로 설치되고 고정 클립으로 고정되었는지 확인하십시오. 해당 부분 볼 밸브가 닫혀 있는지 확인하십시오. 배관이 잔여물로 인해 차단되어 있는지 확인하십시오. y-스트레이너를 세척하고 매니폴드에서 잔여물을 제거하십시오. 공기 배관의 손상, 꼬임 또는 절단 여부를 확인하십시오. 필요 시 교체하십시오.
	주 밸브에 압력이 없습니다.	신속 차단 매니폴드가 올바로 설치되고 고정 클립으로 고정되었는지 확인하십시오. 해당 부분 볼 밸브가 닫혀 있는지 확인하십시오. 배관이 잔여물로 인해 차단되어 있는지 확인하십시오. 매니폴드에서 잔여물을 제거하십시오. 공기 배관의 손상, 꼬임 또는 절단 여부를 확인하십시오. 필요 시 교체하십시오.
	파일럿 밸브 오작동이 발생했습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.
	주 밸브 오작동이 발생했습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.



문제 해결 계속

문제	가능한 원인	해결 조치
기기가 물을 뿐지 않습니다. (계속)	체크 밸브 문제입니다.	관리, 재설치 후 체크 밸브가 단단하게 설치되지 않았습니다.
		실이 마모되었습니다. 재조립 키트로 교체하십시오.
	하우징이 손상되었습니다.	교체하려면 WET에 문의하십시오.
기기가 최대 높이까지 물을 뿐지 않습니다.	체크 밸브가 마모되었습니다.	재조립 키트로 교체하십시오.
	파일럿 밸브가 완전히 열리지 않습니다.	전기 신호가 올바르지 않습니다. 메신저 박스 문제 해결을 참조하십시오.
	주 밸브가 완전히 열리지 않습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.
	공기 배관에 물이 있습니다.	시스템에서 물을 빼내십시오.
기기에서 공기가 누출됩니다.	파일럿 밸브 실이 마모되었습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.
	주 밸브 실이 마모되었습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.
	공기 배관이 손상되었습니다.	호스 또는 튜브를 교체하십시오.
	신속 차단 매니폴드 실이 마모되었습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.
기기가 계속 물을 뿐습니다.	전기 시스템 문제입니다.	메신저 박스 문제 해결을 참조하십시오.
	파일럿 밸브가 열렸습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.
	주 밸브가 열렸습니다.	마모된 구성 요소를 재조립 키트로 교체하십시오.



컨트롤

검사 및 관리 일정

월별 작업

전기적 E-Stop(비상 정지) 작동을 테스트하십시오.

분기별 작업

컨트롤 판넬 안의 기화형 부식 방지제 컵을 교체하십시오.

플로트가 차단되지 않도록 하십시오.

검사 및 관리 절차

플로트 스위치

플로트 스위치는 모든 풀 사이즈 바닥 장착식 전기 판넬 아래에 설치됩니다. 플로트 스위치는 침수 방지에 사용되며 기기실의 수위가 침수 상태를 나타내는 수준으로 올라가면 주 전기 판넬로의 전원을 폐쇄합니다.



메신저 박스



메신저 박스는 고압 전원으로 실행됩니다. 어떠한 경우에도 수조에서 메신저 박스를 열어서는 안 됩니다.



메신저 박스는 24 볼트 DC를 통해 코일을 컨트롤합니다.
코일을 교체하기 전에는 항상 기기실의 메신저 박스 전원을 분리해야 합니다.

검사 및 관리 일정

메신저 박스는 정비가 필요하지 않으므로 메신저 박스에는 정비할 내부 부품이 없으며 따라서 메신저 박스를 열어서는 안 됩니다.

주별 작업

메신저 박스를 검사해 메신저 박스가 수조 바닥에 고정되어 떠다니지 않는지 확인하십시오. 메신저 박스가 지지대에서 분리된 경우 "증상 - 메신저 박스가 수조에서 떠다님"을 참조하십시오.

문제 해결

문제	가능한 원인	해결 조치
메신저 박스의 모든 Shooter가 작동하지 않습니다.	접지 장애가 트립되었습니다.	메신저 박스에는 박스 내에서 물이 감지되는 경우 즉시 트립되는 물 침투 센서가 있습니다. 메신저 박스 제거 및 교체 시 WET에 문의하십시오.
	SDX(데이터 전송 표시) 신호가 중단되었습니다.	SDX(데이터 전송 표시) 연결을 복구하고 수조에 있는 손상된 와이어 또는 기기실에 있는 고장 난 SDX 배포 박스를 교체하십시오. SDX (데이터 전송 표시) 연결 장애가 발견되지 않는 경우 WET에 정비를 요청하십시오.
솔레노이드 코일에 전기 신호가 없어서 메신저 박스의 Shooter 하나가 작동하지 않습니다.	솔레노이드 코일에 문제가 있습니다.	기기실에서 메신저 박스 전원을 끄십시오. 고장 난 코일의 케이블을 자르고 WET의 접합 키트를 사용해 새로운 WET 코일을 설치하십시오. 재연결 시 케이블 색깔을 녹색은 녹색으로, 흰색은 흰색으로, 검은색은 검은색으로 일치시키십시오.
메신저 박스가 수조 안에서 떠다닙니다.	메신저 박스가 지지대에서 분리되었습니다.	메신저 박스를 지지대로 다시 끼우십시오. 지지대 레일에 메신저 박스 양쪽의 탭을 맞추십시오. 지지대 레일에 탭이 고정될 때까지 메신저 박스를 아래로 미십시오. 메신저 박스가 계속 분리되면 메신저 박스 양쪽에서 탭을 안쪽으로 좀 더 구부리십시오. 메신저 박스가 지지대 레일 위치에 단단히 고정될 때까지 탭을 망치로 두드리십시오. 탭을 지나치게 구부리지 않도록 주의하십시오.



운영

수조 채우기 절차

수조 채우기 준비

모든 배수 밸브가 닫혔는지 확인하십시오. 필요 시 밸브를 닫으십시오.

수조에 잔여물이 있는지 확인하십시오. 채우기 절차를 시작하기 전에 모든 잔여물을 제거하십시오.

브롬화 기구에 브롬 정제가 채워졌는지와 뚜껑이 고정되었는지 확인하십시오. 필요 시 브롬화 기구를 채우거나 뚜껑을 고정하십시오.

제조업체에서 권장하는 대로 필터 스키드에서 세 개의 수질 프로브(ORP(산화 환원 전위), pH, TDS(총 용존 고형물))를 재교정하십시오.

수조 채우기

1. 수조를 채우려면 필터 스키드에서 수동 H₂O 보충 밸브(MANUAL H₂O MAKE-UP VALVE)라고 표시된 밸브를 여십시오.



수동 물 보충 밸브가 열려 있을 경우 절대로 수경 시설을 두고 자리를 비우지 마십시오.

2. 수조 안의 수위가 LSL(수위 스위치 낮음) 스위치에 도달하면 필터 스키드에서 수동 H₂O 보충 밸브(MANUAL H₂O MAKE-UP VALVE)라고 표시된 밸브를 닫으십시오. 그러면 물 보충 밸브를 통해 물이 공급됩니다. 시스템이 수조에 물을 정확한 수위로 채우는 작업을 자동으로 완료합니다.
3. 바스켓 스트레이너에 물이 채워졌는지 확인하십시오.
4. 필요 시 필터 스키드의 모래 필터에서 공기를 빼십시오.



시작 절차

수동 모드

수동 모드는 관리 및 진단을 위해 개별 디스플레이 기기, 시설 조명 및 펌프를 수동으로 작동해야 할 때 사용합니다. 수동 모드에서는 예정된 쇼를 모두 건너뛰므로 관리 직원은 수동 모드를 사용하여 전체 시스템 작동을 확인하고 성능 기준을 평가할 수 있습니다. 디스플레이 기기를 수동 모드로 작동하려면 다음 절차를 수행하십시오.

1. CP-101 및 iPad 인터페이스의 애니메이션 컨트롤 수동/꺼짐/자동 스위치를 수동 위치에 놓으십시오.
2. CP-101 및 iPad 인터페이스의 조명 컨트롤 수동/꺼짐/자동 스위치를 수동 위치에 놓으십시오.

iPad 인터페이스의 Playlist 를 사용해 관리 쇼를 수동 모드에서 실행할 수 있습니다. 이러한 쇼를 통해 관리 직원이 수경 시설 장비를 테스트하고 개별적인 물의 모양을 관찰할 수 있습니다.

비상 정지로부터의 복구

1. 비상 정지의 원인을 파악 및 해결하십시오.
2. 시스템의 모든 전기 판넬의 전원이 켜졌는지 확인하십시오.
3. 모든 비상 정지 스위치가 당겨져 있는지 확인하십시오.
4. 상태에 따라 수경 시설을 자동 모드 또는 수동 모드에서 재시작하십시오.

수조 배수 절차

1. CP-101의 모든 수동/꺼짐/자동 스위치를 꺼짐 위치에 놓습니다.
2. 모든 조명의 전원이 꺼졌는지 확인하십시오.
3. 모든 판넬의 주 전원을 끄십시오.
4. 주 전원이 꺼지면 열 방출 솔레노이드 밸브가 열리는지 확인하십시오.
5. 시스템의 모든 배수 밸브를 여십시오.



수조 배수 절차 계속

6. 모래 필터 배수 플러그를 제거하십시오.
7. 모든 차단 밸브가 열려 있고 수조를 채울 준비가 될 때까지 열려 있는지 확인하십시오.
8. 수조에서 물이 완전히 빠졌는지 육안으로 검사하십시오.

저온에서의 정지

기온이 너무 낮으면 시스템이 쇼를 실행하지 않습니다.

기온이 너무 낮으면 시스템이 수조의 물을 자동으로 빼냅니다.

수조에서 물이 완전히 빠졌는지 육안으로 검사하십시오.

스프링 시작 절차

1. 모든 배수 밸브를 닫으십시오. 시스템이 가동되면 열 방출 밸브가 자동으로 닫힙니다.
2. 모든 판넬 및 공기 압축기 시스템을 가동하십시오.
3. 수조 채우기 절차를 수행하십시오.
4. 모든 스위치를 자동 위치에 놓으십시오. 이제 시스템이 자동으로 시작됩니다.



물 필터

검사 및 관리 일정

일일 작업

모든 펌프의 흡입구 쪽에서 압력계 측정값을 확인하십시오. 압력계 측정값이 명목 범위 내에 있는지 확인하십시오.

모래 필터 양쪽의 압력계를 확인하십시오. 차압 스위치는 8psi로 사전 설정됩니다.

주별 작업

바스켓 스트레이너를 세척하십시오.

월별 작업

필터 펌프 주입구 쪽의 압력 스위치를 육안으로 점검해 부식 또는 손상 여부를

필요에 따른 작업

iPad 인터페이스에 표시가 나타나면 바스켓 스트레이너를 세척하십시오.

브롬을 다시 채우십시오.

검사 및 관리 절차

바스켓 스트레이너 세척 절차

- 필터 펌프 스위치를 꺼짐 위치에 놓으십시오.
- 바스켓 스트레이너의 상향류와 하향류에 있는 차단 밸브를 닫으십시오.
- 바스켓 스트레이너 배수 밸브(바스켓 스트레이너 바닥 또는 부근에 위치)를 여십시오.
- 덮개 볼트를 느슨하게 해 바스켓 스트레이너 덮개를 제거하고 바스켓 스트레이너에서 물을 완전히 빼십시오.
- 덮개와 바스켓 스트레이너 부품을 제거하십시오. 스트레이너 부품의 방향을 확인하십시오.



バスケット ストレイ너 세척 절차 계속

6. 호스로バスケット ストレイ너 부품을 완전히 씻어 내고 필요 시 굵은 브러시로 잔여물을 제거하십시오.
- 7.バスケット ストレ이너 덮개 O링을 검사 및 세척하십시오. O링에 실리콘계 윤활유를 바르십시오.
- 8.バスケット ストレ이너 부품을バスケット ストレ이너 바디로 교체하십시오.バスケット ストレ이너 부품은 올바른 방향으로 되어 있어야 하며 바디에 정확히 고정되어야 합니다.
- 9.バスケット ストレ이너 배수 밸브를 닫으십시오.
10. 상향류 차단 밸브를 천천히 열어バスケット ストレ이너를 완전히 채우고 밸브를 닫으십시오.
11. 스트레이너 덮개를 교체하고 고정하십시오.
12. 상향류 및 하향류 차단 밸브를 천천히 여십시오.
- 13.バスケット ストレ이너 및 덮개의 누수 여부를 확인하십시오.
14. 필터 펌프 스위치를 켜짐 위치로 되돌리십시오.

압력 스위치 테스트

필터 펌프 주입구 쪽의 압력 스위치를 육안으로 점검해 부식 또는 손상 여부를 확인하십시오.

압력 스위치의 작동을 테스트하려면 다음 절차를 수행하십시오.

1. 깨끗한バスケット ストレ이너 및 정상 작동 모드로 실행되는 필터 펌프를 통해 펌프 입구 쪽의 압력 측정값을 확인하십시오.
2. 펌프의 필터 펌프 흡입 압력을 관찰하면서 스트레이너 입구 차단 밸브를 천천히 닫으십시오.
3. 밸브가 닫힌 후 하향류 압력계에서 압력을 확인하십시오. 이 압력 측정값은 정상 작동 압력 측정값 아래인 약 5psi이어야 합니다.
4. 압력 스위치가 트립되고 시스템에 스트레이너를 세척해야 한다는 표시가 나타납니다.
5. 압력계가 -10psi를 나타낼 때까지 밸브를 계속 닫아 두십시오. 두 번째 압력 스위치가 트립되고 펌프가 정지됩니다.



압력 스위치 테스트 계속

시스템의 정상 작동을 재개하려면 다음 절차를 수행하십시오.

1. 차단 밸브를 완전히 여십시오.
2. 여과 화면의 왼쪽 하단에서 "재설정" 버튼을 누르십시오.
3. CP-101의 "필터 펌프" 스위치를 꺼짐 위치에 놓았다가 다시 켜짐 위치에 놓아 필터 펌프를 재설정하십시오.
4. 필터 펌프가 정상 작동을 재개했는지 확인하십시오.

열 방출 밸브 테스트

1. iPad 온도 화면에 "POOL DRAIN" 표시기가 나타나면 열 방출 밸브가 열려 있는 것입니다. 이는 수온이 너무 낮을 때 발생합니다.
2. 테스트를 수행하려면 CP 패널의 전원을 분리하고 각 열 방출 밸브 위치로 이동하십시오. 물이 밸브를 지나 관련 배수관으로 들어가는 모양과 소리를 점검하십시오.
3. CP가 재가동되면 표시기 색깔이 밝은 파란색(불이 켜져 있음)에서 어두운 파란색(불이 꺼져 있음)으로 변해 열 방출 밸브가 닫혔음을 나타냅니다.
4. 밸브가 닫혔는지 육안으로 확인하십시오.
5. 시스템이 가동되었을 때 밸브가 닫히지 않는 경우 퓨즈를 확인하십시오.

모래 필터 관리

모래 필터의 여과 속도 및 차압은 사전 설정되었으며 WET®에 의해 테스트되었습니다. 이 시스템은 PLC(프로그램 가능 논리 제어 장치)의 명령에 따라 역세척을 자동 수행합니다. PLC(프로그램 가능 논리 제어 장치)는 모래 필터 배관에 설치된 차압 스위치를 모니터링하여 역세척이 필요한지 여부를 감지합니다.



모래 필터를 화학 세척하지 마십시오. 모래 필터가 손상될 수 있습니다.

문제 해결

문제	가능한 원인	해결 조치
모래 필터 전체의 차압이 최대 권장치를 계속 초과합니다.	모래 필터가 막혔습니다.	모래 필터의 모래를 교체하십시오. 모래 필터 문서를 참조하십시오.
iPad 인터페이스에 "CLEAN BASKET STRAINER" 표시가 나타납니다.	바스켓 스트레이너가 막혔습니다.	바스켓 스트레이너를 세척하십시오.
펌프 흡입 게이지가 정상 작동 시 대비 5psi 이상의 차이를 나타냅니다.	바스켓 스트레이너가 막혔습니다.	바스켓 스트레이너를 세척하십시오.
iPad 인터페이스에 "CHECK BASKET STRAINER" 표시가 나타납니다.	바스켓 스트레이너가 막혔습니다.	바스켓 스트레이너를 세척하십시오.
펌프 흡입 게이지가 정상 작동 시 대비 5psi 이상의 차이를 나타냅니다.	바스켓 스트레이너가 막혔습니다.	바스켓 스트레이너를 세척하십시오.
수질이 정상이 아닙니다(더럽거나 탁함).	필터 펌프가 꺼졌습니다. 스트레이너가 막혀 필터 펌프 작동이 정지했습니다.	스위치를 켜짐 위치에 놓으십시오. 바스켓 스트레이너를 세척하십시오.
열 방출이 표시될 때 물이 배관에서 빠져나가지 않습니다.	열 방출 솔레노이드 밸브에 문제가 발생했습니다.	솔레노이드 밸브 재조립 키트로 솔레노이드 밸브를 수리하십시오. 필요 시 교체하십시오.



수위

수위 및 작동

수위 지정	수위 한계	한계에서의 작동
수위 센서(LS-1000) - CanopyShooter 트로프 저지역(물 보충)		
LSH(수위 센서 높음)	582mm(23인치)	필 밸브가 닫힘
LSL(수위 센서 낮음)	556mm (22인치)	필 밸브가 열림
LSLL(수위 센서 하한)	200mm (8인치)	펌프가 중지됨
수위 센서(LS-1001) - CanopyShooter 트로프 저지역(조명 보호)		
LSLL(수위 센서 하한)	457mm (18인치)	모든 시설 조명이 꺼짐
수위 스위치 어셈블리(LS-1002) - 중앙 CanopyShooter 영역		
LSLL(수위 센서 하한)	556mm (22인치)	모든 시설 조명이 꺼짐
수위 스위치 어셈블리(LS-1003) - WaterIris 영역		
LSLL(수위 센서 하한)	300mm (11.8인치)	모든 시설 조명이 꺼짐

검사 및 관리 일정

일일 작업

두 개의 차단 밸브 모두가 열려 있으며 수동 물 보충 밸브가 닫혔는지 확인하십시오.

수경 시설의 정상 작동을 위해 옥내 급수가 작동되었는지 확인하십시오.

월별 작업

각 수위 스위치 어셈블리에서 단일 수위 플로트 스위치의 기능을 테스트하십시오.

수위 센서의 정상 작동 여부를 테스트하십시오.

연례 작업

물 보충 밸브 루프의 "완폐형" 솔레노이드 밸브를 재조립하십시오.



문제 해결

문제	가능한 원인	해결 조치
일반 시스템 문제가 발생했습니다.	물 보충 루프에서 솔레노이드 밸브에 문제가 발생했습니다.	솔레노이드 밸브 재조립 키트로 솔레노이드 밸브를 수리하십시오. 필요 시 교체하십시오.
	코일이 느슨합니다.	코일이 네임 플레이트 및 마운팅 클립으로 솔레노이드 밸브 바디에 단단히 고정되었는지 확인하십시오.
	컨트롤 패널의 퓨즈가 손상되었습니다.	퓨즈를 교체하십시오.
"완폐형" 솔레노이드 밸브가 신호를 수신하고 있지만 열리지는 않습니다.	밸브에 오물이 있거나 부품이 깨졌습니다.	필요 시 솔레노이드 밸브를 수리 또는 교체하십시오.
	코일 또는 배선이 손상되었습니다.	코일이 연속되어 있는지 확인하고 장애 상태인 경우 교체하십시오. 전체 회로의 배선을 확인하십시오.
"완폐형" 솔레노이드 밸브가 신호를 수신하지 않습니다.	퓨즈를 확인하십시오.	필요 시 교체하십시오.
수위가 낮은데도 수조에 물이 채워지지 않습니다.	물 보충 밸브 상태가 좋지 않습니다.	필요 시 물 보충 밸브를 수리 또는 교체하십시오.
	수위 센서 LS-1000이 손상되었거나 정상 작동하지 않습니다.	전기 연결을 확인하십시오. 필요 시 수위 센서를 수리 또는 교체하십시오.
	부력구가 없습니다.	부력구를 교체하십시오.
	퓨즈가 끊어졌습니다.	퓨즈를 교체하십시오.
	열 방출 밸브가 열렸습니다.	열 방출 밸브 문제를 해결하십시오.
수위가 낮은데도 조명이 꺼지지 않습니다.	수위 센서 LS-1001, LS-1002 및 LS-1003이 손상되었거나 정상 작동하지 않습니다.	전기 연결을 확인하십시오. 필요 시 수위 센서를 수리 또는 교체하십시오.
	플로트 스위치(LS-1001, LS-1002 또는 LS-1003)가 막혔습니다.	잔여물이 수위 플로트 스위치를 막고 있는지 확인하십시오.
	플로트 스위치 볼 안의 자석이 떨어져 나왔습니다.	필요 시 플로트 스위치를 수리 또는 교체하십시오.



순도



시중의 pH 테스트 키트 및 조절 화학제 사용이 권장되며 이러한 물품을 항상 현장에 구비해야 합니다. 최적의 pH 범위는 7.2~7.6 pH입니다.

화학 처리 구성 요소

이 섹션에서 설명할 부산 프리미엄 아울렛에 설치된 화학 처리 기기는 다음과 같습니다.

브롬화 기구

오존 발생기

수질 모니터링

모든 화학 처리 기구는 필터 스키드에 있습니다.

오존 발생기

오존 발생기 어셈블리는 필터 스키드의 전기 엔클로저에 장착됩니다. 이 어셈블리는 두 개의 코로나 UV 램프 하우징과 흡입구의 소형 공기 필터로 구성됩니다. UV 램프용 안정기는 램프 하우징 가까이에 위치합니다. 하우징 끝에서 나가 엔클로저의 측벽(외부)에서 끝나는 광섬유를 통해 UV 램프의 작동 상태를 시각적으로 모니터링할 수 있습니다. 엔클로저 도어에 켜짐/꺼짐 스위치를 통해 기술자가 램프 작동을 해제할 수 있습니다. 이 스위치는 오존 발생기가 켜짐 위치에 있으며 작동 중일 때 불이 켜집니다.

주입기

주입기는 수류를 통해 오존 발생기 램프 하우징에서 오존 함유량이 높은 공기를 빨아들여 진공을 형성합니다. 주입기는 수조로 다시 들어가는 수류에 오존을 주입합니다. 주입기 진공 연결의 오존 발생기 체크 밸브는 필터 펌프가 꺼졌을 때 오존 발생기 어셈블리에 물이 다시 들어가는 것을 방지합니다.



수질 모니터링 루프

수질 모니터링은 PLC(프로그램 가능 논리 제어 장치)가 적절한 화학 처리를 위한 명령을 전송하기 위해 사용하는 수질 요인을 수치화합니다. 수조의 물 샘플이 수질 모니터링 루프 내에서 채취됩니다.

수질 모니터링에는 10가지 주요 구성 요소가 사용됩니다. 아래에 나열된 이러한 구성 요소는 수질 모니터링 루프를 구성합니다.

pH 트랜스미터

TDS(총 용존 고형물) 전도도 프로브

ORP(산화 환원 전위) 트랜스미터

유량 센서

TDS(총 용존 고형물) 컨트롤러

유량계

pH 전극

샘플 포인트

ORP(산화 환원 전위) 전극

T-스트레이너

브롬 관련 경고



농축된 화학 용액이 피부 또는 옷에 튀면 물로 즉시 닦아내고 비누로 깨끗이 씻으십시오. 옷이 손상되지 않도록 옷을 벗고 즉시 행구십시오. 브롬 용액의 작용은 농축된 세탁물 표백제와 비슷합니다. 옷을 다시 입기 전에 세탁하십시오.

브롬 처리 시 또는 브롬화 기구 정비 시 피부, 눈, 코 및 목을 자극하지 않도록 고무 장갑, 필터 마스크 및 눈 보호대를 착용하십시오.



브롬 컨테이너에 대한 다음의 안전 예방책을 자세히 읽고 따르십시오. 브롬을 건조한 상태로 보관하고 컨테이너에 어떠한 물도 들어가지 않게 하십시오.

이 시스템에는 브롬 화합물만 사용해야 합니다. 절대로 다른 유형의 살균제 또는 화학 물질과 혼합하지 마십시오. 절대로 염소를 사용하지 마십시오. 브롬을 과다하게 사용하면 이 시설과 관련된 장비에 심각한 손상이 발생할 수 있습니다. 화학 물질의 부적절한 사용은 부상을 초래할 수 있습니다.

오존 관련 경고



오존에 노출될 수 있는 직원 중 심장 또는 호흡기 질환을 앓았던 모든 직원에게 오존에 대한 노출을 방지하기 위해 예방 조치를 취하도록 지시하십시오.

주의 사항을 올바로 준수하면 오존 작업은 안전합니다. 오존은 오존 발생기를 통해 생성되며 수조의 물에 즉시 투입되고 빠르게 소멸됩니다. 오존은 찌르는 듯이 자극적인 금속성 냄새가 특징이며 점막을 자극할 수 있습니다. 정상 작동 상태에서는 오존 냄새가 감지되지 않아야 합니다.

검사 및 관리 일정

일일 작업

필터 펌프가 작동 중인지 확인하십시오.

두 광섬유 끝(오존 발생기 엔클로저 측면에 위치)에 불이 켜져 있는지 확인해 오존 발생기가 작동 중인지 확인하십시오.

유량 센서(FSL-1000)의 빨간 LED에 불이 켜져 있는지 확인하십시오.

격주 작업

T-스트레이너를 세척하십시오.

월별 작업

브롬화 기구에 브롬을 다시 채우십시오.

연 2회 작업

제조업체에서 권장하는 대로 ORP(산화 환원 전위) 및 pH 전극과 TDS(총 용존 고형물) 전도도 프로브를 재교정하십시오.

연례 작업

오존 발생기 자외선(UV) 램프를 교체하십시오.

제조업체에서 권장하는 대로 ORP(산화 환원 전위) 및 pH 전극과 TDS(총 용존 고형물) 전도도 프로브를 교체 및 보정하십시오.

필요에 따른 작업

브롬화 기구에 브롬 정제를 다시 채우십시오.

오존 발생기 어셈블리에 있는 UV 램프 하우징 입구 옆에 있는 소형 공기 필터를 교체하십시오. 필터는 하얀색이어야 합니다. 색깔이 회색으로 변하면 필터를 즉시 교체하십시오.

물의 pH 레벨이 7.2~7.6pH 인지 확인하십시오. 필요 시 시중의 pH 테스트 키트와 조절 화학제를 사용해 지역 규정에 따라 pH 레벨을 수동으로 조절하십시오. 수조 전체에서 pH 조절 화학제를 고르게 사용하십시오.

문제 해결

문제	가능한 원인	해결 조치
수질이 좋지 않습니다. 물속에 조류 및 박테리아가 있습니다.	시스템에 브롬이 충분하지 않습니다.	브롬화 기구에 브롬 정제가 채워졌는지 확인하십시오.
	오존 발생기가 작동하지 않습니다.	오존 발생기 작동 여부를 확인하십시오.
	pH, ORP(산화 환원 전위) 또는 TDS(총 용존 고형물) 트랜스미터가 손상되었습니다.	트랜스미터를 교체하십시오.
	수질 모니터링 루프에 흐름이 없습니다.	유량 센서 (FSL-1000)의 LED를 확인하십시오. LED가 켜지지 않으면 Y-스트레이너를 확인하고 필요 시 잔여물을 제거하십시오.
	브롬화 기구에 흐름이 없습니다.	밸브가 열렸는지 확인하십시오. 퓨즈의 브롬 솔레노이드 밸브를 확인하십시오. 필요 시 교체하십시오.
수조에서 브롬 냄새가 나며 물속에 거품이 있습니다.	브롬화 기구 솔레노이드가 개방된 상태로 문제가 발생하여 시스템에 다양한 브롬이 투입되었습니다.	솔레노이드를 분해해 잔여물을 확인하십시오. 분해 후 다이어프램 시트의 마모 또는 손상 여부를 확인하십시오. 필요 시 재조립 또는 교체하십시오.
	pH 레벨이 허용 범위를 초과해 ORP(산화 환원 전위) 레벨에 영향을 미쳐 브롬이 과다하게 투여되고 있습니다.	pH 레벨이 허용 범위(7~8pH) 내에 있는지 확인하십시오. 최적의 범위는 7.2~7.6pH입니다. 수조의 물에 산을 추가해 pH를 낮추십시오.
필터 펌프가 작동하지 않습니다.	스위칭이 올바르지 않습니다.	해당 UI 페이지에서 펌프 작동을 확인하십시오.
	펌프 전원 차단 장치가 꺼졌습니다.	
	바스켓 스트레이너 압력 스위치 문제입니다.	
	오존 발생기 엔클로저 안의 모터 기동기가 열 과부하 상태입니다.	모터가 원활하게 돌아가는지 확인하십시오.
TDS(총 용존 고형물) 수치가 1500ppm을 초과합니다.	모래 필터 역세척 주기가 충분하지 않습니다.	수조에서 물을 빼고 세척한 후 다시 채우십시오. 역세척 일정을 확인하고 필요 시 변경하십시오.
물이 오존 발생기 압력계 밖으로 누수됩니다.	밸브 누수 여부를 확인하십시오.	체크 밸브는 추출기의 진공 연결에 위치하며 세척 및 수리가 필요합니다. 필요 시 교체하십시오.



압축된 공기

검사 및 관리 일정

일일 작업

공기 탱크에서 압력계 측정값을 확인하십시오. 측정값이 명목 범위 내에 있는지 확인하십시오.

공기 압축기가 작동 중인지 확인하십시오.

공기 건조기가 작동 중인지 확인하십시오.

공기 필터에서 불이 켜진 표시기가 있는지 확인하십시오. 필터 표시기에 불이 켜진 경우 제조업체의 지침에 따라 필터 부품을 교체하십시오.

주별 작업

공기 탱크의 수동 배수 밸브를 여십시오. 공기 배관에서 습기를 제거하십시오.

APC(공기압 컨트롤러)를 검사해 누수 및 정상 작동 여부를 확인하십시오.

월별 작업

물이 응결되어 있는지 공기 탱크를 확인하십시오. 각 공기 탱크의 자동 배수 밸브(솔레노이드)가 작동하는지 확인하십시오.

APC(공기압 컨트롤러) 드립 레그의 수동 밸브를 열어 공기 배관에서 습기를 제거하십시오.

연 2회 작업

미립/조립 응집 공기 필터 부품을 교체하십시오.

필요에 따른 작업

ERI(부품 교체 표시기)가 깜박이거나 계속 불이 켜져 있으면 미립/조립 응집 공기 필터 부품을 교체하십시오.



검사 및 관리 절차

공기 탱크에서 물 제거

공기 탱크에 남아 있을 수 있는 물을 빼려면 다음 절차를 수행하십시오.

1. 공기 탱크 바닥 가까이에 있는 수동 배수 밸브(볼 밸브)를 찾으십시오.
2. 밸브를 천천히 여십시오. 압축된 공기가 관을 빠져나오는 소리가 들릴 때까지만 밸브를 살짝 열면 됩니다.
3. 배수관에서 나오는 모든 응축수를 확인하십시오. 물이 더 이상 보이지 않을 때까지 공기를 배출하십시오.
4. 수동 배수 밸브를 닫으십시오.

공기 필터 변경

정비 또는 교체 시 다음을 수행해 공기 필터 중 하나를 분리하십시오.

1. CP-101의 애니메이션 캐짐/꺼짐/자동 스위치가 꺼짐 위치인지 확인하십시오.
2. 관리가 실시되는 급기선에서 상향류 및 하향류 차단 밸브 모두를 닫으십시오.
3. 제조업체의 지침에 따라 필터 부품을 제거 및 교체하십시오.
4. 필터 하우징을 다시 설치하십시오.
5. 상향류 및 하향류 차단 밸브 모두를 여십시오.
6. 상향류 및 하향류 압력계를 확인하고 압력계 측정값이 범위 내에 있는지 확인하십시오.
7. CP-101의 애니메이션 캐짐/꺼짐/자동 스위치를 자동 위치에 놓으십시오.

공기압 컨트롤러 검사



전공 변환기의 나사를 조절하지 마십시오. 조절 시
변환기가 손상될 수 있습니다.

문제 해결

문제	가능한 원인	해결 조치
CanopyShooter가 물을 뿜지 않습니다.	공기 압축기가 꺼져 있거나 장애 상태입니다.	공기 압축기 전원이 켜져 있는지 확인하십시오. 장애 원인을 해결 및 수리하십시오. 관련 정보는 제조업체의 문서를 참조하십시오.
	CanopyShooter에 공기가 공급되고 있는지 확인하십시오. 모든 연결, 공기 배관 및 관련 밸브를 확인하십시오. 필요 시 수리하십시오.	
	공기 밸브가 닫혀 있습니다.	공기 밸브를 여십시오.
	필터가 막혔습니다.	필터를 세척하십시오.
	압축기에 문제가 있습니다.	공기 압축기를 수리 또는 교체하십시오.
특정 CanopyShooter가 작동하지 않습니다.	특정 CanopyShooter에 대한 디스플레이 공기원이 존재하지 않습니다.	모든 압축 공기 구성 요소 전원이 켜지고 작동 중인지 확인하십시오. 모든 차단 밸브가 열려 있는지 확인하십시오. 해당 압력계를 확인하십시오. 필요 시 수리하십시오.
	공기 밸브가 닫혔습니다.	공기 밸브를 여십시오.
	공기 배관 또는 연결에 고장이나 손상이 발생했습니다.	모든 공기 배관 및 연결을 검사하십시오. 필요 시 수리 또는 교체하십시오.
	공기 건조기가 작동하고 있지 않습니다.	공기 건조기가 작동 중인지 확인하십시오. 필요 시 수리하십시오. 원 제조업체의 문서를 참조하십시오.
	공기 필터의 상태가 좋지 않습니다.	공기 필터 부품을 교체하십시오.
하나 이상의 압축 공기원에서 과도한 습기가 발견되었습니다.	공기 탱크 자동 배수 밸브가 작동하지 않습니다.	자동 배수 밸브를 검사하십시오. 필요 시 수리 또는 교체하십시오.
	공기 탱크에 습기가 너무 많습니다.	자동 배수 밸브를 검사하십시오. 필요 시 수리 또는 교체하십시오. 공기 탱크의 수동 배수 밸브를 열어 습기를 모두 제거하십시오.
	공기압 컨트롤러에 문제가 있습니다.	공기압 컨트롤러를 필요에 따라 수리, 교체 및 재교정하십시오.
	디스플레이 공기압이 적절하지 않습니다.	해당 압력계를 확인하십시오. 필요 시 압축 공기 구성 요소를 수리하십시오.
	공기 밸브가 부분적으로 닫혔습니다.	밸브를 여십시오.
CanopyShooter가 예상 디스플레이 높이에 미치지 못합니다.	공기 스트레이너가 막혔습니다.	스트레이너를 세척하십시오.
	공기 호스가 꼬였습니다.	꼬인 부분을 펴십시오.



조명

GFCI(누전 차단기) 보호

수조에 있는 모든 조명 회로는 조명 판넬에 설치된 GFCI(누전 차단기) 회로 차단기를 통해 보호됩니다. GFCI(누전 차단기)는 과전류 감지 기기의 정상적인 기능과 GFCI(누전 차단기) 기능(보호)을 보장합니다. GFCI(누전 차단기) 부분은 "전원선"을 통해 나가는 전류량과 "중립선"을 통해 돌아오는 전류량을 비교하여 작동합니다. 전류량 차이는 의도한 전기 회로 이외로 이동하는 전류량으로 간주되므로 전류량의 차이가 큰 경우 차단기가 "트립"됩니다.



수중 조명은 정상 작동 시 많은 열을 발생시키며
수중에서만 작동하도록 설계되었습니다.

A급 GFCI(누전 차단기)로만 GFCI를 교체하십시오.
누전 감지기 사용 시 사망 또는 심각한 부상을 입을
수 있는 위험한 상황이 발생할 수 있습니다.

검사 및 관리 일정

일일 작업

고장 난 LED의 수중 조명 기구를 검사하십시오. 필요 시 기구를 교체하십시오.

월별 작업

기구의 과열을 방지하고 조명이 수경 시설을 충분히 밝힐 수 있도록 수중 조명 렌즈를 세척하십시오.

각 GFCI(누전 차단기)를 테스트하고 장애 상태인 GFCI를 모두 즉시 교체하십시오.



검사 및 관리 절차

GFCI(누전 차단기) 절차

1. 조명 판넬에서 각 GFCI(누전 차단기) 회로 차단기의 테스트 버튼을 잠시 누르십시오(한 번에 하나씩).
2. 차단기는 즉시 트립되어야 합니다.
3. 트립되지 않는 차단기는 직원 및 장비의 안전 유지를 위해 동일한 새 장치로 교체해야 합니다.
4. 트립된 차단기는 꺼짐 위치로 이동시킨 후 조명을 다시 작동하기 전에 켜짐 위치로 되돌려야 합니다.

문제 해결

문제	가능한 원인	해결 조치
조명이 켜지지 않습니다.	CP-101의 조명 컨트롤 수동/꺼짐/자동 스위치가 꺼짐으로 설정되어 있습니다.	스위치를 자동으로 전환하십시오. 참고: 테스트를 위해 이 스위치를 잠시 켜짐 위치에 놓으면 모든 조명을 켤 수 있습니다.
	조명을 켜도록 예약되지 않았습니다.	iPad에서 Light Schedule을 확인하십시오. 필요 시 편집하십시오.
	관련 조명 판넬의 접촉기에서 오작동이 발생했습니다.	퓨즈를 확인하십시오. 접촉기를 교체하십시오.
	수위 센서 퓨즈가 손상되었습니다.	퓨즈를 교체하십시오.
	수조의 수위가 낮습니다.	iPad 인터페이스에서 Low Water Level 표시기를 확인하십시오. 관련 수위 센서를 검사하고 물 보충 솔레노이드 밸브가 정상 작동하는지 확인하십시오. 필요 시 수리하십시오.
	수위 센서 볼이 없거나 작동하지 않습니다.	수리 또는 교체하십시오.
조명을 켜도록 예약하지 않았는데 모든 조명이 켜집니다.	CP-101 및 iPad의 조명 컨트롤 수동/꺼짐/자동 스위치가 켜짐으로 설정되었습니다.	스위치를 자동으로 전환하십시오.
켜지지 않는 조명이 1개 있습니다.	조명이 손상되었습니다.	조명을 교체하십시오.
한 그룹의 조명이 켜지지 않습니다.	회로 차단기가 트립되었습니다.	회로 차단기 연결을 확인하십시오. 필요 시 수리 또는 교체하십시오.
	해당 수중 정션 박스에 문제가 있습니다.	정션 박스 연결을 확인하십시오. 필요 시 수리 또는 교체하십시오. 수질을 확인하십시오.

유지 및 보수 일정

일일 작업

워터 디스플레이 기기 - WaterIris™

개구부에 잔여물이 있는지 확인하십시오.

워터 디스플레이 기기 - CanopyShooter™

CanopyShooter 내부 또는 근처에서 발견된 모든 잔여물을 제거하십시오.

물 순환 및 여과

모든 펌프의 흡입구 쪽에서 압력계 측정값을 확인하십시오. 압력계 측정값이 명목 범위 내에 있는지 확인하십시오.

모래 필터 양쪽의 압력계를 확인하십시오. 차압 스위치는 8psi로 사전 설정됩니다.

수위 컨트롤

두 개의 차단 밸브 모두가 열려 있으며 수동 물 보충 밸브가 닫혔는지 확인하십시오.

수경 시설의 정상 작동을 위해 옥내 급수가 작동되었는지 확인하십시오.

화학 처리

필터 펌프가 작동 중인지 확인하십시오.

두 광섬유 끝(오존 발생기 엔클로저 측면에 위치)에 불이 켜져 있는지 확인해 오전 발생기가 작동 중인지 확인하십시오.

유량 센서(FSL-1000)의 빨간 LED에 불이 켜져 있는지 확인하십시오.

압축 공기 시스템

공기 탱크에서 압력계 측정값을 확인하십시오. 측정값이 명목 범위 내에 있는지 확인하십시오.

공기 압축기가 작동 중인지 확인하십시오.

공기 건조기가 작동 중인지 확인하십시오.

공기 필터에서 불이 켜진 표시기가 있는지 확인하십시오. 필터 표시기에 불이 켜진 경우 제조업체의 지침에 따라 필터 부품을 교체하십시오.

조명 시스템

고장 난 LED의 수중 조명 기구를 검사하십시오. 필요 시 기구를 교체하십시오.

주별 작업

메신저 박스

메신저 박스를 검사해 메신저 박스가 수조 바닥에 고정되어 떠다니지 않는지 확인하십시오. 메신저 박스가 지지대에서 분리된 경우 "증상 - 메신저 박스가 수조에서 떠다님"을 참조하십시오.

물 순환 및 여과

バス켓 스트레이너를 세척하십시오.

압축 공기 시스템

공기 탱크의 수동 배수 밸브를 여십시오. 공기 배관에서 습기를 제거하십시오.

APC(공기압 컨트롤러)를 검사해 누수 및 정상 작동 여부를 확인하십시오.

주별 작업

화학 처리

T-스트레이너를 세척하십시오.



월별 작업

워터 디스플레이 기기 - WaterIris™

WaterIris에 대해 관리 쇼를 실행하십시오.

전기 및 컨트롤 판넬

전기적 E-Stop(비상 정지) 작동을 테스트하십시오.

물 순환 및 여과

필터 펌프 주입구 쪽의 압력 스위치를 육안으로 점검해 부식 또는 손상 여부를 확인하십시오.

수위 컨트롤

각 수위 스위치 어셈블리에서 단일 수위 플로트 스위치의 기능을 테스트하십시오.

수위 센서의 정상 작동 여부를 테스트하십시오.

화학 처리

브롬화 기구에 브롬을 다시 채우십시오.

압축 공기 시스템

물이 응결되어 있는지 공기 탱크를 확인하십시오. 각 공기 탱크의 자동 배수 밸브(솔레노이드)가 작동하는지 확인하십시오.

APC(공기압 컨트롤러) 드립 레그의 수동 밸브를 열어 공기 배관에서 습기를 제거하십시오.

조명 시스템

기구의 과열을 방지하고 조명이 수경 시설을 충분히 밝힐 수 있도록 수중 조명 렌즈를 세척하십시오.

각 GFCI(누전 차단기)를 테스트하고 장애 상태인 GFCI를 모두 즉시 교체하십시오.

분기별 작업

전기 및 컨트롤 판넬

컨트롤 판넬 안의 기화형 부식 방지제 컵을 교체하십시오.

플로트가 차단되지 않도록 하십시오.

연 2회 작업

화학 처리

제조업체에서 권장하는 대로 ORP(산화 환원 전위) 및 pH 전극과 TDS(총 용존 고형물) 전도도 프로브를 재교정하십시오.

압축 공기 시스템

미립/조립 응집 공기 필터 부품을 교체하십시오.

연례 작업

워터 디스플레이 기기 - CanopyShooter™

y-스트레이너를 세척하십시오.

수위 컨트롤

물 보충 밸브 루프의 "완폐형" 솔레노이드 밸브를 재조립하십시오.

화학 처리

오존 발생기 자외선(UV) 램프를 교체하십시오.

제조업체에서 권장하는 대로 ORP(산화 환원 전위) 및 pH 전극과 TDS(총 용존 고형물) 전도도 프로브를 교체 및 보정하십시오.



필요에 따른 작업**물 순환 및 여과**

iPad 인터페이스에 표시가 나타나면バス켓 스트레이너를 세척하십시오.

브롬을 다시 채우십시오.

화학 처리

브롬화 기구에 브롬 정제를 다시 채우십시오.

오존 발생기 어셈블리에 있는 UV 램프 하우징 입구 옆에 있는 소형 공기 필터를 교체하십시오. 필터는 하얀색이어야 합니다. 색깔이 회색으로 변하면 필터를 즉시 교체하십시오.

물의 pH 레벨이 7.2~7.6pH 인지 확인하십시오. 필요 시 시중의 pH 테스트 키트와 조절 화학제를 사용해 지역 규정에 따라 pH 레벨을 수동으로 조절하십시오. 수조 전체에서 pH 조절 화학제를 고르게 사용하십시오.

압축 공기 시스템

ERI(부품 교체 표시기)가 깜박이거나 계속 불이 켜져 있으면 미립/조립 응집 공기 필터 부품을 교체하십시오.



예비 부품 목록

이 섹션에는 부산 프리미엄 아울렛 수경 시설에 대한 예비 부품을 확인 및 주문하는데 유용한 예비 부품 목록이 포함됩니다.

이 목록에는 안전 관리 및 예방에 가장 일반적으로 사용되는 부품 및 어셈블리가 포함됩니다.



목록에서 "권장 보유 수량" 열을 주의해서 살펴보십시오. 관련 수경 시설의 작동 중단이 발생하지 않도록 수위를 적절하게 유지해야 합니다.

WET CARE®

예비 또는 교체 부품을 주문하려면 WET Care®에 문의해 주십시오. 캘리포니아 선밸리에 있는 WET Care 본사 담당자에게 연락하실 수 있습니다. 연락처는 다음과 같습니다.

WET Care®

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이메일: WETCare@WETDesign.com



WC ID	설명	권장 보유 수량	실제 보유 수량	주문 수량
컨트롤 패널				
1987	쇼 재생 모듈 DATA/SDX (Show playback module DATA/SDX)	1		
3880	1입력, 8출력 와이어 터미널 연결 (One input, 8 output wire terminal connection)	1		
4536	전원 공급 장치	1		
5040	미니 출력 모듈 – 단자 (SDX 입력)	1		
1097	퓨즈, 2A, Slo-Blo, 5x20mm (Fuse, 2A, Slo-Blo, 5x20mm)	5		
1098	퓨즈, 5A, Slo-Blo, 5x20mm (Fuse, 5A, Slo-Blo, 5x20mm)	1		
1123	회로 차단기, 피드스루, GFCI (Circuit breaker, feed through, GFCI)	2		
1248	회로 차단기, 피드스루, GFCI (Circuit breaker, feed through, GFCI)	2		
1352	퓨즈, 4A, Slo-Blo, 5x20mm (Fuse, 4A, Slo-Blo, 5x20mm)	2		
1354	퓨즈, 0.16A, 속응성, 5x20mm (Fuse, 0.16A, Fast Acting, 5x20mm)	4		
1357	퓨즈, 10A, Slo-Blo, 5x20mm (Fuse, 10A, Slo-Blo, 5x20mm)	2		
1374	퓨즈, 0.032A, Slo-Blo, 5x20mm (Fuse, 0.032A, Slo-Blo, 5x20mm)	4		
1578	퓨즈, 0.5A, 속응성, 5x20mm (Fuse, 0.5A, Fast Acting, 5x20mm)	2		
1878	회로 차단기, 피드스루, GFCI (Circuit breaker, feed through, GFCI)	2		
1907	KLDR-일시 고자화 전류, 20A (KLDR-Momentary High Magnetizing Currents, 20A)	1		
2001	KLDR-일시 고자화 전류, 12A (KLDR-Momentary High Magnetizing Currents, 12A)	1		
2276	퓨즈, 1A, 속응성, 5x20mm (Fuse, 1A, Fast Acting, 5x20mm)	2		
2334	KLDR-일시 고자화 전류, 5A (KLDR-Momentary High Magnetizing Currents, 5A)	1		
4177	KLDR-일시 고자화 전류, 15A (KLDR-Momentary High Magnetizing Currents, 15A)	1		
4836	전원 공급 장치 SDR-480-24, 115VAC 5A 입력 24VCD, 20A 출력 (Power supply SDR-480-24, 115 VAC 5A in 24VCD, 20A out)	1		
5403	퓨즈, 6.3A, 속응성, 5x20mm (Fuse, 6.3A, Fast Acting, 5x20mm)	5		
5930	KLDR-일시 고자화 전류, 0.8A (KLDR-Momentary High Magnetizing Currents, 0.8A)	1		
1353	퓨즈, 0.5A, Slo-Blo, 5x20mm (Fuse, 0.5A, Slo-Blo, 5x20mm)	3		
1479	KLDR-일시 고자화 전류, 3A (KLDR-Momentary High Magnetizing Currents, 3A)	2		
1998	KLDR-일시 고자화 전류, 0.5A (KLDR-Momentary High Magnetizing Currents, 0.5A)	2		
1999	KLDR-일시 고자화 전류, 6A (KLDR-Momentary High Magnetizing Currents, 6A)	2		

WC ID	설명	권장 보유 수량	실제 보유 수량	주문 수량
공기압 컨트롤				
1085	재조립 키트, 볼륨 부스터, 1-1/2" (Rebuild Kit, Volume Booster, 1-1/2")	1		
2269	탑 스프링, 볼륨 부스터 (Top Spring, Volume Booster)	3		
2270	보텀 스프링, 볼륨 부스터 (Bottom Spring, Volume Booster)	3		
4503	스프링 시트, 볼륨 부스터 (Spring Seat, Volume Booster)	3		
CanopyShooter				
5933	20-01091용 밸브 재조립 키트 (VALVE REBUILD KIT for 20-01091)	10		
5949	30-03567용 3방향 주 밸브 재조립 키트 (MAIN 3 WAY VALVE REBUILD KIT for 30-03567)	5		
5951	어셈블리, 3방향 솔레노이드 밸브 및 코일, 일반적으로 닫혀 있음 (ASSY, 3-WAY Solenoid Valve and Coil, NORMALLY CLOSED)	5		
5952	어셈블리, 노즐, CanopyShooter (Assembly, Nozzle, CanopyShooter)	10		
5953	어셈블리, 체크 밸브, CanopyShooter (Assembly, Check Valve, CanopyShooter)	5		
5948	어셈블리 바디 CanopyShooter (Assembly Body CanopyShooter)	3		
수질 관리				
1468	ORP 프로브 (ORP Probe)	1		
1469	pH 프로브 (pH Probe)	1		
1528	TDS 프로브 (TDS Probe)	1		
1584	ORP 교정 솔루션 (ORP calibration solution)	1		
1588	pH 버퍼 솔루션 (pH buffer solution)	1		
1589	pH 버퍼 솔루션 (pH buffer solution)	1		
1583	TDS 교정 솔루션 (TDS calibration solution)	1		
조명 판넬				
2563	20A 누전 차단기 회로 차단기 (20A Ground Fault Circuit Interrupter Circuit Breaker)	1		
PicoLight				
5902	R5 어셈블리, PicoLight 11 (R5 assy, PicoLight 11)	12		
모터 컨트롤 센터				
1117	퓨즈, 시간 지연, 600VAC (Fuse, time delay, 600VAC)	1		
1372	퓨즈, 시간 지연, 600VAC (Fuse, time delay, 600VAC)	1		
1878	회로 차단기, 피드스루, GFCI 15A (Circuit breaker, feed through, GFCI 15A)	1		
1478	KLDR-일시 고자화 전류, 1A (KLDR-Momentary High Magnetizing Currents, 1A)	1		
5929	KLDR-일시 고자화 전류, 7.5A (KLDR-Momentary High Magnetizing Currents, 7.5A)	2		



Pilot Operated
Gas Shutoff Valves
3/8" to 3/4" NPT

**2/2
SERIES
8210**

Features

- 2-way normally closed operation
- For control of commercial and industrial gas burners
- Ideal for high pressure applications
- Brass body construction
- Mountable in any position

Fluid

Fuel Gas

Construction

Valve Parts in Contact with Fluids	
Body	Brass
Seals and Disc	NBR
Core Tube	305 Stainless Steel
Core and Plugnut	430F Stainless Steel
Springs	302 Stainless Steel
Shading Coil	Copper

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption			Ambient Temp. °F	Spare Coil Family		
	AC				General Purpose	Explosionproof	
	Watts	VA Holding	VA Inrush		AC	AC	
F	10.1	25	70	32 to 125	238610	238614	
F	10.1	25	70	32 to 140	238810	238914	

Standard Voltages: 24, 120, 240 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz).
Optional High Ambient Temp: 140°F Class H coil with prefix HT.

Solenoid Enclosures

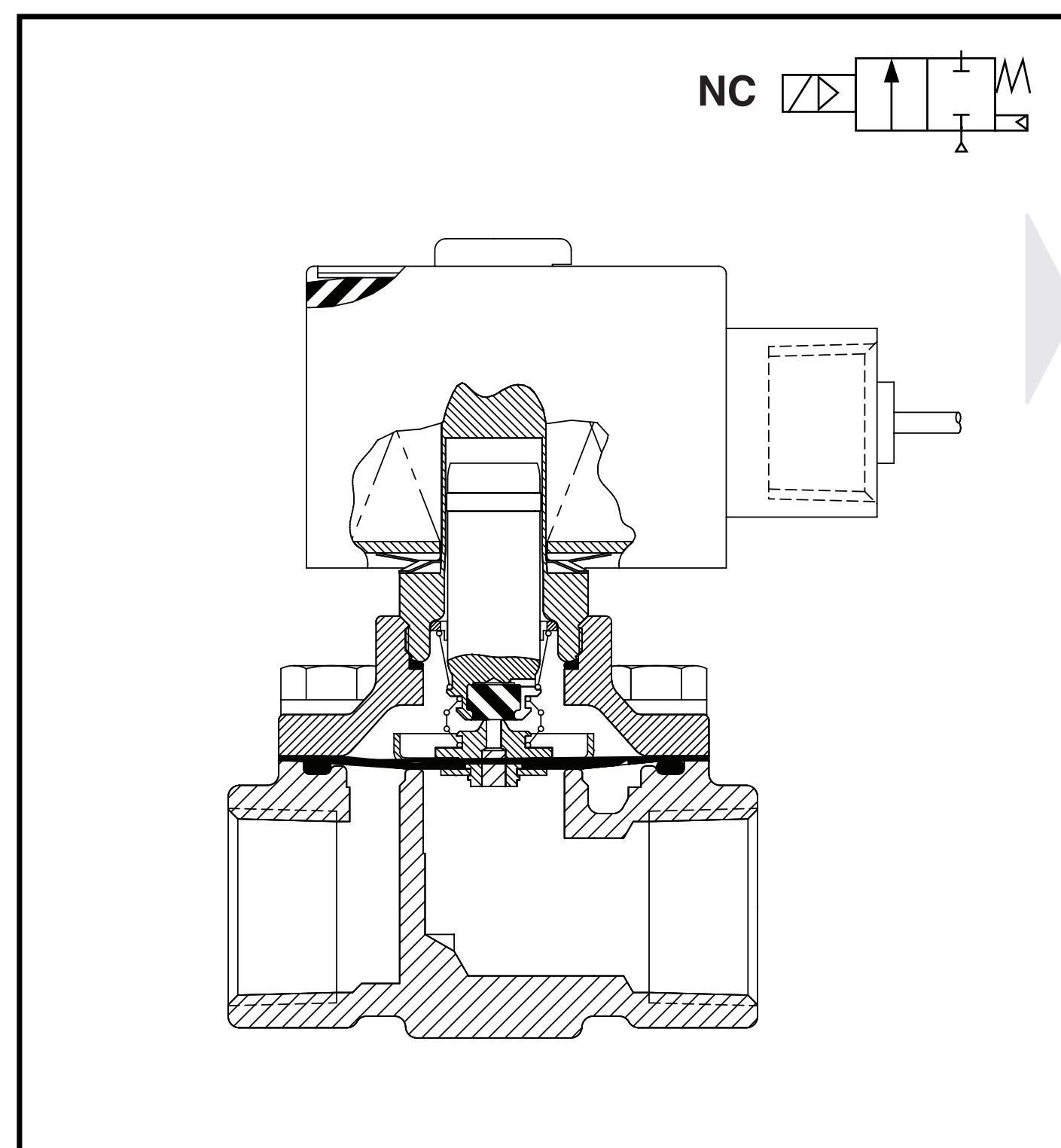
Standard: Watertight, Types 1, 2, 3, 3S, 4, and 4X with 1/2" conduit hub.

Optional: RedHat II - Explosionproof and Watertight. To order, add Prefix "EF" to catalog numbers. (e.g. EF8210G075)

Valve Response Time

Opening Time: Less than 1 second

Closing Time: Less than 1 second



Approvals

UL listed to standard 429 "Electrically Operated Valves," Guide YIOZ, File MP618, Safety Valves.

FM Approved to Class 7400 "Liquid and Gas Safety Shutoff Valves."

CSA Certified to:

- 1) Standard C22.2 No. 139 "Electrically Operated Valves," File 010381
- 2) Automatic Gas Valves Z21.21 (6.5), File 112872.



Specifications (English units)

Pipe Size (in)	Orifice Size (in)	Cv Flow Factor	Gas Capacity ①	Operating Pressure Differential (psi)		Max. Fluid Temp. °F	Catalog Number	Const. Ref.	Agency			Wattage	Approx. Shipping Weight (lbs)
				Btu/hr.	Min.				UL	FM	CSA		
COMBUSTION (Fuel Gas) - NORMALLY CLOSED													
3/8	5/8	2.8	150,000	0	50	125	8210G074	1	○	○	○	10.1	3.2
1/2	5/8	3.6	193,000	0	50	125	8210G075	1	○	○	○	10.1	3.2
3/4	3/4	5.0	295,000	0	50	125	8210G076	2	○	○	○	10.1	3.4

○ = Safety Shutoff Valve. ① 1" W.C. Drop @ 2" W.C. Inlet Pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas.

Specifications (Metric units)

Pipe Size (in)	Orifice Size (mm)	Kv Flow (m³/hr)	Gas Capacity ①	Operating Pressure Differential (bar)		Max. Fluid Temp. °C	Catalog Number	Const. Ref.	Agency			Wattage	Approx. Shipping Weight (kgs)
				Btu/hr.	Min.				UL	FM	CSA		
COMBUSTION (Fuel Gas) - NORMALLY CLOSED													
3/8	16	2.4	150,000	0	3.4	52	8210G074	1	○	○	○	10.1	1.5
1/2	16	3.1	193,000	0	3.4	52	8210G075	1	○	○	○	10.1	1.5
3/4	16	4.3	295,000	0	3.4	52	8210G076	2	○	○	○	10.1	1.5

○ = Safety Shutoff Valve. ① 1" W.C. Drop @ 2" W.C. Inlet Pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas.

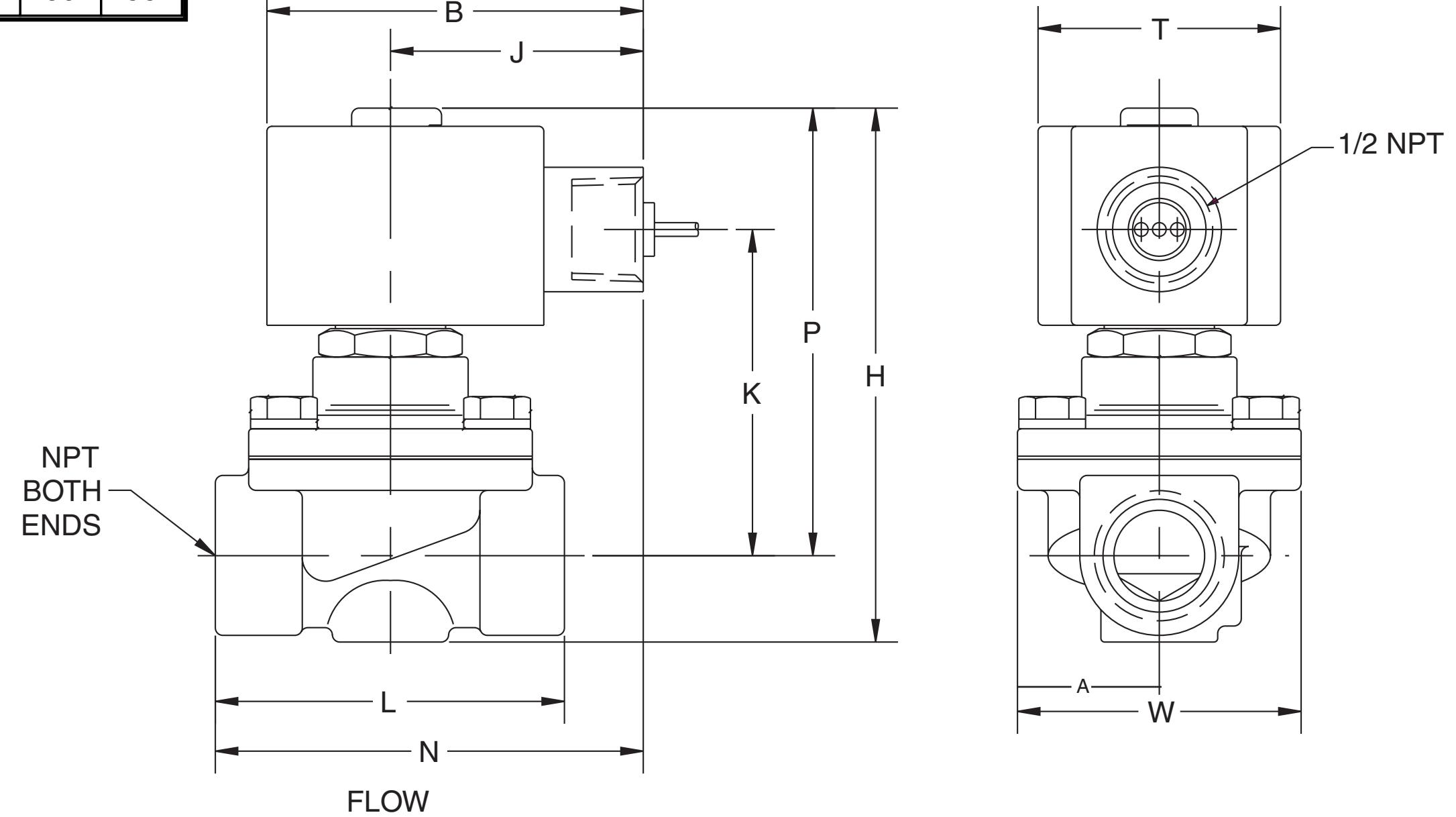
Capabilities Chart

Solenoid Options				Base Catalog Number	Resilient Materials	Standard Rebuild Kit
NEMA Type 3-9	High Temp.	Junction Box	Wiring Box Screw Terminal	Brass	NBR	AC
EF	HT	JB	JKF	8210G074	●	304076
EF	HT	JB	JKF	8210G075	●	304076
EF	HT	JB	JKF	8210G076	●	304076

● = Standard. Other options may be available. All option combinations may not be available.

Dimensions inches (mm)

Const. Ref.	A	B	H	J	K	L	N	P	T	W	
1	in	1.66	3.03	3.95	2.04	2.42	2.75	3.42	3.39	1.95	2.28
	mm	42	77	100	52	61	70	87	86	50	58
2	in	1.66	3.03	4.20	2.04	2.58	2.81	3.45	3.55	1.95	2.28
	mm	42	77	107	52	66	71	88	90	50	58

Const. Ref. 1, 2

Mountable in any position.

P-SERIES Pressure Switches

Switches for Vacuum through 6000 psig with Adjustable Set Points and Fixed or Adjustable Deadband

Features:

- Set point repeatability, $\pm 1\%$ of operating range.
- All wiring terminals, adjustments and visual scales are accessible from the front of the switch.
- Choice of open frame type, general purpose or watertight enclosure.
- Choice of fixed, limited-adjustable or full-range adjustable deadband.
- Choice of single or two-stage units.
- Compact size.
- Mounts in any position.
- Rugged and vibration resistant; e.g., for compressors.
- Visual adjustment scales in psig and bars.
- Wide selection of transducer wetted materials suitable for air, water, oil or corrosive fluids.
- Mix and match switch and transducer components for increased stock flexibility or to change pressure ranges in field.

General Description:

ASCO P-Series pressure switches consist of an open frame or enclosure protected switch unit and a transducer unit. They can be ordered separately for customer stocking and/or field assembly or as a complete factory-assembled unit.

Switch

P-Series pressure switch units incorporate the unique ASCO TRI-POINT alternating fulcrum balance plate to control the operation of one or more electrical snap-action switches. The electrical snap-action switch together with the adjusting mechanism is a fully-tested, self-contained subassembly.

Transducer

Transducer unit incorporates a diaphragm/piston type pressure sensor, and is also a fully-tested, self-contained subassembly.

Operation

When pressure is applied to the transducer it is converted into movement of the piston. This piston movement is then used to control the operation of the electrical snap-action switch in the switch unit.

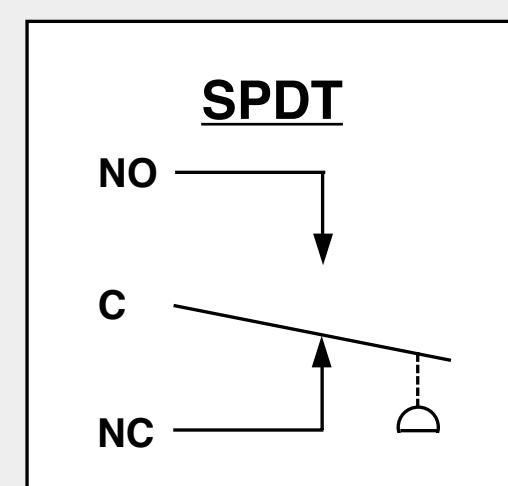
Options (See pages 34-35)



Standard Electrical Ratings

PA, PB, PC ① Series

- 15 Amp Res., 125 VAC
- 10 Amp Res., 250 VAC
- 1/8 HP, 125 VAC
- 1/4 HP, 250 VAC
- 1/2 Amp Res., 125 VDC
- 1/4 Amp Res., 250 VDC



PG Series

- 15 Amp Res., 125 VAC
- 10 Amp Res., 250 VAC
- 1/8 HP, 125 VAC
- 1/4 HP, 250 VAC



① PC Series, UL recognized component, rated 10 Amp Res., 125/250 VAC; 1/3 HP 125/250 VAC.

② Open frame construction, UL recognized component.

③ FM listed for air flow interlocking service.

Standard Temperature Ratings

Ambient: -4°F (-20°C) to 122°F (50°C)

Fluid: For Buna "N" or Neoprene Diaphragm

-4°F (-20°C) to 180°F (82°C)

For Viton Diaphragm

-4°F (-20°C) to 250°F (121°C)

For 316 SS Diaphragm

-50°F (-45°C) to 300°F (149°C)

For Nylon Transducers

-4°F (-20°C) to 180°F (82°C)



Enclosures

ASCO TRI-POINT switches are available in either a general purpose or watertight enclosure, in addition to open frame construction. These enclosed units are made in accordance with NEMA and UL standards. These standards define the protection level an enclosure gives and the tests it must pass to meet a particular design.

General Purpose – Type 1. These enclosures are designed for indoor use to protect personnel from accidental contact with the equipment. P-Series general purpose enclosures are painted, zinc-coated

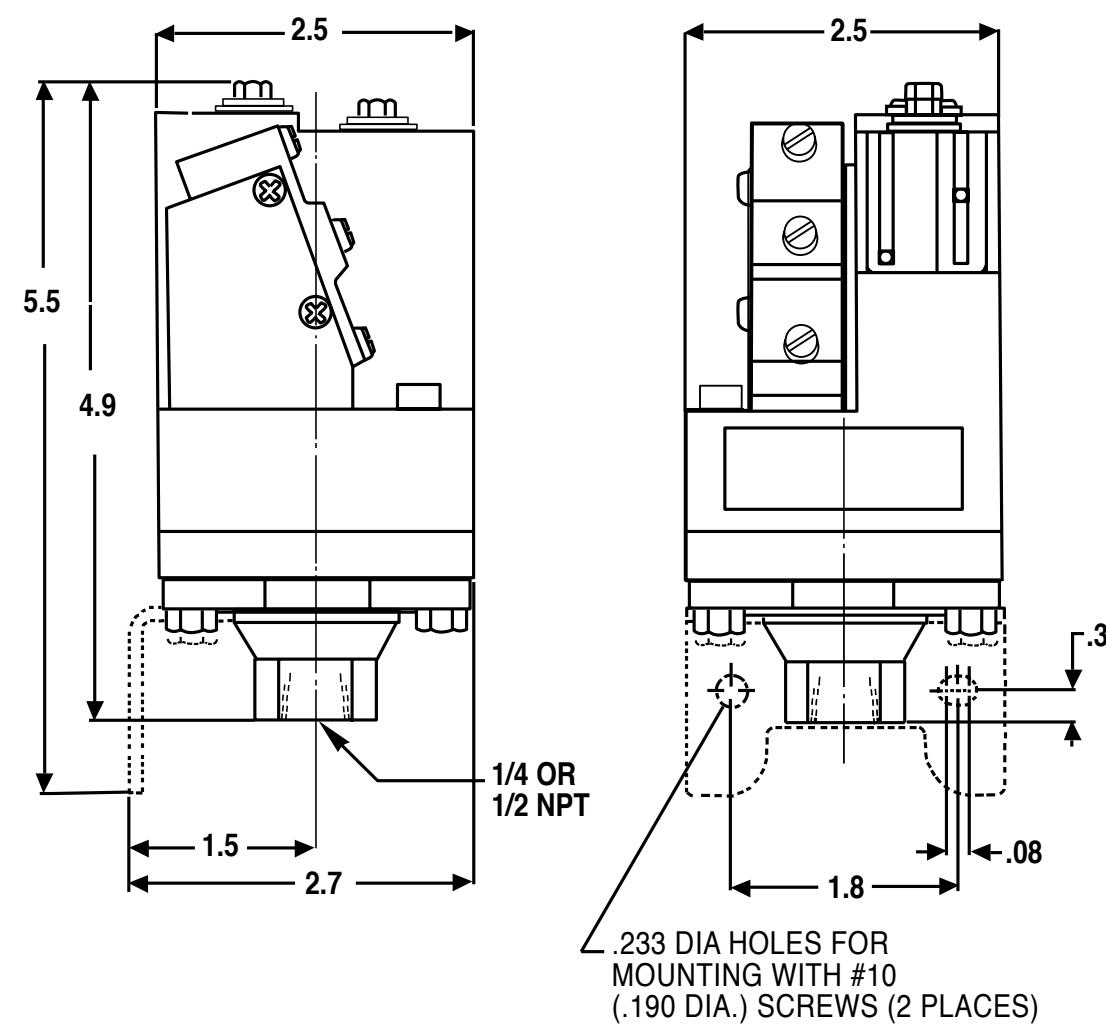
steel and have a 7/8" diameter hole at the top for electrical entry.

Watertight – Type 4. Watertight and dust-tight enclosures are intended for use indoors and outdoors to protect the enclosed equipment against splashing or falling water, windblown dust and water, hose directed water, and severe external condensation. P-Series watertight switch enclosures are epoxy-painted, zinc-coated steel with a 1/2" conduit hub in the side of the lower housing for electrical entry. (For optional 316 SS watertight enclosure see page 13.)

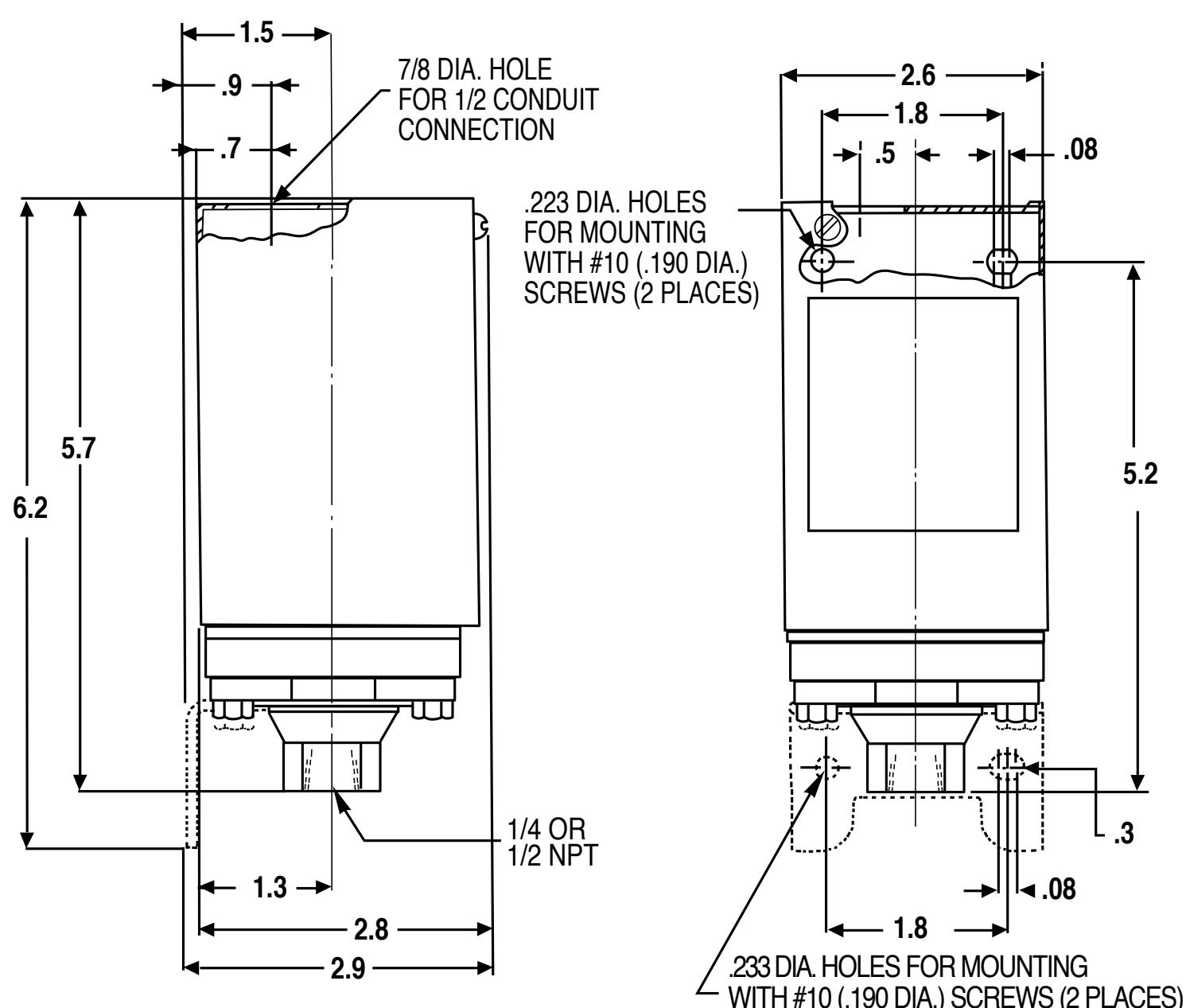
Dimensions (inches)

P-Series Pressure (Mounting brackets optional)

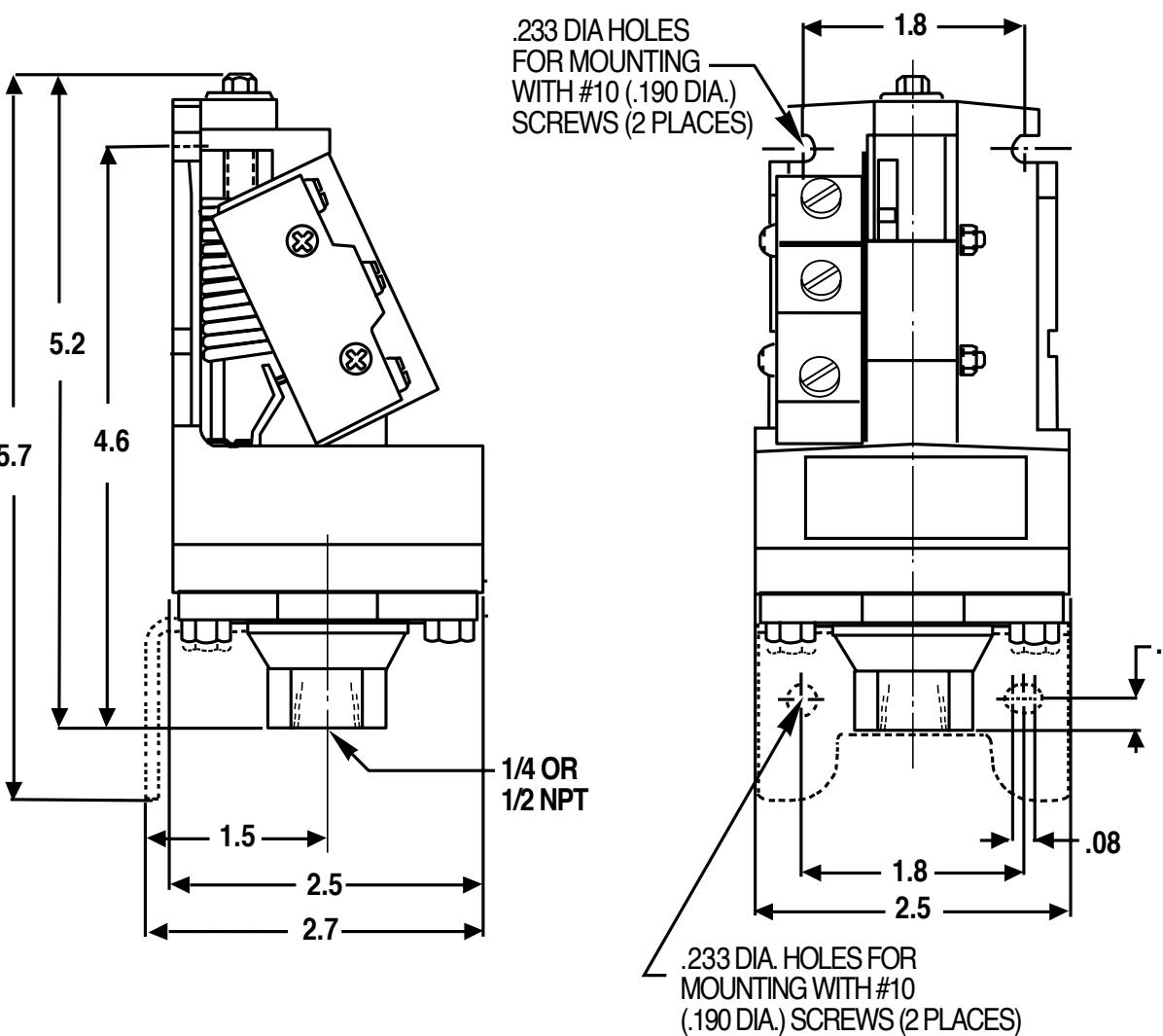
Open Frame PA and PC Switch Units
with Transducer Unit



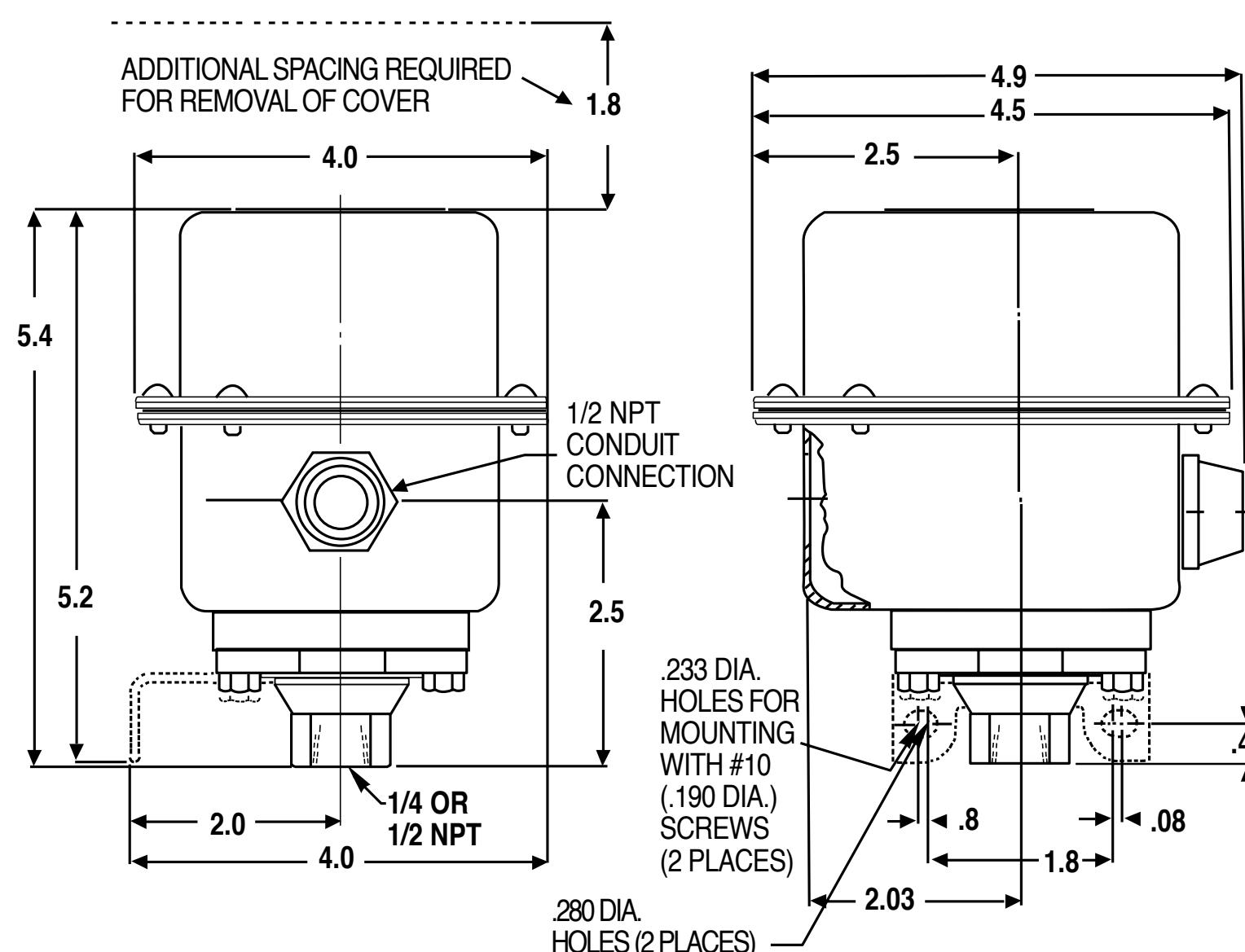
Type 1 General Purpose Switch Unit
with Transducer Unit



Open Frame PB and PG Switch Units
with Transducer Unit



Type 4 Watertight Switch Unit
with Transducer Unit





P-SERIES Pressure Switches



How to Select and Order

ASCO P-Series switches consist of two components, the switch unit and the transducer unit.

How to Select

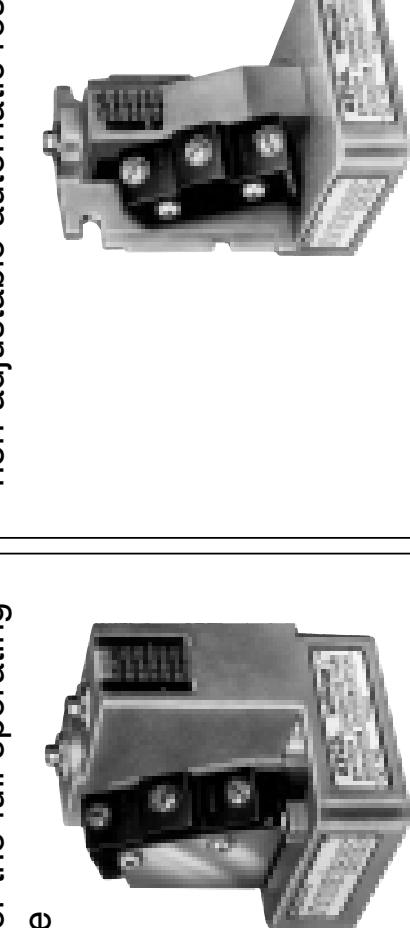
1. Select the adjustable operating range based on desired actuation pressure.
2. Check that proof pressure is sufficient.
3. Read across and select the desired P-Series switch unit with the proper enclosure.
4. Continue across and select a matching transducer unit compatible with the fluid.

General Purpose Enclosure



PA Switch Unit

Single-Stage Adjustable Deadband
units allow independent adjustment of the set and reset points over the full operating range of the switch. The minimum difference between set and reset points is the deadband listed below; the maximum difference is the full range of the switch.

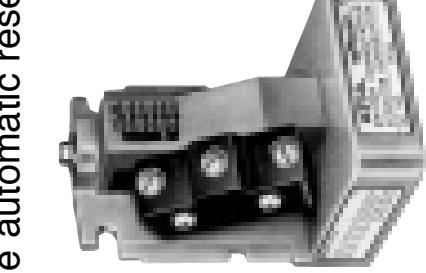


Open Frame

PA, PB, or PC unit below

PA Switch Unit

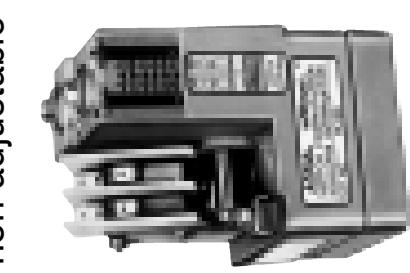
Single-Stage Fixed Deadband units have an adjustable set point and a non-adjustable automatic reset point.



Open Frame

PB Switch Unit

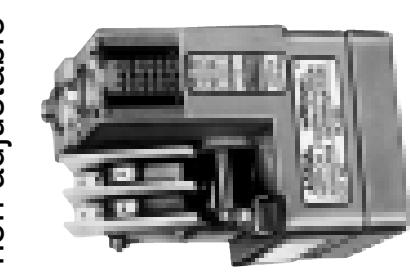
Two-Stage Fixed Deadband units consist of two separate snap-action switches, each with an independently adjustable set point and non-adjustable reset point. The difference between the set and reset points of each switch is the deadband listed below; the minimum difference between the set points of the two switches is the separation.



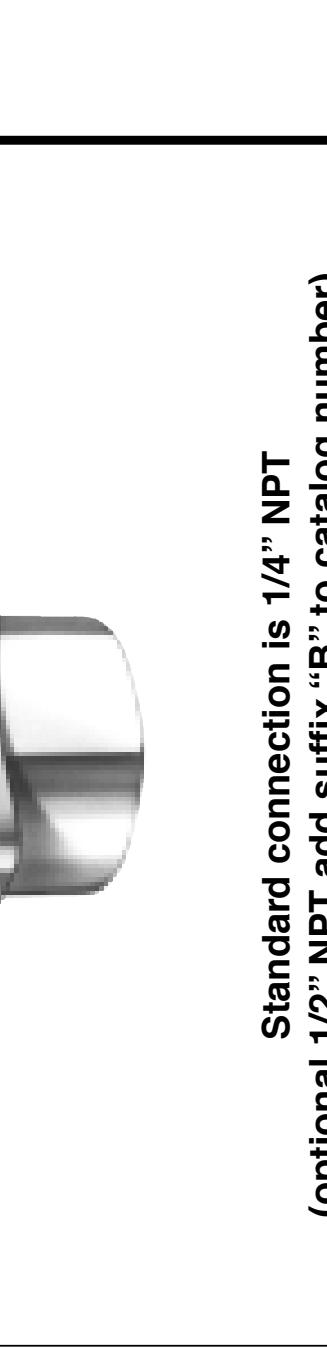
Open Frame

PC Switch Unit

Two-Stage Fixed Deadband units consist of two separate snap-action switches, each with an independently adjustable set point and non-adjustable reset point. The difference between the set and reset points of each switch is the deadband listed below; the minimum difference between the set points of the two switches is the separation.



Open Frame



Standard connection is 1/4" NPT
(optional 1/2" NPT add suffix "B" to catalog number)

Transducer Unit

These gauge pressure type transducers provide for one pressure connection in the bottom of the transducer. They are diaphragm/piston type transducers using an elastomer in contact with the fluid, backed by a piston cylinder. This allows high sensitivity for low pressures and strength for high pressures.

Transducer Units

Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.
Air or Gas	Air, Oil or Gas	Water, Air, Oil or Gas	Brass & Buna "N"	Nylon & Buna "N"	Aluminum & Buna "N"	Watertight Enclosure	Corrosive Fluids
Maximum Full Scale	Maximum At Mid-Range (psig) ^①	Separation	General Purpose	Open Frame	General Purpose	Watertight Enclosure	All 316 SS & Viton ^②
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	Fixed Deadband At Mid-Range (psig) ^①	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.
Adjustable Deadband	Adjustable Deadband	2.7" Hg	3" Hg	4.3" Hg	6" Hg	PC26A	RV34A21
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	0.05	0.05	0.6	1.0	PC20A	RV24A21
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	0.4	0.4	0.8	1.8	PC21B	RV24A32
Adjustable Deadband	Adjustable Deadband	PC31B	RD40A21
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC30A	RD30A21
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RD20A21
Adjustable Deadband	Adjustable Deadband	PC21B	RD40A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RD30A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RD20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A21
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband	PC21B	RE20A42
Maximum Full Scale	Maximum At Mid-Range (In W.C.) ^①	PC31B	RE20A42
Minimum At Mid-Range (In W.C.) ^①	Mid-Range (psig) ^①	PC20A	RE20A42
Adjustable Deadband	Adjustable Deadband						

P-SERIES Pressure Switches

How to Select and Order

ASCO P-Series switches consist of two components, the switch unit and the transducer unit.

How to Select

1. Select the adjustable operating range based on desired actuation pressure.
2. Check that rated proof pressure is sufficient.
3. Read across and select the desired P-Series switch unit with the proper enclosure.
4. Continue across and select a matching transducer unit compatible with the fluid.

How to Order

Factory assembled – Simply order the switch and transducer unit by catalog number joined by a slash (/), e.g., PG36A/RV34A11.

Field assembled – Simply order the switch and transducer units separately by individual catalog number, e.g., one PG36A and one RV34A11.

Options – Add appropriate suffix for desired option (see pages 34-35).

Important Note: The third digit of each of the catalog numbers must be identical, e.g., PG 36A and RV 34A11.

Select P-Series switch unit and transducer unit below

		PG Switch Unit			Transducer Unit					
Specifications		Limited Adjustable Deadband			Transducer Units					
Adjustable Operating Range (psig)	Proof Pressure (psig)	Adjustable Deadband At Mid-Range (psig) ① From/To	Open Frame	General Purpose	Watertight Enclosure	Air or Gas ②	Air, Oil or Gas	Water, Air, Oil or Gas	Corrosive Fluids	
		Catalog No.	Catalog No.	Catalog No.	Catalog No.	Nylon & Buna "N"	Aluminum & Buna "N"	Brass & Buna "N"	All 316 SS ③	
Vacuum 0 - 30" Hg	50	1.8 - 5.0	PG36A	PG30A	PG31B	---	RV34A11	RV34A21	---	RV34A32
Compound 30" Hg-14 psig	50	2.8 - 6.0	PG26A	PG20A	PG21B	---	RV24A11	RV24A21	---	RV24A32
Pressure	0 - 9	0.7 - 1.3	PG36A	PG30A	PG31B	RD30A71	RD30A11	RD30A21	---	RD30A42
	2 - 18	0.8 - 2.1	PG26A	PG20A	PG21B	RD20A71	RD20A11	RD20A21	---	RD20A42
	2 - 18	1.8 - 3.1	PG36A	PG30A	PG31B	---	---	---	RE30A44	---
	4 - 36	2.0 - 4.0	PG26A	PG20A	PG21B	RE20A71	RE20A11	RE20A21	RE20A44	RE20A42
	6 - 60	2.1 - 4.6	PG16A	PG10A	PG11B	RE10A71	RE10A11	RE10A21	RE10A44	RE10A42
	10 - 100	4 - 8	PG16A	PG10A	PG11B	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42
20 - 200	400	8 - 17	PG16A	PG10A	PG11B	RG10A71	RG10A11	RG10A21	RG10A44	RG10A42
30 - 300	450	15 - 25	PG16A	PG10A	PG11B	---	RH10A11	RH10A21	RH10A44	RH10A42
40 - 400	500	22 - 45	PG16A	PG10A	PG11B	---	RJ10A11	RJ10A21	RJ10A44	RJ10A42
60 - 600	2000	35 - 75	PG26A	PG20A	PG21B	---	---	RL20A21	---	RL20A42
100 - 1000	2000	65 - 110	PG16A	PG10A	PG11B	---	---	RL10A21	---	RL10A42
160 - 1650	5000	190 - 290	PG26A	PG20A	PG21B	---	---	RN20B21	---	RN10B42
270 - 2700	5000	200 - 300	PG16A	PG10A	PG11B	---	---	RN10B21	---	RN10B42
600 - 6000	9000	300 - 500	PG16A	PG10A	PG11B	---	---	---	---	RQ10B42

All switch units and transducer units above are in stock for immediate delivery.

① Values shown are nominal. ② Rated proof pressure on RF10A71 is 150 psig and on RG10A71 is 300 psig.

③ 316 SS transducer deadbands are approx. 50% greater than listed. ④ Transducers ending in 32 have 303 SS process connections, not 316 SS.



Switches with Optional 316 Stainless Steel Enclosure

Every ASCO P-Series pressure switch is available in a corrosion-resistant, stainless steel enclosure. Typical applications include:

- Offshore platforms
- Hydrocarbon processing plants
- Oil & gas fields
- Oil & gas transmission lines
- Chemical plants
- Breweries
- Paper pulp mills
- Salt spray locations

Stainless Steel Enclosure

ASCO Type 4X watertight enclosure is designed to provide protection against windblown dust, rain, sleet or external ice formation. The switch and transducer unit are available only as factory-assembled units, and include a UL-approved 1/2" NPT conduit hub.



How to Select and Order

ASCO P-Series switches with 316 SS enclosure consist of two *factory-assembled* components, the switch unit and the transducer unit.

How to Select (use tables on pages 10-12)

1. Select the adjustable operating range based on desired actuation pressure.
2. Check that rated proof pressure is sufficient.
3. Read across and select the desired P-Series switch unit with open frame construction.
4. To add a 316 SS enclosure, change the fourth digit of the open frame catalog number from "6" to "4", e.g., PG3 6 A becomes PG3 4 A.
5. Continue across and select a matching transducer unit compatible with the fluid.

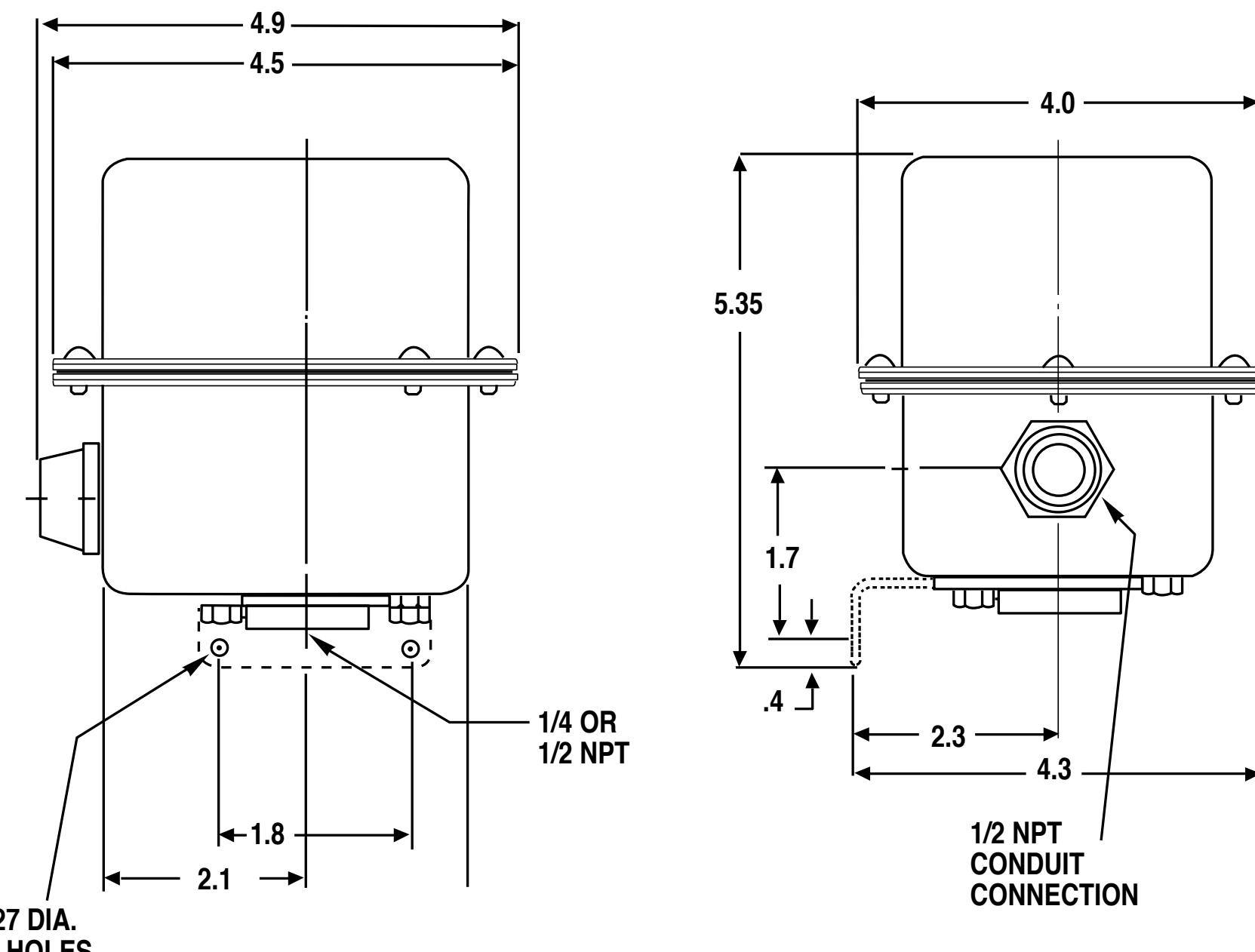
How to Order

Factory assembled only – Simply order the switch and transducer unit by catalog number joined by a slash (/), e.g., PG34A/RV34A32.

Options – Add appropriate suffix for desired option (see pages 34-35).

Dimensions (inches)

P-Series Pressure with Optional 316 SS Enclosure



OPTIONS Pressure/Temperature Switches

H-Series, P-Series and S-Series Snap-Action Switch Options

Optional snap-action switches to meet specific electrical loads or application conditions are available on most ASCO TRI-POINT switch units. Generally, the construction of a switch unit with optional snap-action switches contains other specific parts and may be ordered only as a factory-built unit. To specify a particular optional construction, add the appropriate suffix to the switch unit catalog number, e.g., SA10D with optional gold contact snap-action switch (suffix "P") would become SA10D[P].

Description	Electrical Rating	Catalog Suffix	Deadband Variation From Listing
DC Rating 1 Amp Double Break	5 Amp, 125, 250 VAC 1/4 HP, 125 VAC 1/2 HP, 250 VAC 1 Amp, 125 VDC 1/2 Amp, 250 VDC	G	SA: +50% SB, SC, PA: +100% H: +200% PB: +400% SA: +50%
DC Rating 10 Amps, SPDT	10 Amp, 125 VAC, VDC 1/8 HP, 125 VAC, VDC	M	SB, SC, PA: +100% H: +120% PB: +400%
Double-pole Double-throw (Two SPDT Switches with Common Lever)	5 Amp, 125, 250 VAC 1/8 HP, 125 VAC 1/4 HP, 250 VAC 1/2 Amp, 125 VDC 1/4 Amp, 250 VDC	K	SA, SB, SD, SE, PB: +50%
Gold Contact Dry Circuit SPDT	1 Amp, 28 VAC 1 Amp, 28 VDC 25 Amp Res, 28 VDC	P	SA, SB, SC, PA: +25% H: +50% PB, PC: +100%
Hermetically Sealed SPDT	10 Amp Ind, 28 VDC 5 Amp Motor, 28 VDC 3 Amp Lamp, 28 VDC 1 Amp, 125 VAC	H	SA, PA: +100% H: +200% PB: +600%
High Ambient 250°F SPDT	5 Amp, 125, 250 VAC 1/8 HP, 125 VAC 1/4 HP, 250 VAC 1/2 Amp, 125 VDC 1/4 Amp, 250 VDC	F	SA, SB, SC: +25%
High Power 1 HP SPDT	20 Amp, 125, 250 VAC 1 HP, 125 VAC 2 HP, 250 VAC 1/2 Amp, 125 VDC 1/4 Amp, 250 VDC	W	SA: +50% SB, SC: +100% PB: +400%
Moisture Resistant Sealed Switch SPDT	5 Amp, 125, 250 VAC 1/8 HP, 125 VAC 1/4 HP, 250 VAC 1/2 Amp, 125 VDC 1/4 Amp, 250 VDC	J	SA: None SB, SC, PA: +25% PB, H: +50%
Tight Fixed Deadband SPDT	5 Amp, 125, 250 VAC 1/8 HP, 125 VAC 1/4 HP, 250 VAC 1/2 Amp, 125 VDC	T	SB, SC: -50%

P-Series Switch Options

Panel Mount – Open frame P-Series compact switch units are available for panel mounting with the switch unit inside and the transducer outside. The panel separates the fluid sensing portion from the electromechanical portion. Five holes for bolts and operating stem must be drilled or punched through the panel. Three constructions are available: add the suffix listed below to the switch unit catalog number for the desired thickness.

Panel Thickness	Suffix
10 Ga (.135 \pm .005)	10
14 Ga (.075 \pm .005)	11
16 Ga (.060 \pm .005)	12

S-Series Switch Options

Industrial Adjusting Nut Covers – Available in clear plastic or metal to prevent tampering with set point adjusting nuts.

Clear plastic cover: To order, add suffix "1" to the switch unit catalog number, or order separately as SP01.
Metal cover: To order, add suffix "2" to the switch unit catalog number, or order separately as SP02.

JIC Construction – A switch unit having the electrical and adjusting nut covers attached to the switch body by a chain. Also designed to Type 13 specifications. To order, add suffix "3" to the switch unit catalog number, or order separately as SP03.

Terminal Block – Applicable to switch units with one single-poledouble-throw switch. The terminal strip is prewired to the snap-action switch. To order, add suffix "4" to the switch unit catalog number, or order separately as SP04.

Factory Sealed – Explosion-proof units may be ordered with a factory seal separating the electrical chamber from the conduit hubs and 24" long #14 AWG 105°C. rated lead wires. To order, change the fourth digit of the switch unit catalog number from "2" to "3", e.g., SA1[2]D becomes SA1[3]D.



Pressure Transducer Options

Special Wetted Materials – The following diaphragms may be substituted on transducer body materials of aluminum, brass, polyester and stainless steel. To order, substitute the material code below in the seventh digit of the transducer catalog number, e.g., a TF10A1₁ with optional viton diaphragm becomes a TF10A1₂.

Diaphragm	Material Code	Temperature Range
Buna "N"	1	-4°F (-20°C) to 180°F (82°C)
Ethylene Propylene	6	-4°F (-20°C) to 250°F (121°C)
Neoprene	3	-4°F (-20°C) to 180°F (82°C)
Fluorosilicone	7	-40°F (-40°C) to 250°F (121°C)
Viton	2	-4°F (-20°C) to 250°F (121°C)

Pressure Snubbers – A pressure snubber (1/4" NPTF by 1/4" NPTM) installed in the transducer pressure connection will dampen the pressure spikes to a value which will not cause damage. It consists of a body with a porous metal disc of stainless steel through which the fluid passes. To order, select a snubber compatible with the fluid. Available by separate catalog number only (see table below).

Fluid	Brass Catalog No.	303 SS Catalog No.
Air, Non-Hazardous Gases	TP04G2	TP04G3
Water, Light Oil (under 225 SSU)	TP04E2	TP04E3
Oil (Heavy, (over 225 SSU)	TP04D2	TP04D3
Pressure Rating (psig)	2000	5000

Oxygen Cleaning – Pressure transducers for oxygen service should be specially cleaned. They are degreased and blacklight inspected, then assembled in a clean area and tested with oil-free air or nitrogen. Use metal body transducer with viton or neoprene diaphragm and add suffix "H" to transducer catalog number, e.g., TA40A13 becomes TA40A13_H.

Process Connection – A female process connection (1/4" NPT) is standard on all pressure transducers. A 1/2" NPT is available as an option on gauge pressure transducers. To order, add suffix "B" to transducer catalog number, e.g., RF10A21 becomes RF10A21_B.

Note: Not available on nylon transducers.

P-Series and S-Series Temperature Transducer Options

Armored Capillaries – Double braided copper armor is standard for copper capillary units. Stainless steel spiral interlocked armor is available for stainless steel capillary units. Add suffix "C" to transducer catalog number.

Thermal Well



Thermal Well^① – Use with direct or remote sensors for protecting sensing bulb. This allows removal of bulb while maintaining a pressure-tight vessel. Available in 1/2" NPT or 3/4" NPT process connection in brass or 316 SS. Dimensions are in accordance with SAMA Std. RC17-9. Standard "U" dimension (insertion length) is 2-1/2" for direct mount and 6' capillary units and is 4-1/2" for 12' capillary units.

Material	Pressure Rating (psig)	"U" Dimensions (Inches)	Process Connection	
			1/2" NPT	3/4" NPT
Brass	1000	2-1/2	QP03	QP04
		4-1/2	QP13	QP14
		7-1/2	QP23	QP24
		10-1/2	QP33	QP34
		2-1/2	QP07	QP08
		4-1/2	QP17	QP18
316 SS	6000	7-1/2	QP27	QP28
		10-1/2	QP37	QP38

Longer Capillaries – Standard copper and stainless steel capillary units can be furnished in 12' lengths. To order, add suffix "D" to transducer catalog number.

Consult ASCO for longer length capillaries.

Capillary Length (Feet)	Transducer Suffix	Bulb Length (Inches)	"U" Dimension Required (Inches)
6	---	3-1/2	2-1/2
12	D	5-1/2	4-1/2
13 - 20	E	5-1/2	4-1/2
21 - 50	F	8-1/2	7-1/2
51 - 80	G	11-1/2	10-1/2

Union Connector – For use with remote units for mounting of bulb in fluid being controlled. Available in 1/2" NPT and 3/4" NPT process connections in brass or 316 SS.



Material	Pressure Rating (psig)	Process Connection	
		1/2" NPT	3/4" NPT
Brass	500	QP01	QP02
316 SS	1500	QP05	---

^① Jam nuts provided with thermal wells.

Definitions and Fluid Compatibility Guide

Definitions

Accuracy – The maximum deviation from the set point under specified operating condition (ambient temperature, barometric pressure, etc.).

Adjustable Deadband – Refers to the capability of a pressure or temperature switch to allow the deadband to be adjusted over a given range. Certain ASCO TRI-POINT switches have an adjustable deadband which can be adjusted over the total operating range of the switch.

Adjustable Operating Range – The pressure or temperature range of the switch within which the set point may be adjusted.

Differential Pressure – The difference between two pressures. A differential pressure switch senses two pressure sources and can be adjusted to actuate on a desired difference between them.

Gauge Pressure – The actual reading of a typical pressure gauge and is the difference between the pressure within a vessel and the atmospheric pressure surrounding it. It is normally measured in pounds per square inch (psig).

Manual Reset – The switch is a semi-automatic device which operates automatically with a signal change in one direction but must be manually reset once the signal returns to its original position.

Proof Pressure – A pressure which a device can be subjected to for extended periods of time without changes in its operating characteristics.

Rated Overrange Temperature – A temperature which a device can be subjected to for extended periods of time without changes in its operating characteristics.

Repeatability – The closeness of agreement among a number of consecutive measurements of the output for the same value of input under the same operating conditions approaching from the same direction. Repeatability is normally specified as a percentage of the upper limit of the operating range.

Example: Operating range 5-100 psig with $\pm 1\%$ repeatability; equals $\pm 1\%$ of 100 psig or ± 1 psig.

Reset Point – After a pressure or temperature switch has reached its set point and operated the electrical switch, it must return to a point called the reset point before the electrical switch can return to its original position.

Set Point – The pressure reading at which the electrical switch element changes contact position (it can be specified either increasing or decreasing).

Switch Unit – ASCO uses the term “switch unit” to describe the electromechanical portion of a pressure or temperature switch. This is used in conjunction with a transducer unit to form a complete pressure or temperature switch.

Transducer Unit – ASCO uses the term “transducer unit” to describe that portion of a pressure or temperature switch to which a pressure or temperature is applied which converts the input signal to another form of energy to operate the switch unit.

Two-Stage (Dual) – ASCO uses the term “two stage” to describe a pressure or temperature switch which is equivalent to two pressure or temperature switches which are independently adjustable. This switch is equivalent to two fixed deadband switches.

Deadbands – The deadband is the difference between the set point and reset point readings. Deadbands are listed in the specification tables at nominal values. They are representative of the deadbands of the units at the middle of the range.

The deadband values for the full range adjustable deadband switches and limited adjustable deadband switches indicate the values through which the deadband may be adjusted.

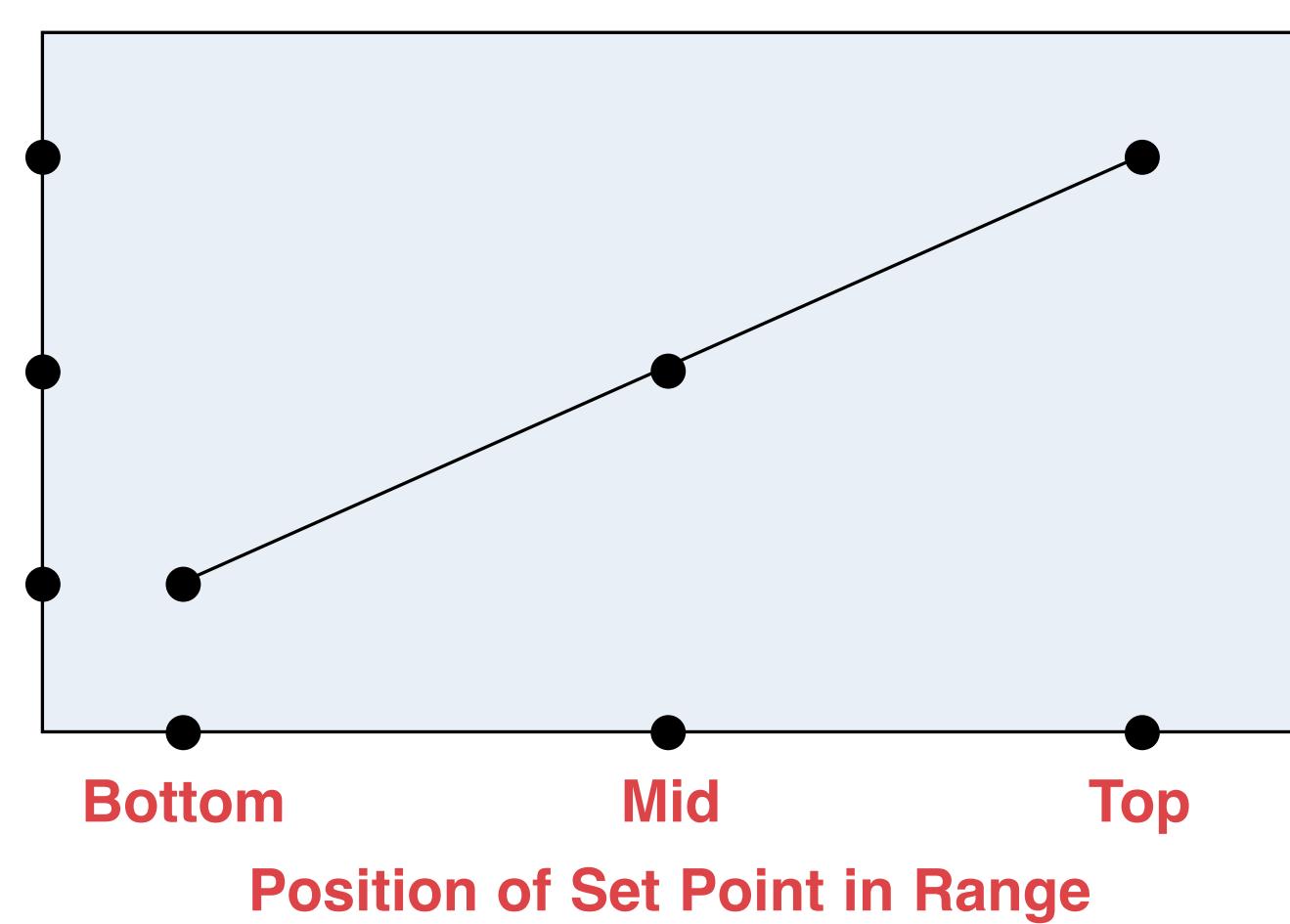
Generally, as the set point is adjusted through the operating range, the deadband will vary. Normally, it will become narrower as the set point is towards the bottom of the range, and will become wider when the set point is towards the top of the range. The graph shown below indicates representative trends of this type of deadband variation.

Deadbands

1.5 x Catalog Value

Catalog Value

Half Catalog Value



Temperature switch deadbands are a result of the characteristics of the vapor pressure curve as well as other factors. Normally, this results in a deadband which is narrower in the top third of the range than in the bottom third of the range. The values published are nominal and representative of mid-range set points.



Fluid Compatibility Guide

These recommendations are to be used as a guide only, as service life of material is dependent on temperature, concentrations, or catalysts that may be added and other conditions which are beyond our control.

Consult ASCO for specific service applications.

Note: Items in black circles are standard catalog units.

All others available on factory order.

P - Indicates preferred construction. S - Indicates satisfactory construction.

Transducer Material Code of Two Digits represents process connection material and diaphragm material, respectively; these are the sixth and seventh positions of the pressure transducer catalog number.

Process Connection: 6th Position Diaphragm: 7th Position

1 Aluminum	4 316 S.S.	1 Buna "N"	4 316 S.S.
2 Brass	7 Nylon/Brass	2 Viton	6 Ethylene Propylene
3 303 S.S.		3 Neoprene	7 Fluorosilicone

Material Code	11	12	13	16	17	21	22	23	26	27	31	32	33	36	37	42	44	71
Ranges Available																		
Vacuum	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Inches of Water	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
P.S.I.G. ^⑤ to	400	400	400	400	400	3500	3500	3500	3500	3500	8000	8000	8000	8000	8000	8000	400	200
Acetic Acid													S	S			P	
Acetylene	P	S		S								S	S		S	S	S	S
Air	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P
Ammonia																	P	
Argon-Welding ①	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P
Benzene-Benzol	P								S				S			S	S	S
Butane	P	S				S	S				S	S				S	S	
Carbon Tetrachloride												P			P	S		
Cellulube		P		S			S			S		S		S		S	S	S
Coke Oven Gas												P			P	S		
Ethyl Alcohol (denatured)	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Ethylene Glycol	P	S	S	S		S	S	S	S	S	S	S	S	S	S	S	S	S
Freon Refrigerants																P		
Freon Solvents ("MF", "TF", "BF")							P	S				S	S			S	S	
Fuel Oils and Diesel ④	P	S				S	S				S	S				S	S	
Gasoline																P		
Gas, Inert	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P
Gas (natural and manufactured) ④	P	S	S		S	S	S	S	S	S	S	S	S	S	S	S	S	S
Helium	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P
Hydrogen	P	S	S	S		S	S	S	S	S	S	S	S	S	S	S	S	S
Jet Fuel (JP1 to JP6)	P			S		S	S			S		S			S	S	S	S
Kerosene	P	S				S	S				S	S				S		S
Methyl Alcohol (Methanol)	P		S	S	S	S		S	S	S	S	S		S	S	S	S	S
Naphtha	P	S				S	S				S	S			S	S	S	S
Nitrogen	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P
Oils (coolant, hydraulic, lubricating and motor)	P	S				S	S				S	S			S	S	S	P
Oxygen, Gaseous ②		S	P		S		S	S	S	S	S	S	S	S	S	S	S	S
Potassium Sulfate	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Propane Gas and Liquid	P	S	S			S	S	S			S	S	S		S	S	S	S
"Pydraul" ("Monsanto")		P			S		S			S		S			S	S	S	S
Steam ③						P	S		S	S	S	S	S		S	S	S	S
Steam Condensate						P	S		S	S	S	S	S		S	S	S	P
Stoddard Solvent	P	S				S	S			S	S	S			S	S	S	S
Toluene (Tolulo)	P					S				S		S			S	S	S	S
Vacuum	P	S	S	S	S	S				S	S	S	S	S	S	S	S	S
Vegetable Oil	P	S	S		S					S	S	S		S	S	S	S	S
Vinegar										S				S	S	S	P	
Water, Fresh, Boiler Feed						P	S		S	S	S	S	S		S	S	S	P
Water (Distilled, Deionized, Demineralized)											P	S	S	S	S	S	S	S
Water, Sea																S		

Notes: ① For high purity applications use stainless steel transducers. ② Oxygen service requires special cleaning, specify suffix "H". ③ For steam service a condensate loop (pigtail) is required.

④ For pressure transducers for combustion service see pages 20-23. ⑤ Material availability refers to standard gauge pressure constructions only.

DELTECH

INSTALLATION, OPERATING AND MAINTENANCE MANUAL FOR DELTECH AUTOMATIC DRAIN VALVE

Models ADV-1711, ADV-1723,
ADV-1811 and ADV-1823

This instruction manual must be read by everyone who installs or works with this equipment.

Introduction

Deltech automatic drain valves are designed to automatically discharge accumulated condensed water and other liquids from receivers, dryers, separators, filters and other collection areas in the compressed air system.

To ensure effective use and continuing good performance of this drain valve, carefully follow the instructions in this manual.

Safety

The ADV is designed and built with safety as a prime consideration; industry-accepted safety factors have been used in the design.

Do not operate the ADV at pressures and temperatures in excess of the rated conditions shown on the nameplate. Operation above maximum conditions may cause damage to the drain valve or serious injury to personnel.

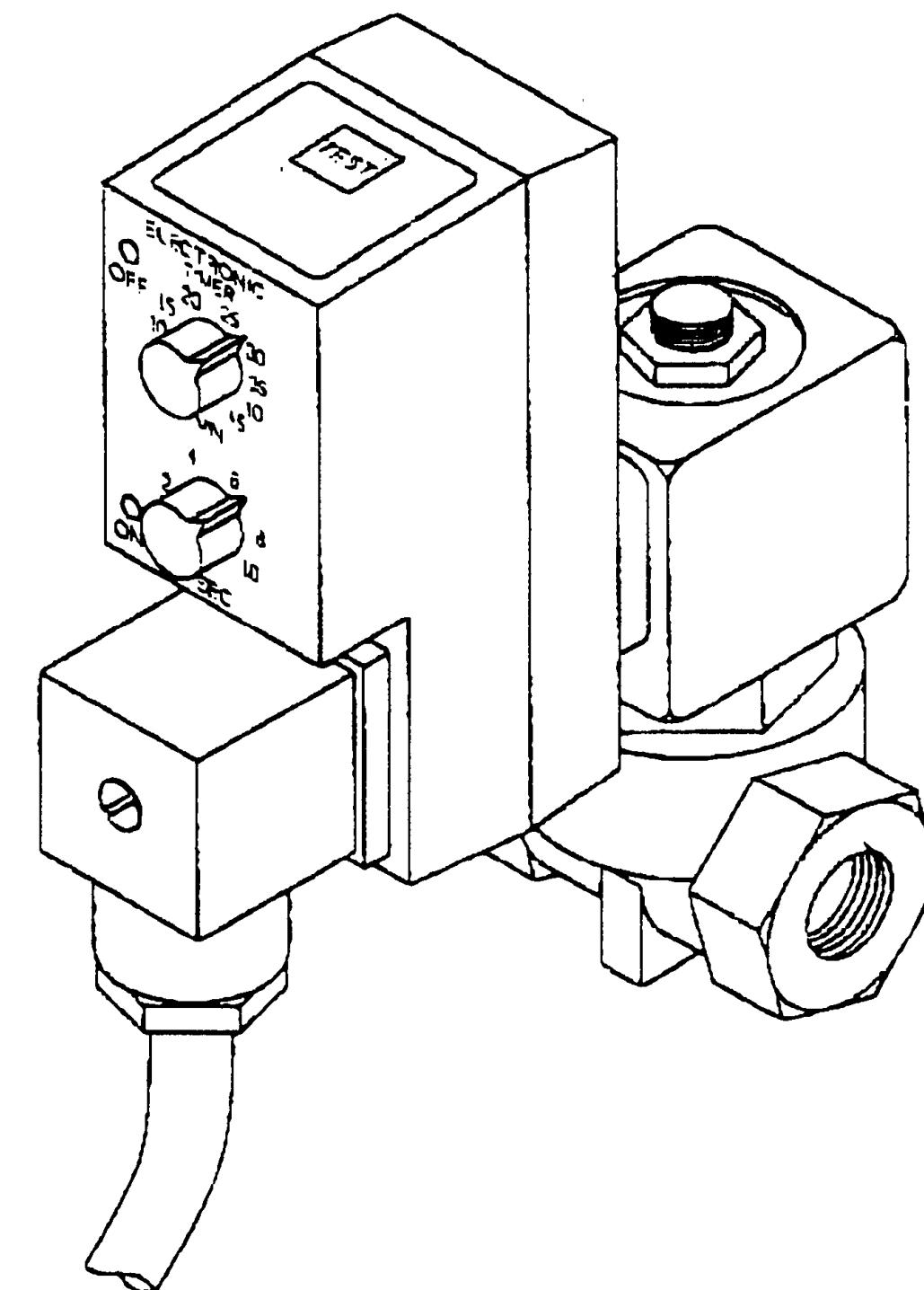
WARNING
COMPRESSED AIR CAN BE DANGEROUS. SAFETY PRECAUTIONS MUST BE OBSERVED IN THE USE OF COMPRESSED AIR AND COMPRESSED AIR EQUIPMENT. BEFORE INSTALLING THE ADV, COMPLETELY VENT TO ATMOSPHERIC PRESSURE THE INTERNAL PRESSURE OF THE COMPONENT TO BE DRAINED.

Installation

Piping and connections

Inlet and outlet connections are $\frac{1}{4}$ " NPT for the ADV-1711 and ADV-1723, $\frac{1}{2}$ "NPT for the ADV-1811 and ADV-1823.

¹Piping to the ADV must be furnished by the customer unless otherwise specified. Connections and fittings must be rated



for the maximum operating pressure given on the ADV nameplate and must be in accordance with applicable industry-wide codes. Support all piping.

If the component to be drained does not have a sump or reservoir, install a drip leg at the drain connection. Install a shutoff valve ahead of the drain valve to isolate the ADV for servicing. Install a vent valve between the shutoff valve and the ADV. If the air system is subject to contamination by pipe scale or other solid particles, install a strainer between the shutoff valve and the ADV to protect the drain valve from wear. See Figure 1 for recommended arrangement.

To install ADV:

1. Close shutoff valve or slowly vent pressure to atmosphere.
2. Connect drip leg, or air system component to be drained to the fitting at the ADV inlet. Use pipe dope, Teflon tape or equivalent.
3. Connect drain line to the fitting at the ADV outlet. Run drain line to suitable drain. If flexible tubing is used, fasten drain line to prevent it from whipping when the condensate discharges.

Because it contains oil, regulations prohibit the discharge of air system condensate into storm sewers, surface waters or waste treatment facilities. Contact Deltech for information on oil-water separators for compressed air systems.

The ADV will operate when installed in any position, but be sure the flow direction is the same as the direction indicated by the arrow on the valve body (see Figure 2).



Power supply

The ADV is prewired for use and fitted with a 6-ft, 3-wire, grounded power cord. Connect the ADV-1711 or ADV-1811 to a 115/1/60 power supply. Connect the ADV-1723 or ADV-1823 to a 230/1/60 power supply. Drain valves may be operated at 50 Hz. The ADV-1711 and ADV-1811 draw approximately 0.12 amp; the ADV-1723 and ADV-1823, approximately 0.06 amp.

The Deltech ADV is equipped with two LED indicators and a push-to-test button to help verify proper operation. One LED indicates that power is being supplied to the ADV. The other indicates that the solenoid coil has been activated to open the drain port. The power indicating light goes off when the solenoid indicator light goes on. If either fails to light at the proper time, consult Deltech.

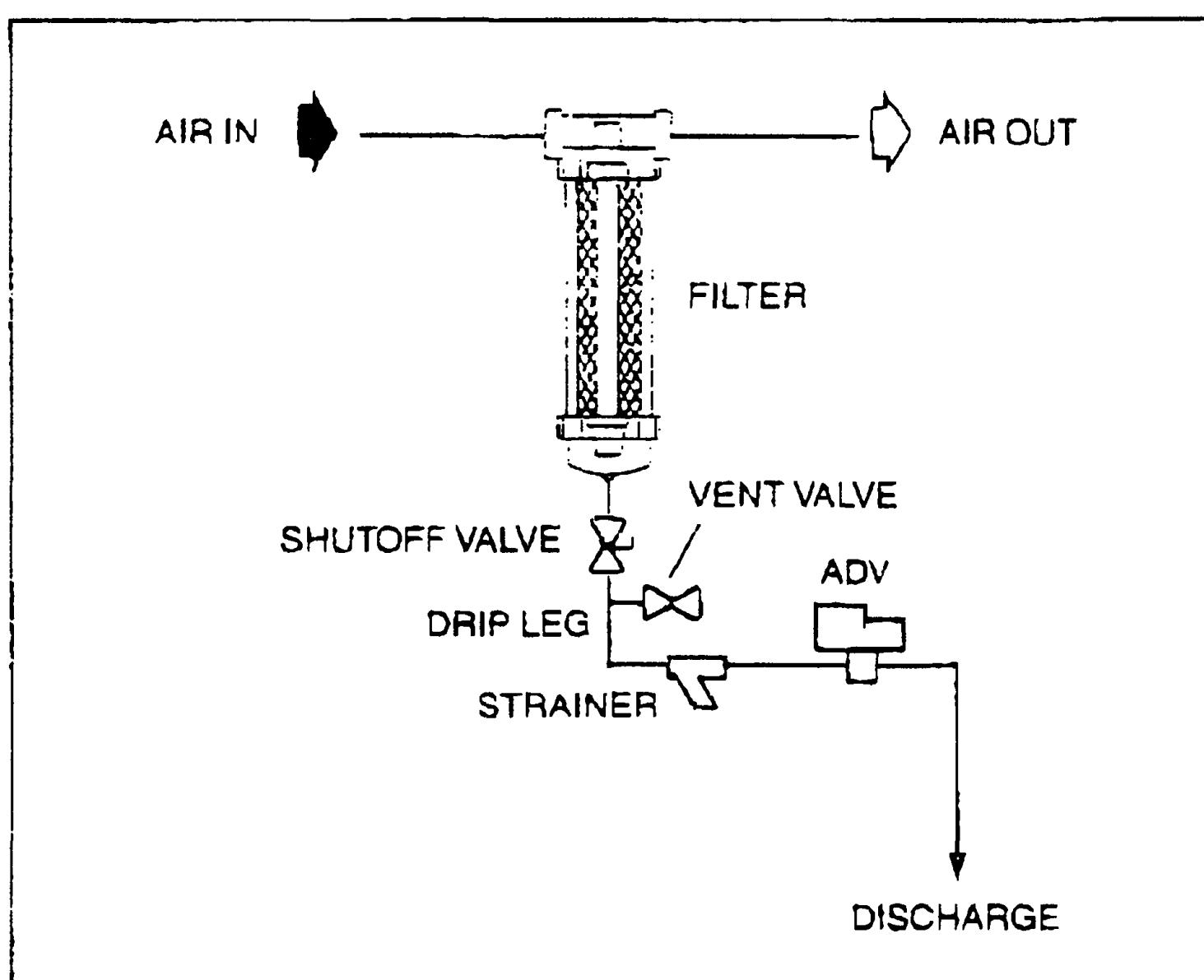


Figure 1. RECOMMENDED ADV ARRANGEMENT WITH COMPRESSED AIR FILTER

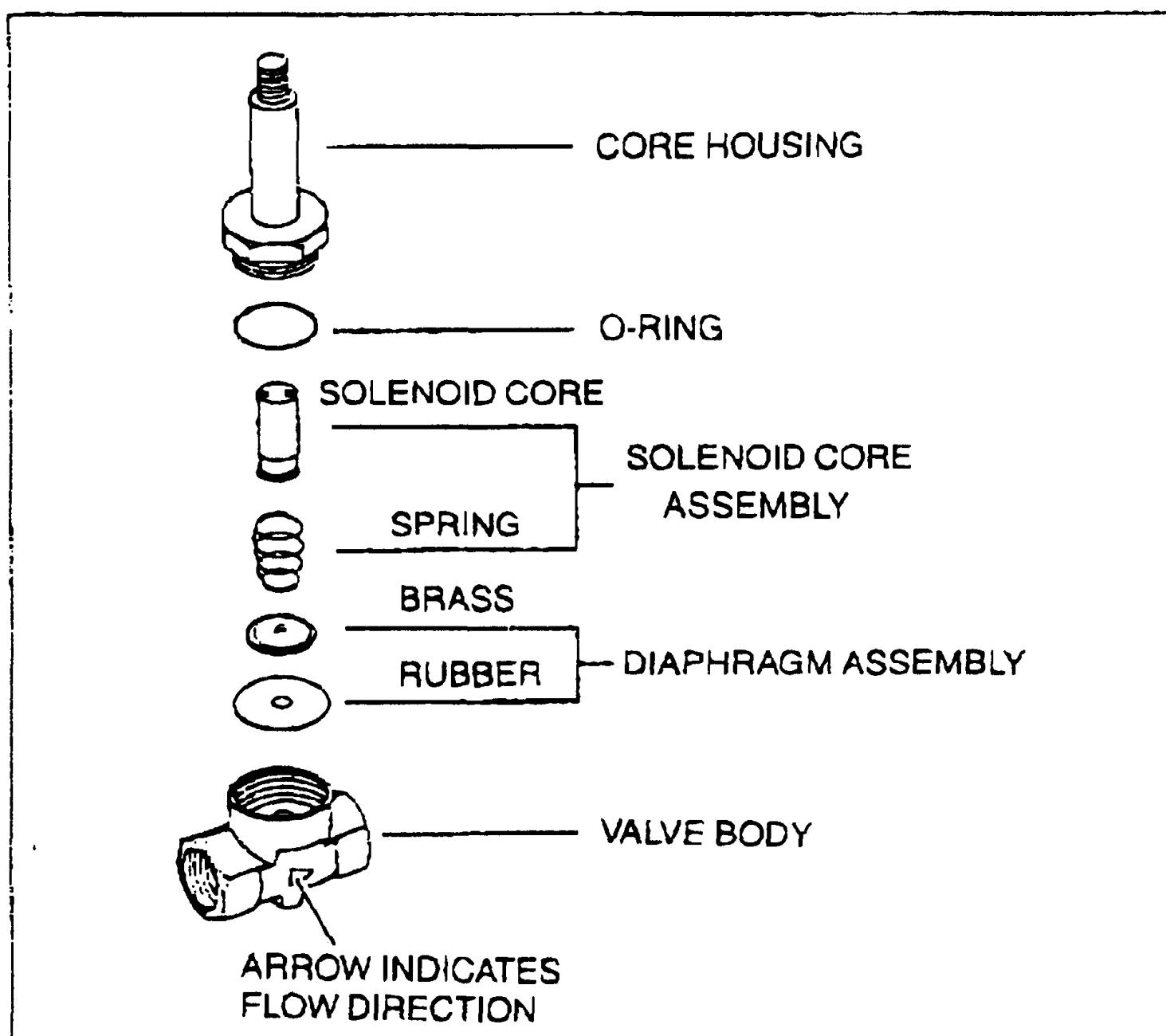


Figure 2. EXPLODED VIEW OF SOLENOID AND DIAPHRAGM ASSEMBLIES

Operation

Do not operate the ADV outside the following pressure and temperature ranges:

	Minimum	Maximum
Pressure	3 psig	300 psig
Temperature		
Fluid	35°F	180°F
Ambient	35°F	120°F

To put the ADV into operation (refer to Figure 1):

1. Plug power cord into appropriate power supply.
2. Open shutoff valve or pressurize system to operating pressure.
3. Adjust timer for proper cycle (see "Setting Timer").

Setting timer

The ADV operates automatically. The timer can be set to cycle 0.5 to 45 minutes. The drain opening can be set for 0.5 to 10 seconds each cycle. Maximum discharge varies with pressure and drain opening.

To minimize air losses, the timer should be adjusted to open the port just long enough to discharge accumulated condensate. The timer is properly set if nothing but air vents at the end of the open period. If air vents for more than one second, set the timer for a longer cycle or shorter drain opening. If liquid is still discharging when the port closes, set the timer for a shorter cycle or longer drain opening.

Maintenance

Preventive maintenance

The following simple routine checks will help ensure reliable operation of the ADV.

- Check valve operation daily by pressing the push-to-test button (see Power Supply).
- Check condensate daily.
- Check timer setting weekly; adjust as required.

If the ADV does not discharge condensate as required, consult the Field Service Tips and follow the instructions for ADV disassembly and cleaning. These tips will remedy most problems that may occur with ADV operation. If further assistance is needed, call Deltech.

Modular construction

The ADV is made up of several replaceable components (see Figure 4). Except for the timer, these components can be easily disassembled for cleaning and repair.

CAUTION
DO NOT DISASSEMBLE TIMER OR ATTEMPT TO REPAIR ELECTRICAL PARTS. CONSULT FACTORY FOR ELECTRICAL SERVICE.

Disassembly and cleaning

Disassembly and cleaning of the drain valve may be required under conditions of gross particulate contamination.

WARNING
COMPRESSED AIR CAN BE DANGEROUS. SAFETY PRECAUTIONS MUST BE OBSERVED IN THE USE OF COMPRESSED AIR AND COMPRESSED AIR EQUIPMENT. BEFORE DOING ANY WORK ON THE ADV, COMPLETELY VENT THE INTERNAL PRESSURE TO THE ATMOSPHERE.

To clean strainer (refer to Figure 1):

1. Close shutoff valve and open vent valve to depressurize system. If no shutoff valve is used, slowly vent internal pressure of component to be drained.
2. Remove and clean strainer; replace strainer.
3. To clean or replace diaphragm:
4. Unplug drain valve power cord.

WARNING
FAILURE TO UNPLUG POWER CORD MAY RESULT IN SERIOUS PERSONAL INJURY AND DAMAGE TO DRAIN VALVE.

5. Remove screw and washer from front of ADV.
6. Disconnect connector from timer assembly; do not lose or damage gasket.
7. Disconnect timer assembly from solenoid coil housing; do not lose or damage gasket.
8. Remove the 13mm nut and spring washer from top of solenoid coil housing.
9. Lift the solenoid coil housing from the valve body.
10. Remove the solenoid core assembly and diaphragm assembly (refer to Figure 2). Clean or replace diaphragm as required.

To clean drain ports:

11. Follow steps 1 through 7 under "To Clean or Replace Diaphragm."
12. Remove debris from valve body, diaphragm assembly, solenoid core assembly and core housing.
13. Wipe components with a clean cloth or blow out remaining debris with low pressure compressed air.

Before reassembling, check that small ports in diaphragm assembly are cleared and solenoid coil moves freely in housing; lubricate if necessary.

To restart ADV after cleaning or performing corrective maintenance:

1. Reverse the steps under "To Clean or Replace Diaphragm."
2. Check for leaks; tighten connections as required.
3. Plug in ADV power cord.
4. Adjust timer as necessary (see "Setting Timer").

Corrective Maintenance

Part numbers for replacement parts are listed in the following table. Refer to the label on the ADV for the correct model number.

Description	ADV-1711	ADV-1723	ADV-1811	ADV-1823
	part no.	part no.	part no.	part no.
valve repair kit*	7DE347AB	7DE345AB	7DE347CR	7DE347CR
solenoid coil	7DE345NT	7DE345NV	7DE345NT	7DE345NV
timer assembly	7DE270CF	7DE270CF	7DE270CF	7DE270CF
valve body with coil	7DE345NL	7DE345NP	7DE345QY	7DE345QY
diaphragm support disc, ADV 1711/1723	7DE347CF	7DE347CF	7DE347CF	7DE347CF
diaphragm support disc, ADV 1811/1823	7DE347CS	7DE347CS	7DE347CS	7DE347CS

*Kit includes washer, spring, diaphragm and plunger

To replace timer assembly:

1. Follow steps 1 through 6 under "To Clean or Replace Diaphragm."
2. Replace solenoid coil.
3. Reassemble according to instructions under "To restart ADV..."

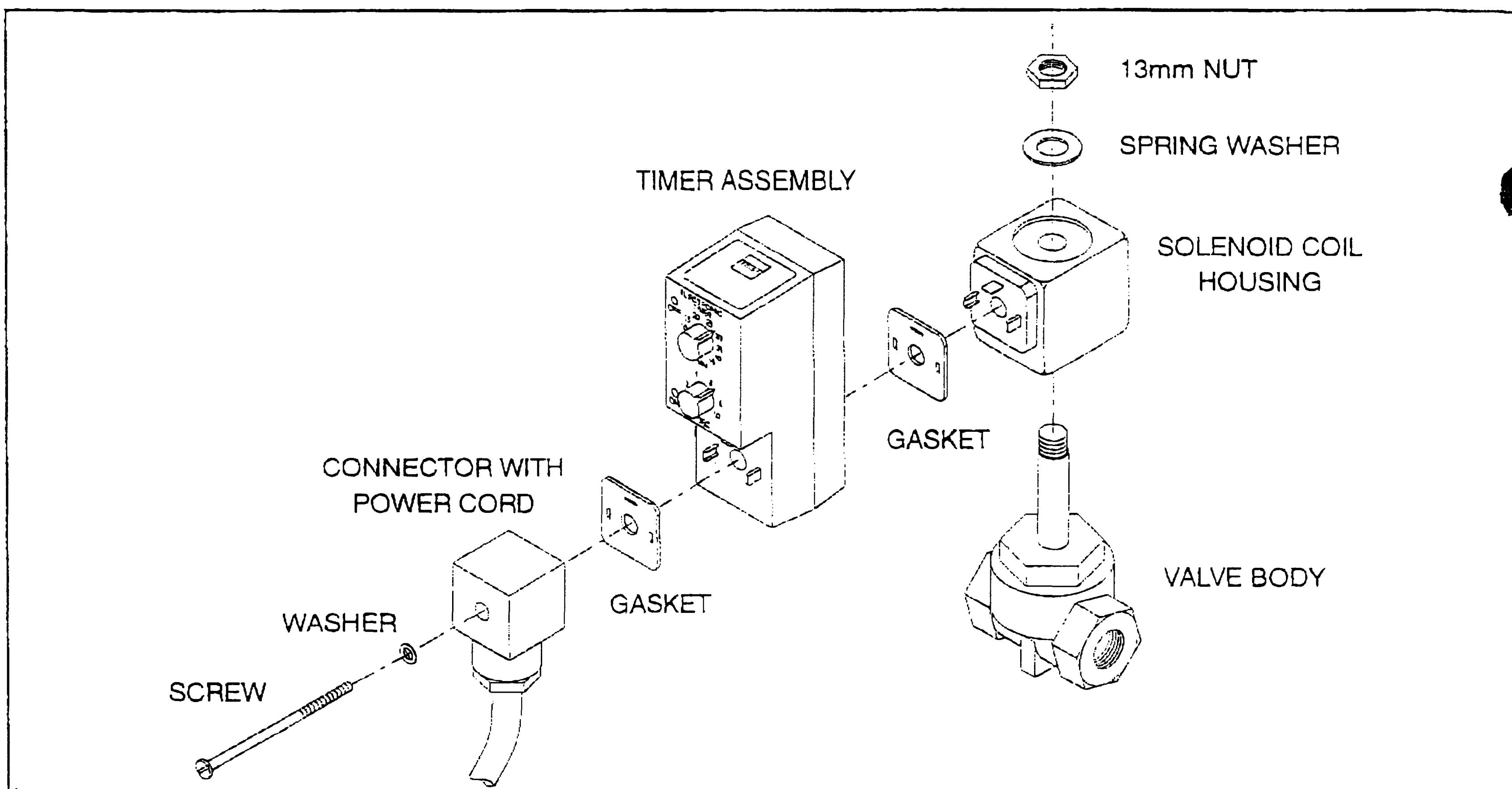
To replace solenoid coil:

4. Follow steps 1 through 4 under "To Clean or Replace Diaphragm."
5. Replace timer assembly.
6. Reassemble according to instructions under "To restart ADV..."

If the ADV must be returned to Deltech, first call Deltech for a return authorization number. Ship the material freight prepaid to:

Product Service Department
Deltech Engineering, Inc.
344 Churchmans Road
New Castle, DE 19720

Field Service Tips		
Problem	Possible cause	Remedy
Valve continually discharging/ venting	1. Clogged diaphragm 2. Short in electrical component	1. Clean diaphragm 2. Check and replace connector or timer assembly
Valve not discharging	1. No electrical power 2. Timer malfunction 3. Solenoid coil malfunction 4. Clogged ports	1. Check and correct power supply and connections 2. Replace timer assembly 3. Replace solenoid coil 4. Clean ports
No response when push-to-test button is pressed	1. No electrical power 2. Timer malfunction	1. Check and correct power supply and connections 2. Replace timer assembly



Another premium Deltech product from

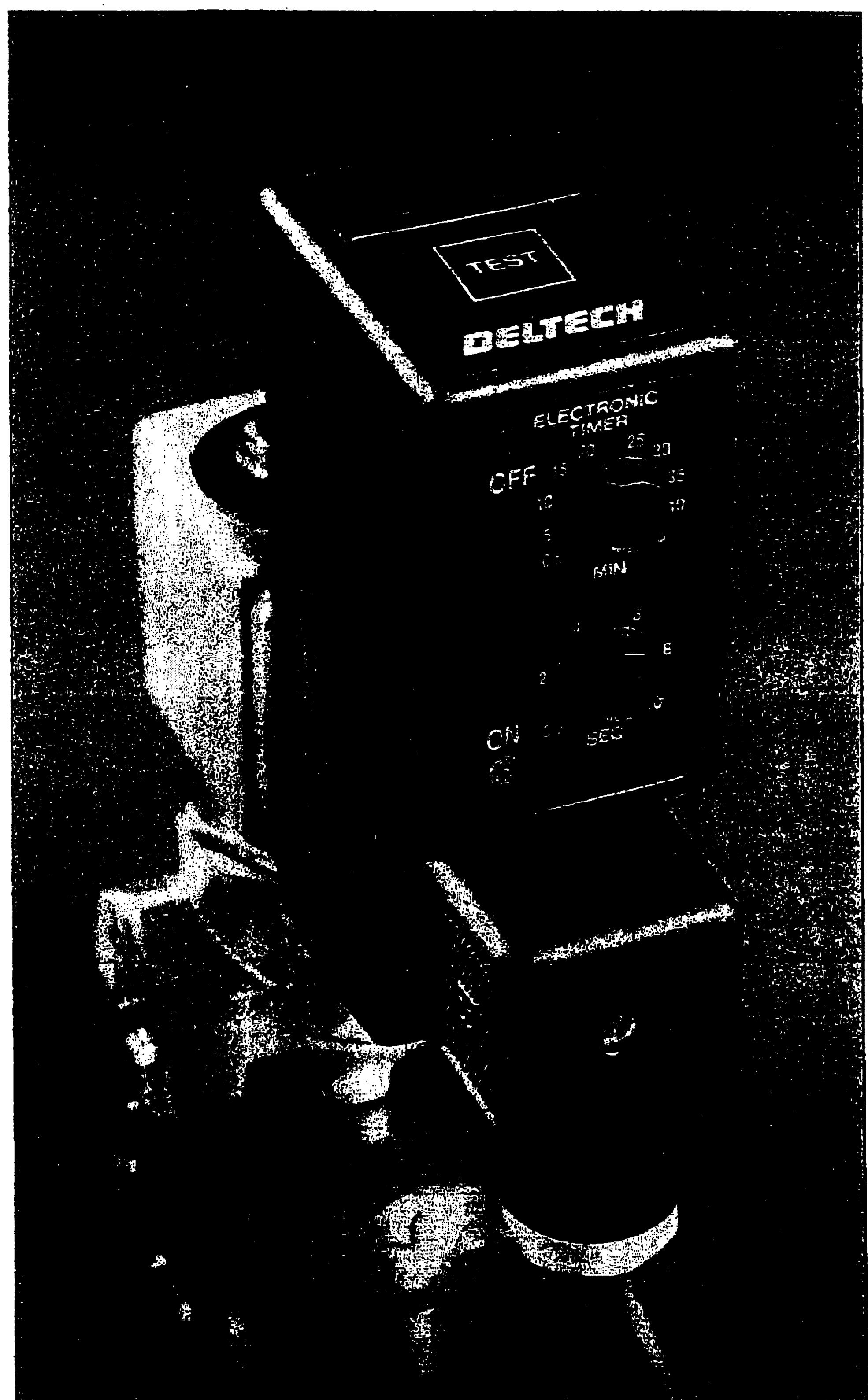
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344 Churchmans Road • P.O. Box 667 • New Castle, DE 19720
Telephone 302-328-1345 • FAX 302-328-4833

Deltech Automatic Drain Valves

FOR COMPRESSED AIR
SYSTEMS AND OTHER
APPLICATIONS



FLAIR
INDUSTRIAL AIR DIVISION

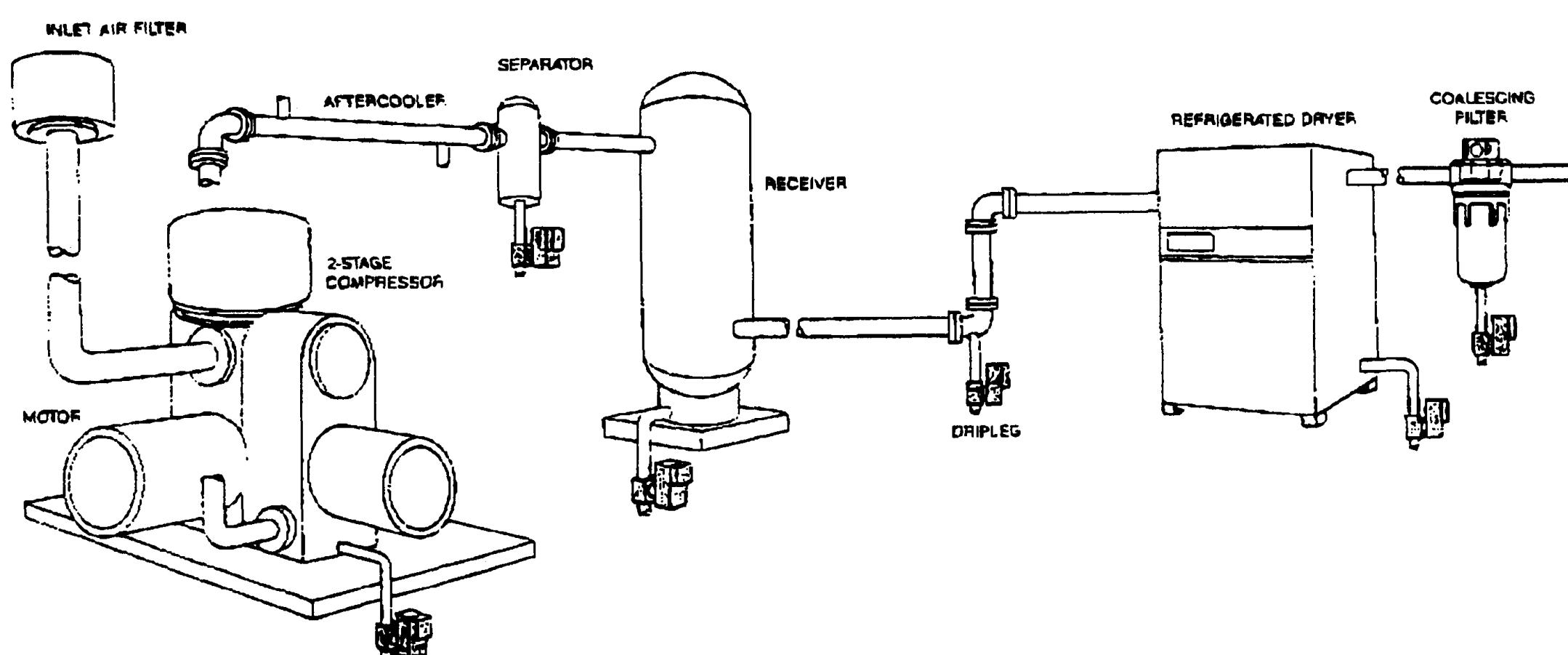
Value through performance

Automatic drain valves

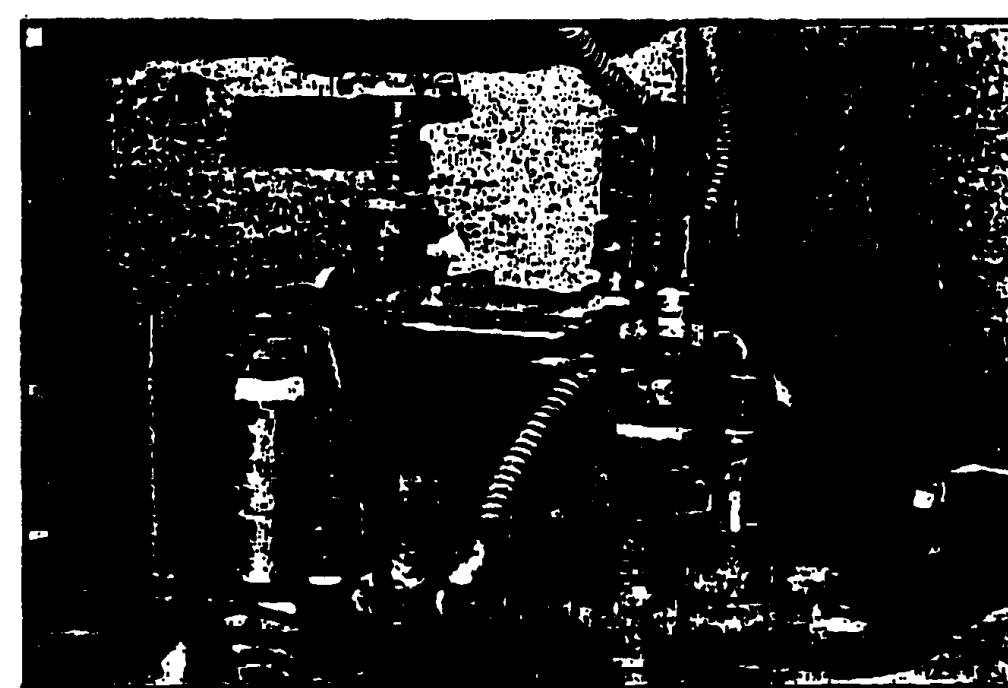
All compressed air systems produce internal condensate which must be drained away. Inadequately drained oil and water can cause equipment damage, downtime and wasted manhours. Deltech ADVs offer a simple, low-cost solution to these problems. ADVs automatically discharge accumulated fluids from compressors, filters, dryers, driplegs, receivers, separators and other collection points.

Precision control of flow rate by simple timer adjustments make the ADV uniquely suited for a broad range of applications, including compressor interstage cooling, where large quantities of condensate must be discharged before the next compression stage.

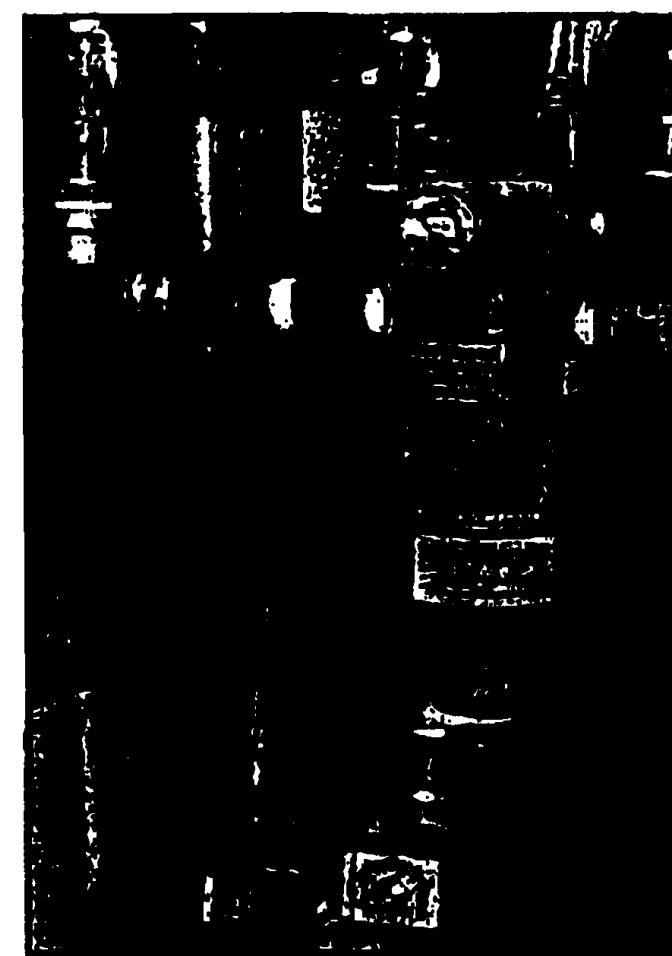
Typical ADV applications



The ADV can be used anywhere to provide metered fluid flow at fixed intervals. *For applications other than compressed air, contact Flair for compatibility of fluid with ADV materials.*



Deltech ADVs can be used to discharge the condensate from an air compressor between compression stages.



Deltech ADVs automatically discharge oil and water collected by coalescing-type compressed air filters.

Completely automatic

- No operator attention
- Minimal routine servicing
- LEDs signal "power on" and "drain open"

Unique design

- Modular timer-drain assembly
Replace separately: timer, solenoid coil or solenoid valve
- High strength, high impact resistant thermoplastic housings
- Brass valve body

Operating economy

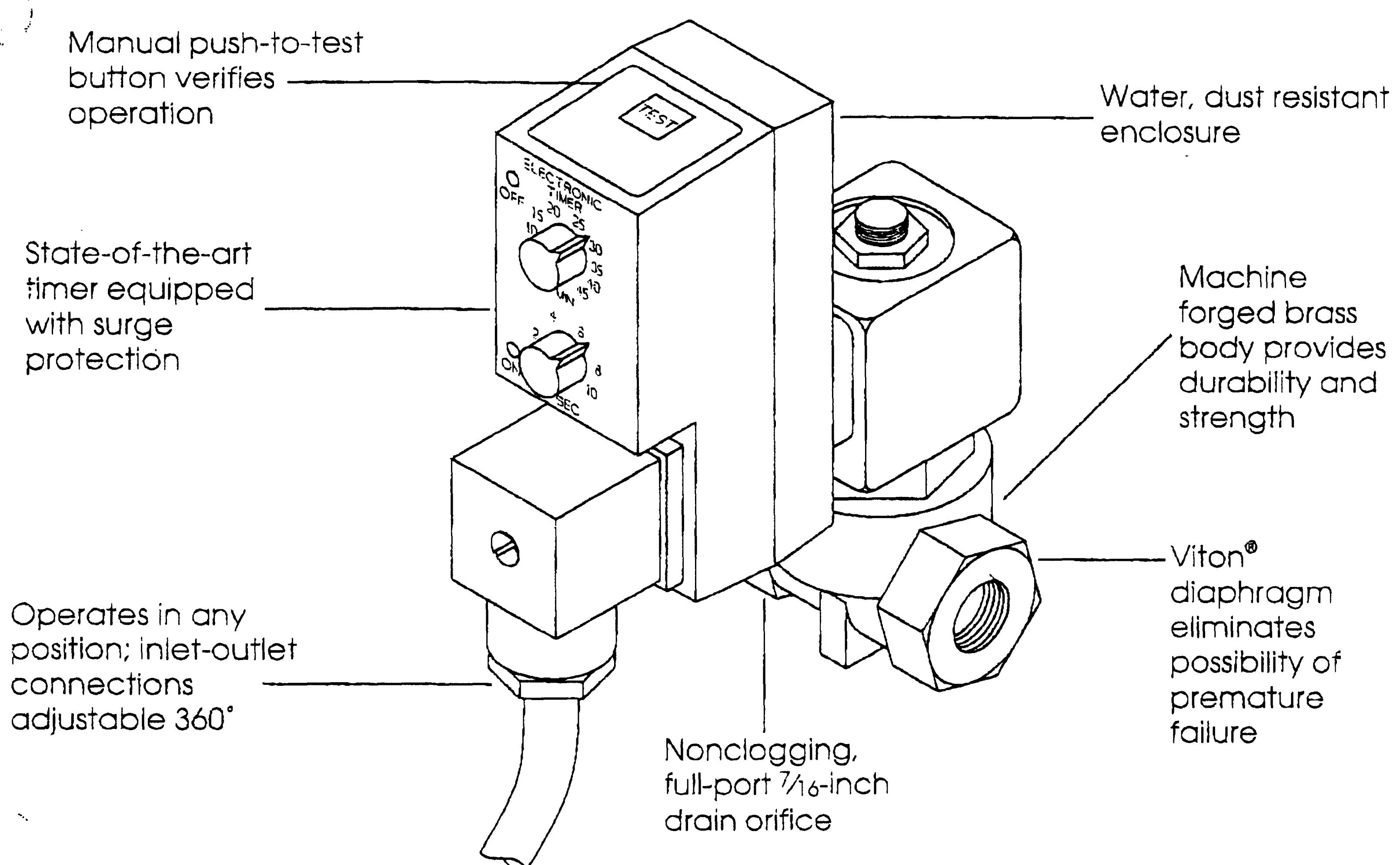
- Dual adjustments precisely match contaminant load; *select drain cycle and drain duration*
- Discharges accumulated fluids with minimum air loss
- Only 8 watts electric power

Broad application range

- High capacity discharge, more than 2 gallons per drain cycle at 100 psig
- Operating pressure from 3 psig to 300 psig
- Internal seals compatible with all major compressor lubricants
- Can be installed indoors or outdoors (drain line may require heat tracing)



The reliable way to keep downstream operations free of liquid contaminants



Designed for maximum dependability—where you need it most

Our first automatic drain valve, introduced in 1978, represented a unique contribution to the state of the art. Today's ADV continues to represent state-of-the-art technology—from its unique modular design to its carefully specified components. It is the most reliable automatic drain valve available.

The timer

The timer, designed exclusively for the ADV, is manufactured according to stringent quality control guidelines. The proprietary design of the timer includes a water and dust resistant enclosure and high quality components with built in surge protection. The timer features a

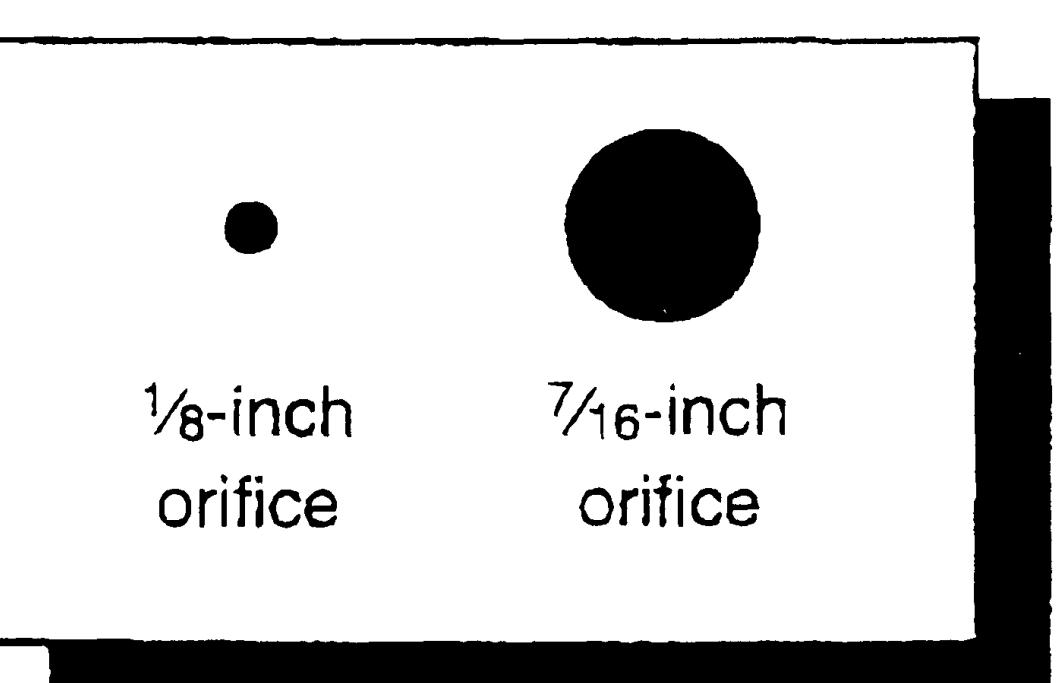
manual push-to-test button and LED indicators that verify ADV operation by signaling "power on" and "drain open."

The valve

The ADV utilizes a reliable pilot-operated diaphragm valve, a valve engineered for fast response, reliability and long life under even the most adverse conditions. In this design, the diaphragm protects all moving parts from contamination by the condensate which might cause clogging or corrosion. The diaphragm is Viton, an exceptionally durable material that eliminates the possibility of premature diaphragm failure and

is compatible with all common compressor lubricants.

The forged brass valve body has a full-port 7/16-inch drain orifice. This orifice has 12 times more area than a 1/8-inch orifice, the size of the orifices in many drain valves. This large orifice virtually eliminates clogging by rust, scale or other air system debris and can discharge more than two gallons of condensate per drain opening at 100 psig.

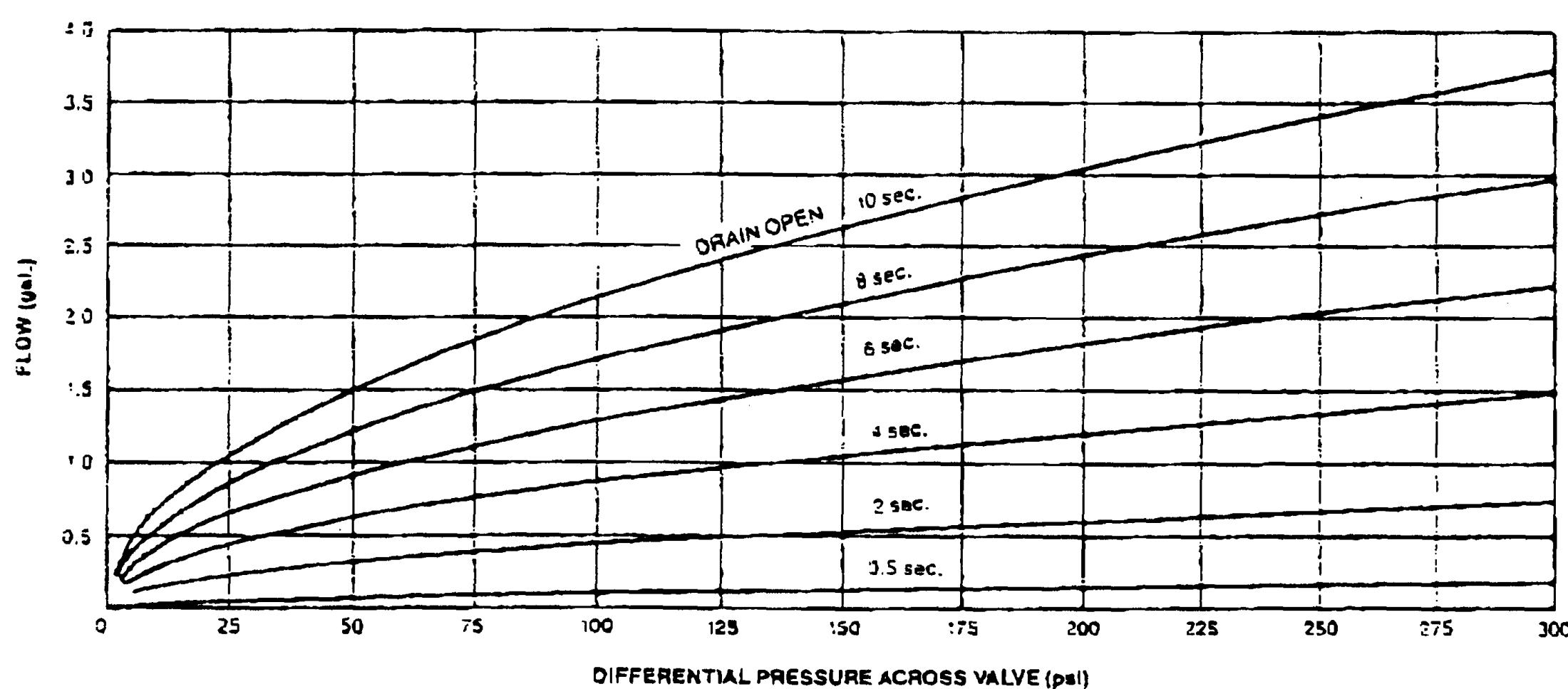


Specifications

	Model			
	ADV 1711	ADV 1723	ADV 1811	ADV 1823
Connections	1/4" NPT			1/2" NPT*
Voltage	115 VAC	230 VAC	115 VAC	230 VAC
Timer interval			0.5 to 45 minutes	
Drain cycle			0.5 to 10 seconds	
Maximum air pressure			300 psig	
Dimensions			5 1/2 X 4 1/2 X 2	
Weight			1 1/2 LBS	
Operating temperature			35°F minimum; 180°F maximum	
Fluid			35°F minimum; 120°F maximum	
Ambient				
Options				
Isolation valve with Strainer		Part number 35DE245A		Part number 35DE245B

*Larger sizes available, consult factory.

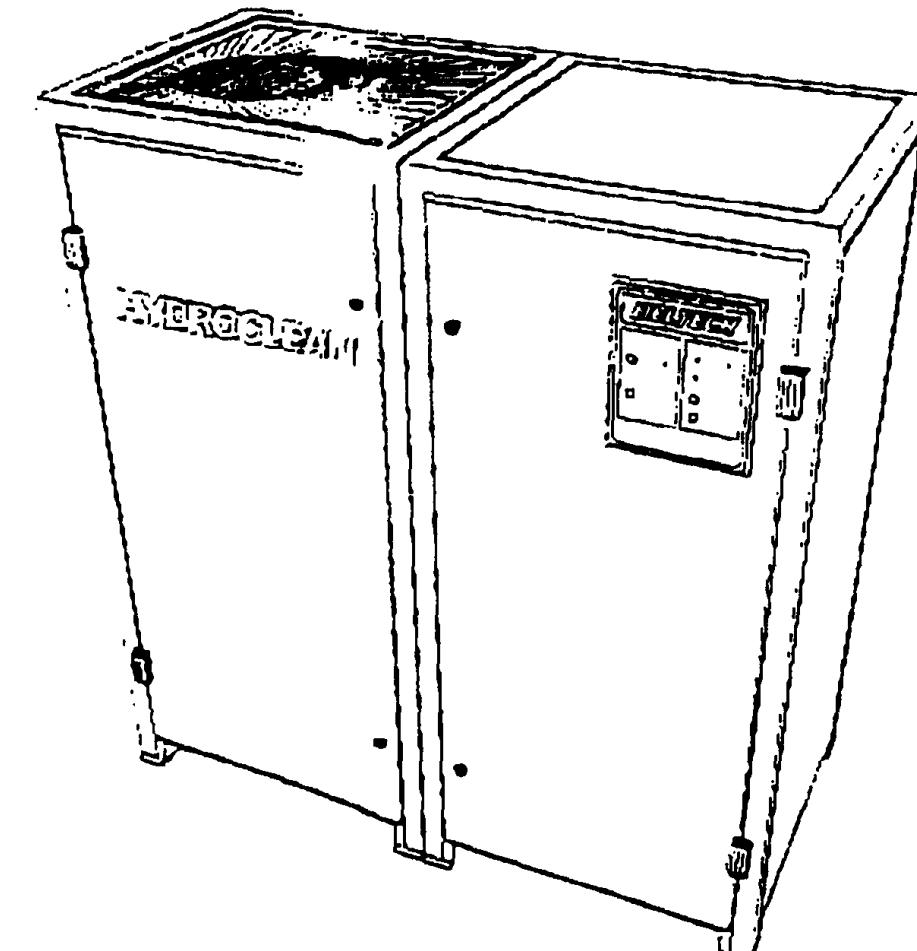
ADV discharge capacity



Be sure to clean up that condensate prior to disposal...

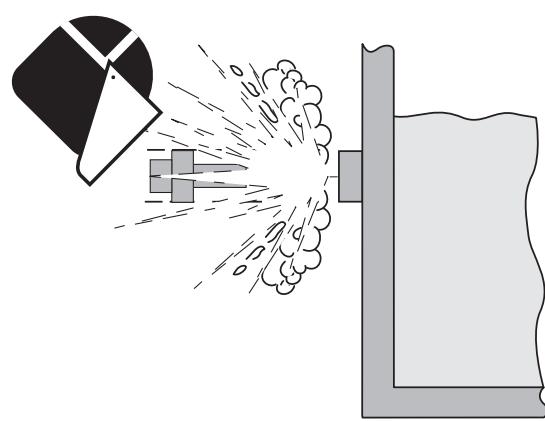
Because it contains oil, environmental regulations prohibit the disposal of air system condensate into storm sewers, waste treatment plants or surface waters. Hydroclean® oil-water separators remove oil and solid

particles from air system condensate. The remaining wastewater—more than 95 percent of the total air system discharge—can be disposed of conventionally. For additional information and a cost savings

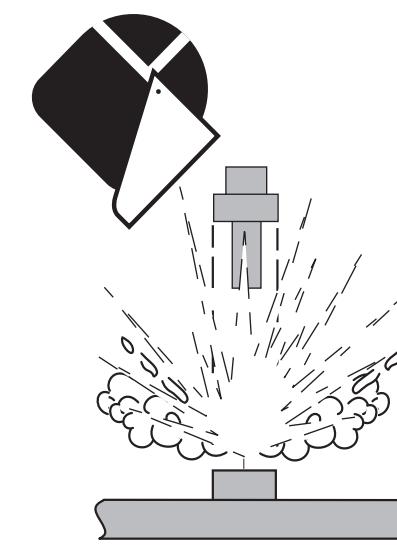


3-2350.090-1 Rev. H 2/11

English

Safety Instructions

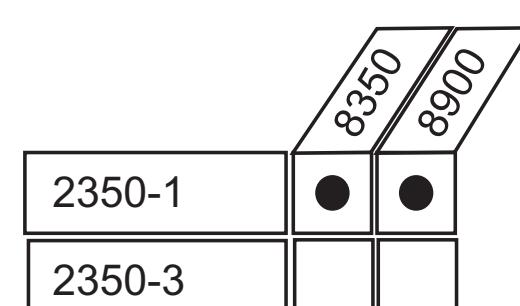
1. Prior to installation or removal:
 - Depressurize and vent system
 - Drain below sensor level
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature/pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.
6. Dispose of properly; DO NOT INCINERATE!

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1. Description
2. Specifications
3. Installation
4. (S^3L) wiring
5. 4 to 20 mA wiring
6. 4 to 20 mA span adjustment
7. Ordering information

1. Description

The 2350 Temperature Sensor has a one-piece injection molded PVDF body that is ideal for use in high purity applications. It also outlasts metal sensors in aggressive liquids and eliminates the need for costly custom thermowells. These sensors are available with (S^3L) digital output or field-scaleable 4 to 20 mA output. Dual threaded ends ($\frac{3}{4}$ in. NPT) allow submersion in process vessels, or in-line installation with conduit connection. Integral adapters (sold separately) may be used to create a compact assembly with field mount versions of the 8350 Temperature Transmitter.

2. Specifications**Compatibility**

General
Wetted material: PVDF

Measurement range:

- In-line installation: -10 °C to 100 °C (14 °F to 212 °F)
- Submersible installation: -10 °C to 85 °C (14 °F to 185 °F)

Response time, τ : 10 seconds

Process connection: $\frac{3}{4}$ in. NPT male thread

Rear connection: $\frac{3}{4}$ in. NPT male thread

Cable type: 3 cond + shield, 22 AWG
Black/Red/White/Shield

Standard cable length:

- 2350-1, -3: 4.6 m (15 ft)

Shipping weight: 0.22 kg (0.5 lb)

Electrical

Power requirements:

- (S^3L) models: 5 VDC $\pm 10\%$, <1.5 mA
- 4 to 20 mA models: 12-24 VDC $\pm 10\%$

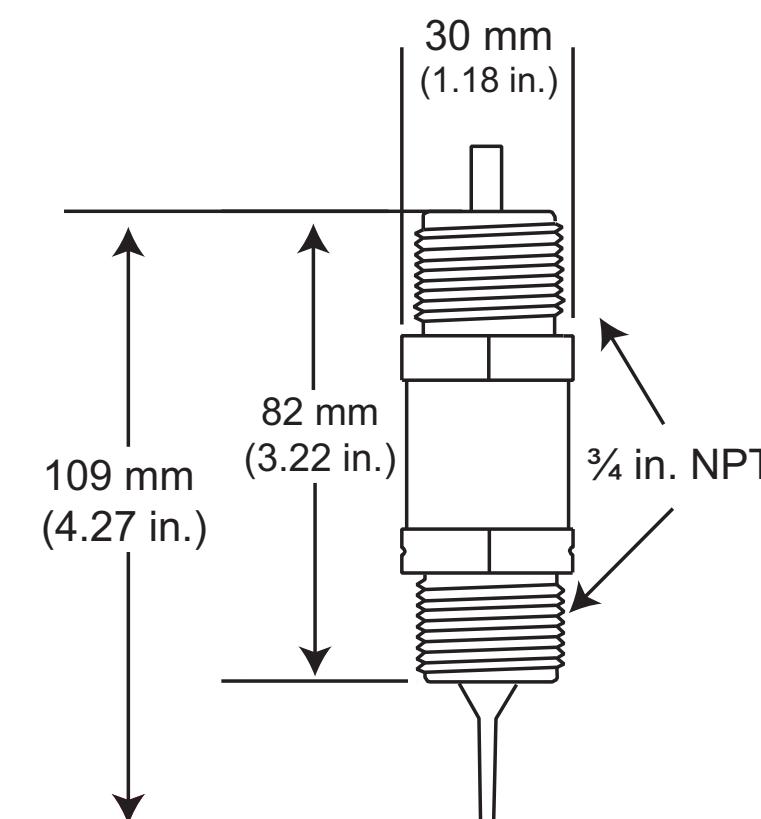
Short circuit & reverse polarity protected

(S^3L) output: Serial ASCII, TTL level 9600 bps

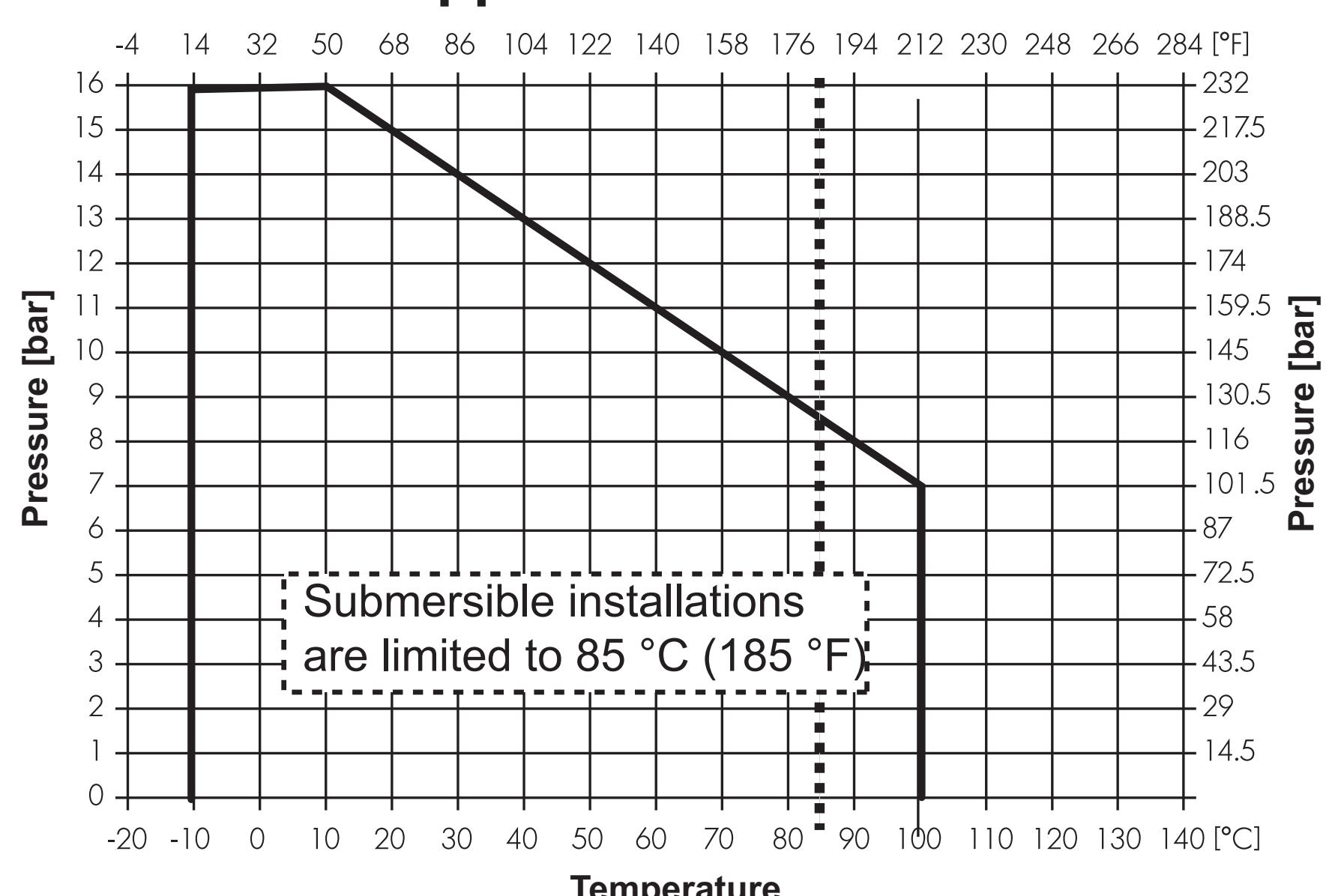
- Accuracy: ± 0.5 °C (± 0.9 °F)
- Repeatability: ± 0.1 °C (± 0.2 °F)
- Resolution: 0.01 °C (0.02 °F)
- Update rate: <100 ms

4 to 20 mA output:

- Accuracy: ± 32 μ A
- Repeatability: ± 0.1 °C (± 0.2 °F)
- Resolution: <5 μ A
- Span: Factory set 4 to 20 mA = 0 °C to 100 °C, Field-scaleable.
- Max loop impedance: 50 Ω @ 12 V
325 Ω @ 18 V
600 Ω @ 24 V
- Update rate: <100 ms

Dimensions**Environmental**

Relative humidity: 0 to 95% (Non-condensing)
Storage temperature: -55 °C to 100 °C (-67 °F to 212 °F)

Application Limits**Approvals & Standards**

- CE
- EN 61326-2 Heavy Industry Immunity
- EN 55011 Class A Heavy Industry Emissions
- Manufactured under ISO 9001 and ISO 14001

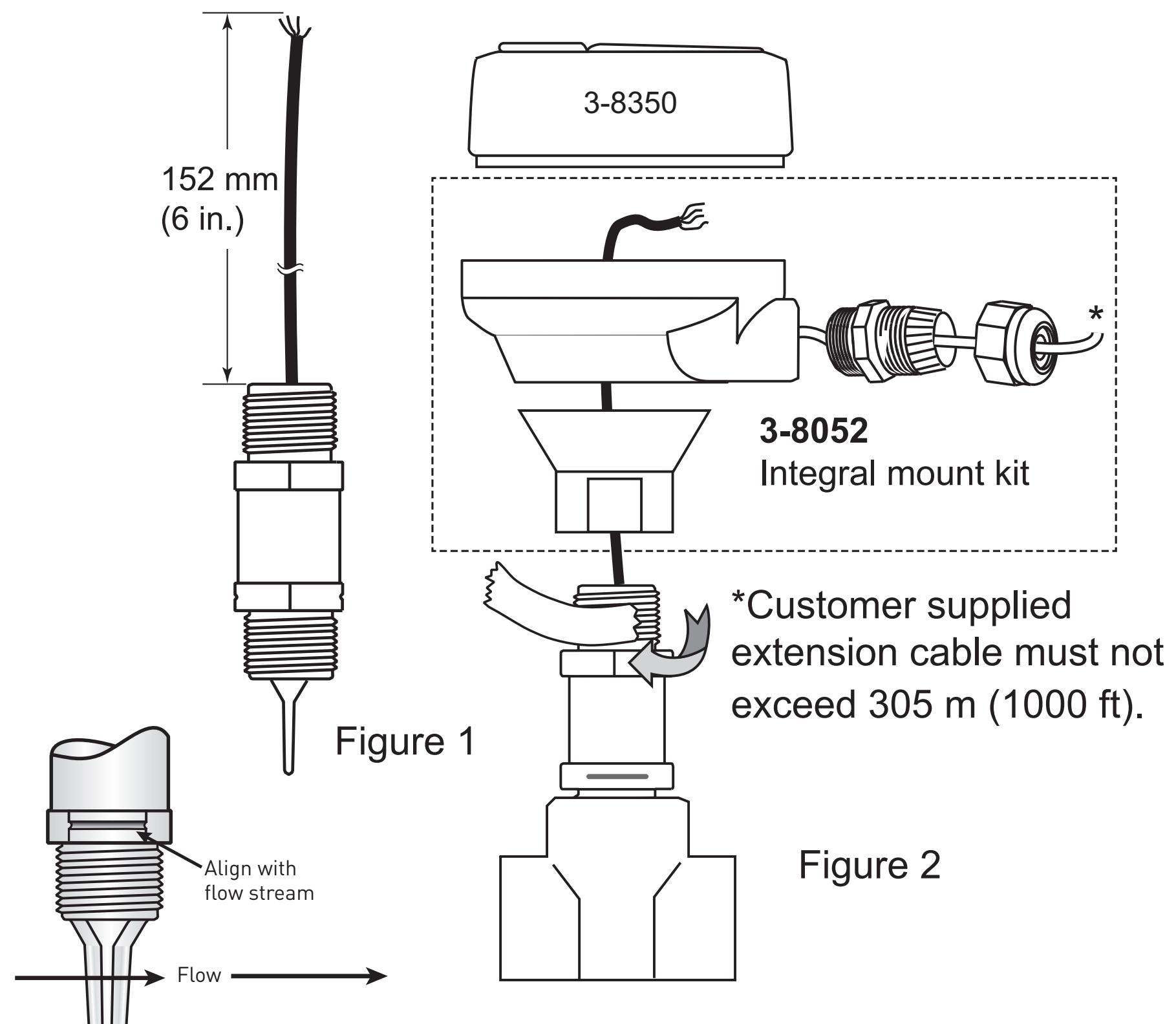


3. Installation

The compact integral assembly can be assembled by using the following directions:

3.1 2350-1 Integral Assembly Sensor Modification

- Modify sensor part number 3-2350-1 per figure 1.
- Apply sealant or PTFE tape to the process connection threads per figure 2, after inspecting threads to ensure integrity. Do not install a sensor with damaged threads.
- Thread the sensor into the 3-8052 mounting kit.
- Tighten the sensor 1½ turns past finger tight into the process connection.
- Make sure the flow alignment indicator is in correct position in the pipe. Damage to the sensor tip can occur if the sensor tip is installed improperly.
- Install 8350 transmitter (refer to 8350 manual for wiring info).
- The 3-8052 Integral kit includes:
 - ¾ in. NPT process connection
 - 3-9000.392-1 liquid tight connector, ½ in. NPT
 - Conduit base to attach 8350.



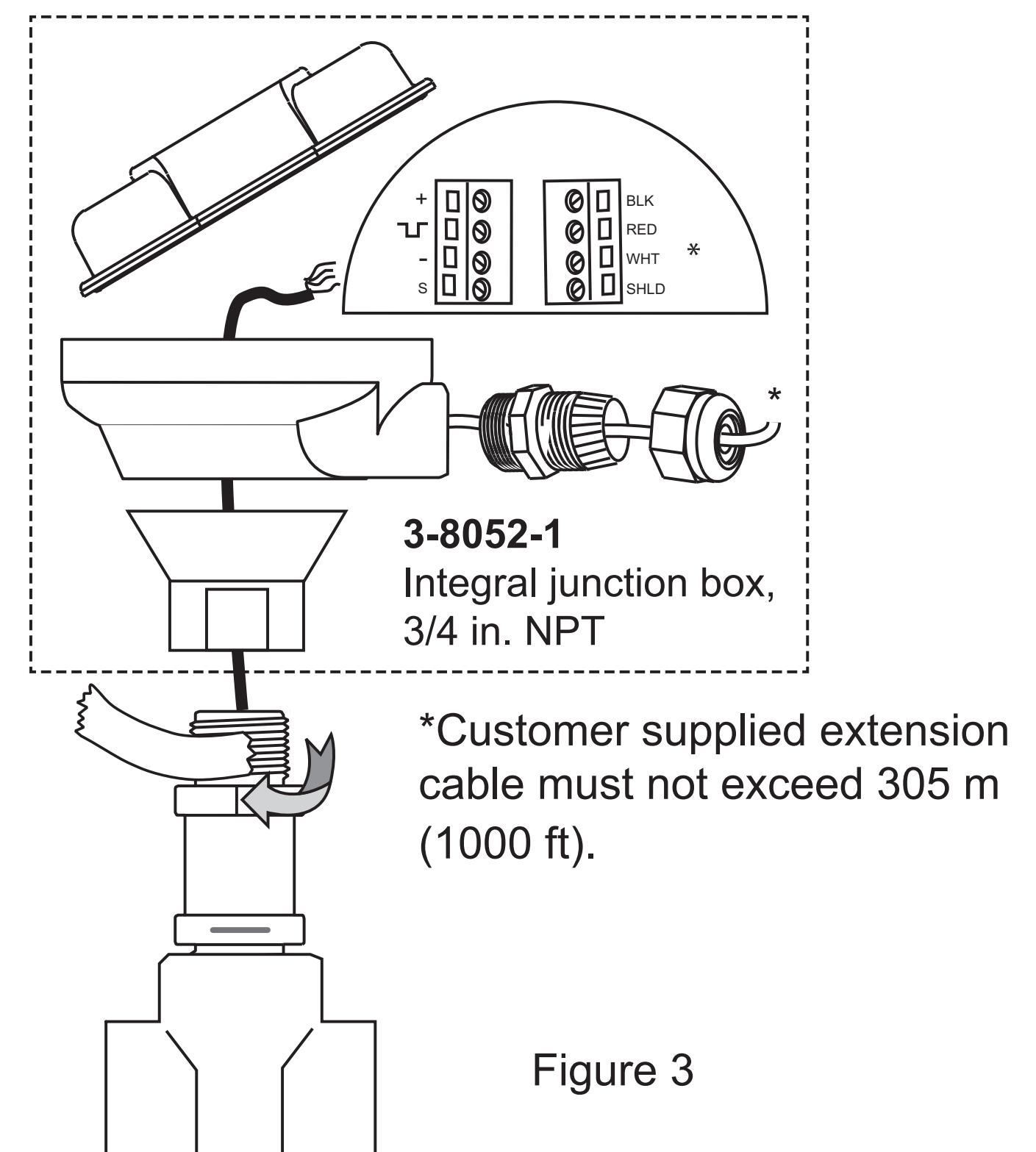
3.2 2350-3 In-line Remote Assembly

The optional 3-8052-1 Integral Junction box with ¾ in. process connection offers a convenient terminal point to extend the 2350 cable over a distance greater than 4.6 m (15 ft).

- The kit includes:
 - ¾ in. NPT process connection
 - Conduit base and cap with junction terminals
 - 3-9000.392-1 liquid tight connector, ½ in. NPT

To extend the wires longer than 4.6 m (15 ft)

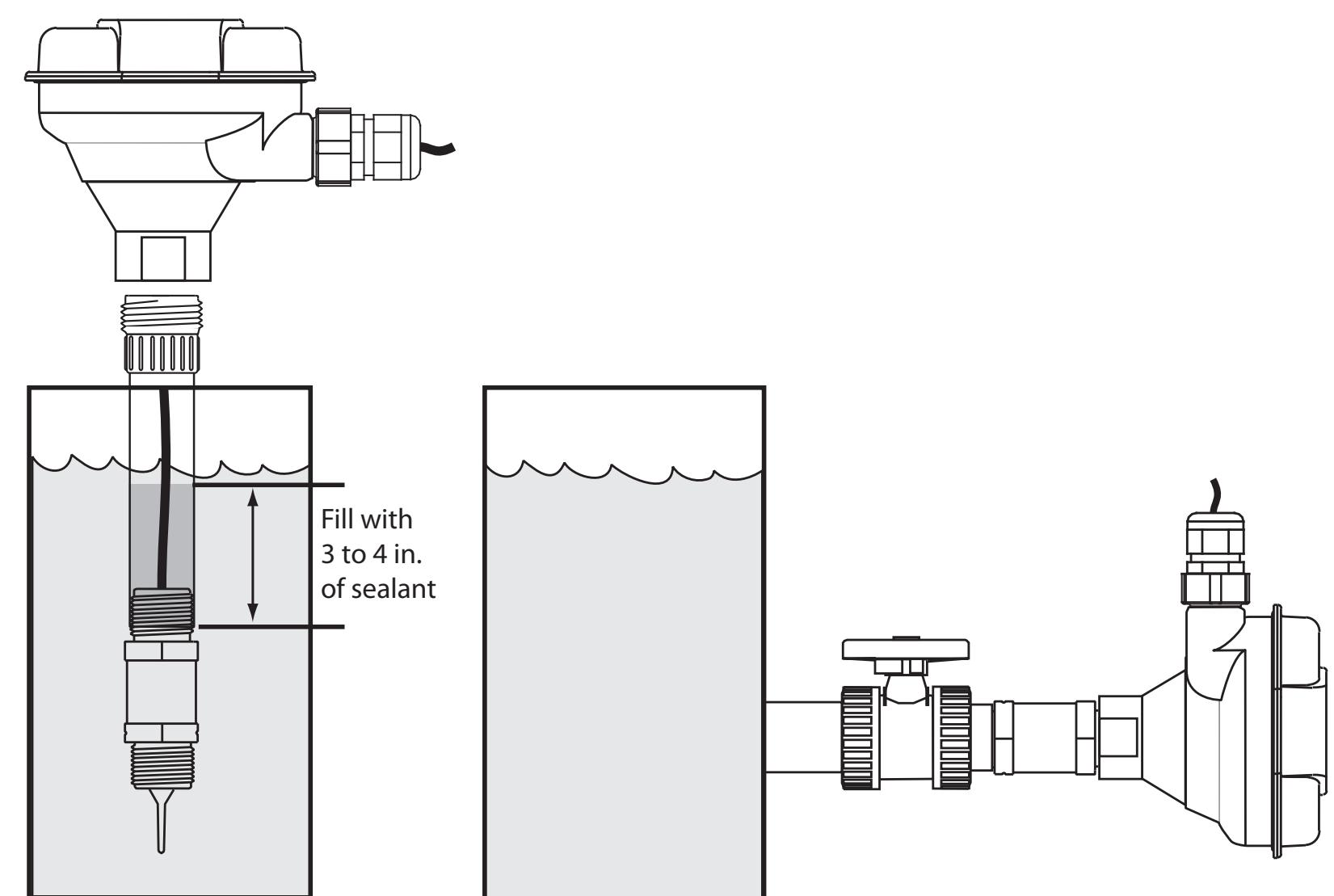
- Modify sensor 3-2350-1 or 3-2350-3 as described in figure 1.
- Terminate the three wires to the terminal board located in the cap assembly.
- Add customer supplied wire to extend the cable.
- Terminate to the transmitter or the 4 to 20 mA input device.
- Apply sealant or PTFE tape to the process connection threads per figure 3, after inspecting threads to ensure integrity. Do not install a sensor with damaged threads.
- Tighten the sensor 1½ turns past finger tight into the process connection.



3.3 2350-1 or 2350-3 Submersible Installation

- Use the 2350-1 or 2350-3 sensor with 4.6 m (15 ft) cable.
- Mount the sensor to an extension pipe or watertight conduit using thread sealant. (Refer to the Signet Submersion Kit 3-0000.707)
- Use a cable gland at the top of the extension to prevent moisture intrusion/accumulation inside the pipe.
- For additional defense against possible accumulation of condensation at the back seal area of the sensor, fill the lower 75 to 100 mm (3 to 4 inches) of conduit or extension pipe with a flexible sealant such as silicone.
- The 8050-1 and the 8052-1 junction boxes can be useful accessories for this installation option.
- The fluid temperature must not exceed 85 °C (185 °F) in submersible installations.

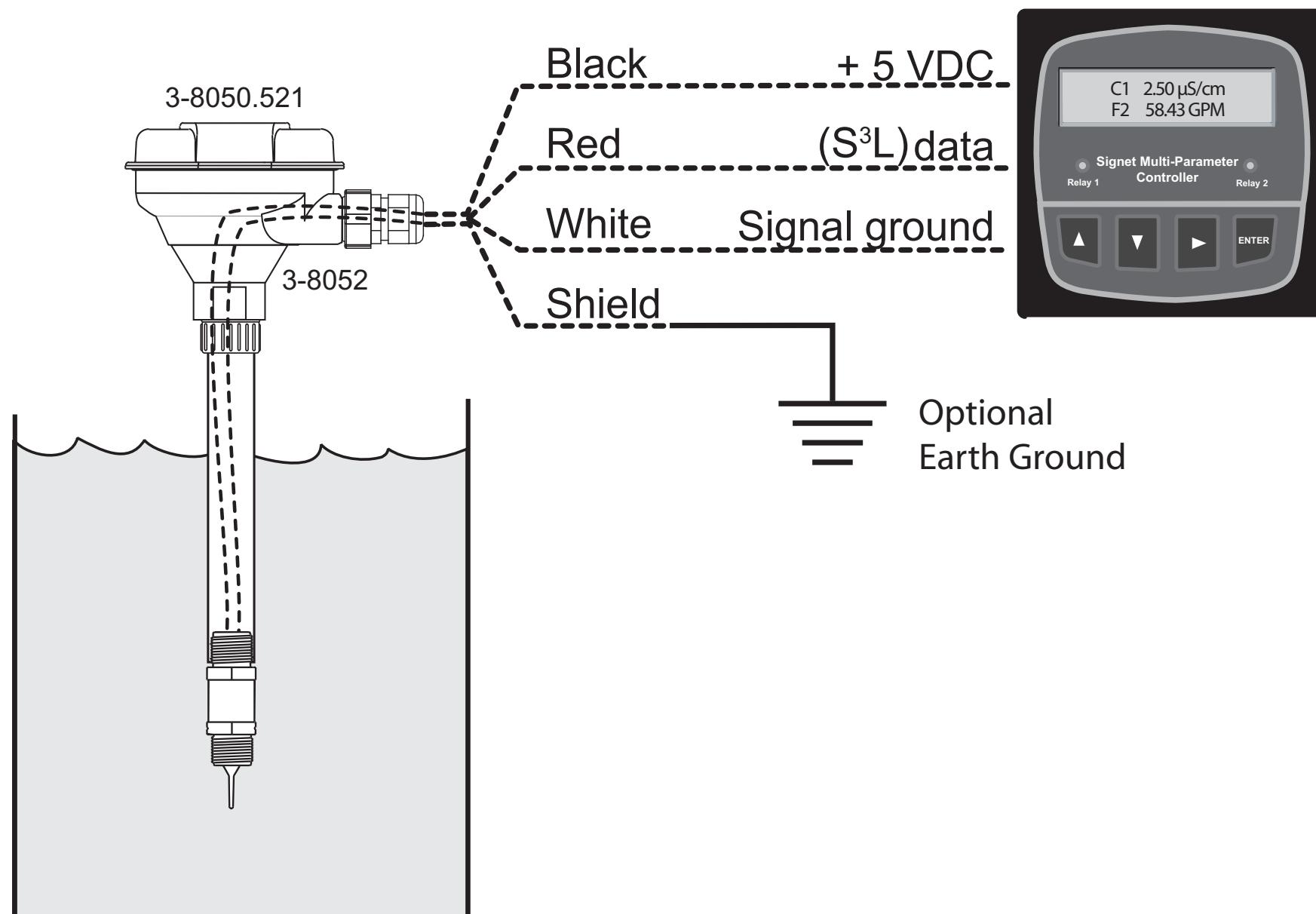
- Install 3-8052-1 junction box recommended.



4. (S³L) Wiring

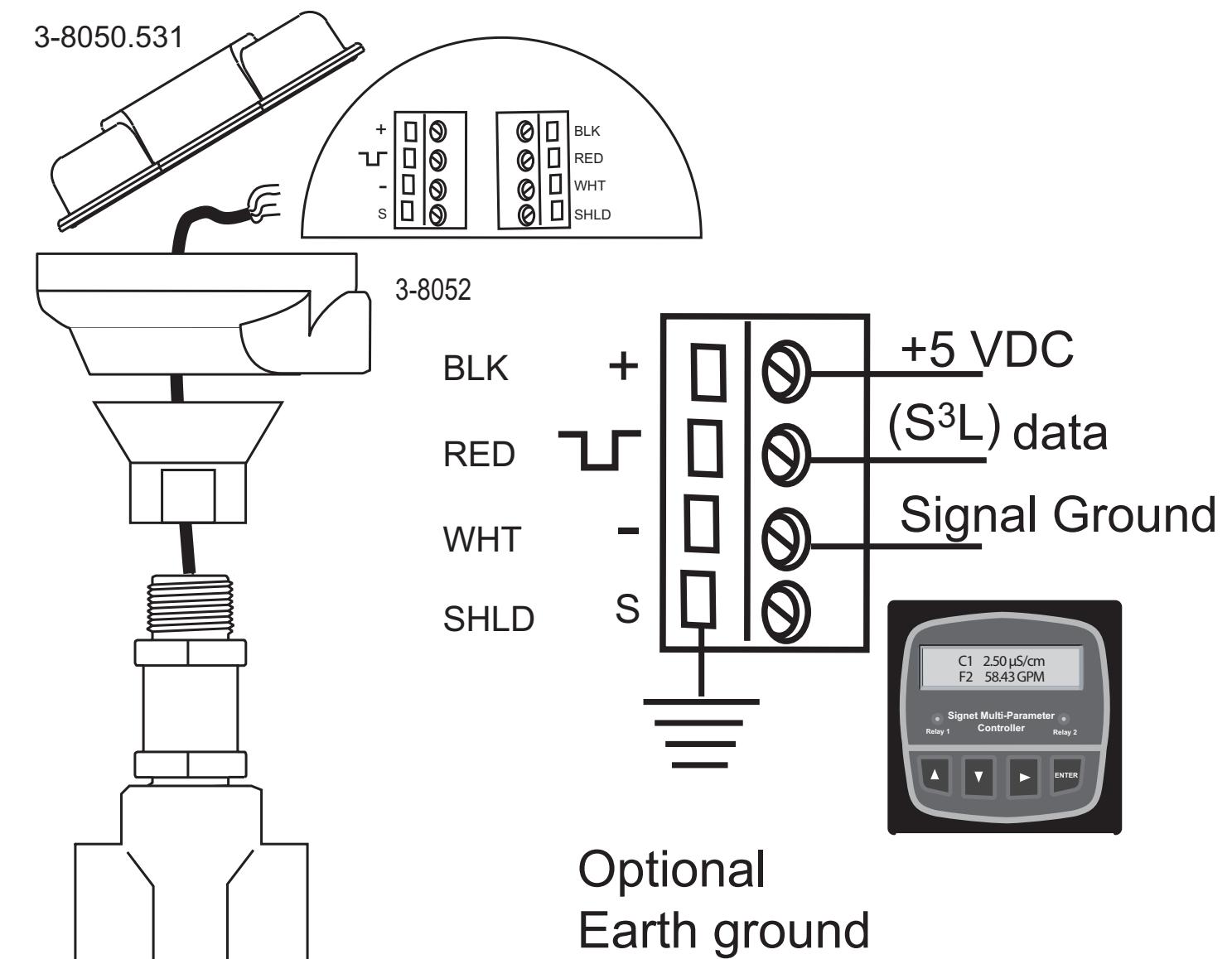
- All models of the 2350 provide (S³L) output when powered with 5 VDC.
- Connecting the SHIELD to a direct Earth ground may reduce electrical noise interference.
- The maximum (S³L) cable length is dependent upon the instrument to which the sensor is connected. Consult the instrument manual for details.

4.1 (S³L) With No Junction Box



- Connect the 2350 cable directly to (S³L) I/O terminals.

4.2 (S³L) with Junction Box

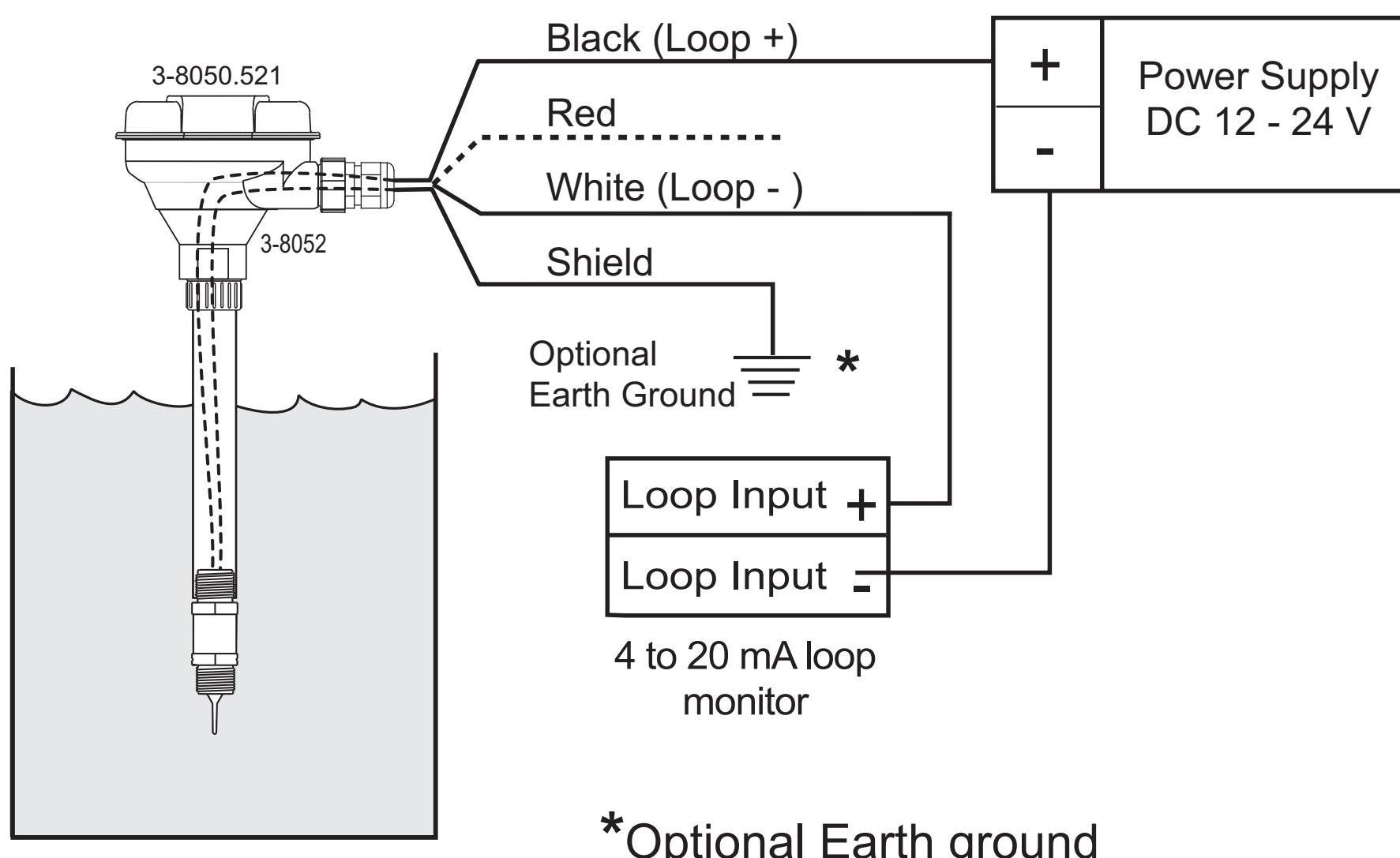


- When the 2350 includes a junction box, connect the 2350 terminals to any (S³L) I/O port as shown.

5. 4 to 20 mA Loop Wiring

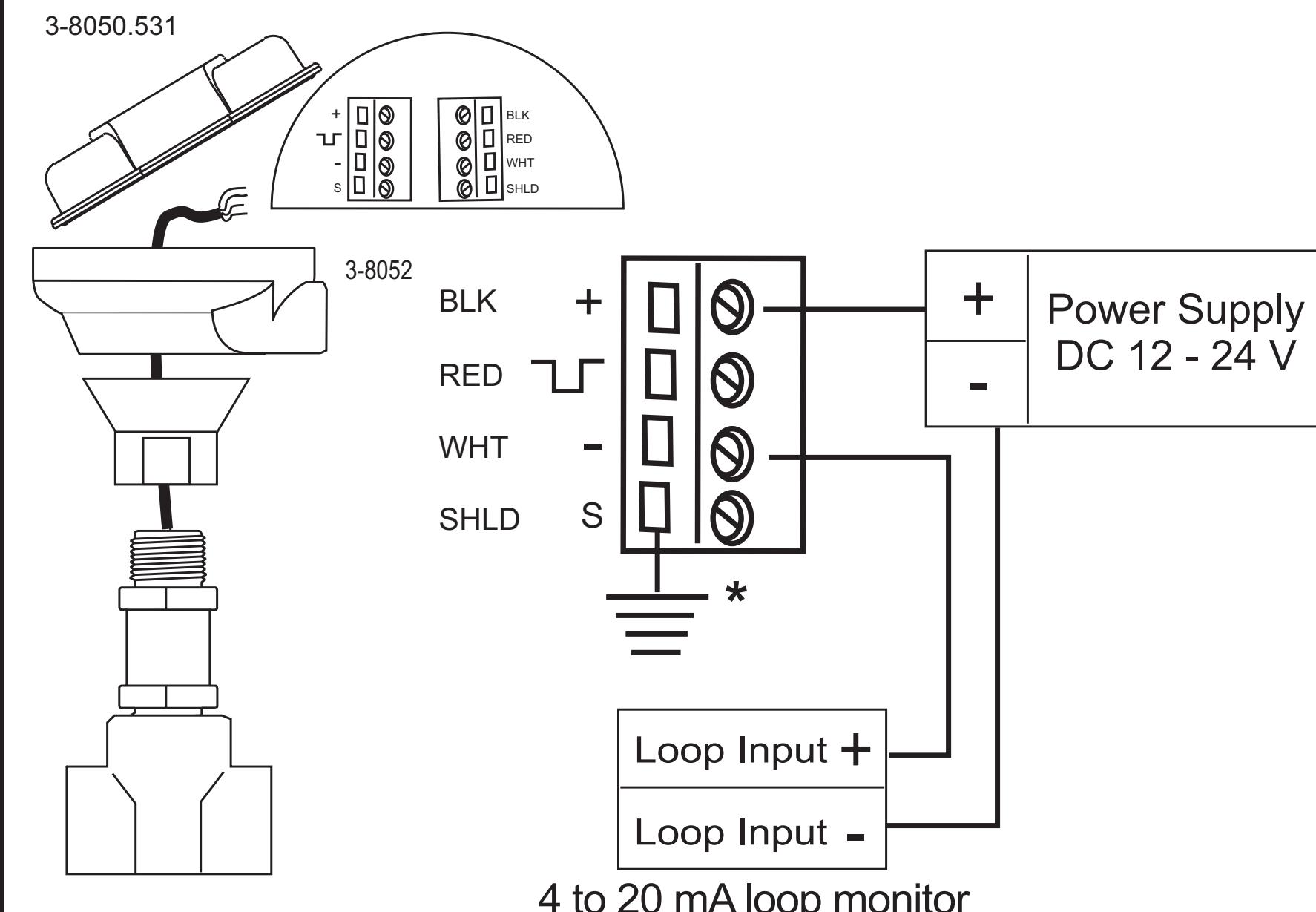
- The 2350-3 provides a 4 to 20 mA loop output when powered with 24 VDC.
- Connecting the SHIELD to a direct Earth ground may reduce electrical noise interference.
- Red wire is not used, do not remove the heat shrink. See Section 6, 4 to 20 mA span adjustment.

5.1 Current Loop With No Junction Box



- Connect the 2350 cable directly to a loop device as shown.

5.2 Current Loop With Junction Box



*Optional Earth ground

- When the 2350 includes a junction box, connect the 2350 terminals to a loop device as shown.

6. 4 to 20 mA Span Adjustment

The 4 to 20 mA endpoint values are independent of one another and may be adjusted in the field. For example, to reduce the 20 mA endpoint value from the factory setting of 100 °C, but to allow the 4 mA endpoint to remain at 0 °C, perform only the steps listed in 6.2 below.

NOTE: The RED wire, which is not connected during normal 4 to 20 mA operation, assumes an important role in the following procedures.

6.1 To adjust the 4mA endpoint in the field:

- Carefully remove the heat shrink tube that is protecting the red wire.
- Expose the sensor to the temperature desired to correspond with 4 mA (-10 °C to 100 °C/85 °C submersible).
(Be sure to allow sufficient time for the sensor to equilibrate to this temperature.)
- With power applied as described in Section 5, connect the RED wire to the WHITE wire for 15 seconds.
(After about 10 seconds the output will drop to 3.6 mA and remain there until the RED wire is disconnected.)
- Disconnect the RED wire from the WHITE wire; the 4 mA endpoint has been adjusted.

NOTE: The output will act as a switch if the 4 and 20 mA endpoints are set very near to the same value.

6.2 To adjust the 20 mA endpoint in the field:

- Expose the sensor to the temperature desired to correspond with 20 mA (-10 °C to 100 °C/85 °C submersible).
(Be sure to allow sufficient time for the sensor to equilibrate to this temperature.)
- With power applied as described in Section 5, connect the RED wire to the BLACK wire for 15 seconds.
(After about 10 seconds the output will rise to 22 mA and remain there until the RED wire is disconnected.)
- Disconnect the RED wire from the BLACK wire; the 20 mA endpoint has been adjusted.

NOTE: The output will act as a switch if the 4 and 20 mA endpoints are set very near to the same value.

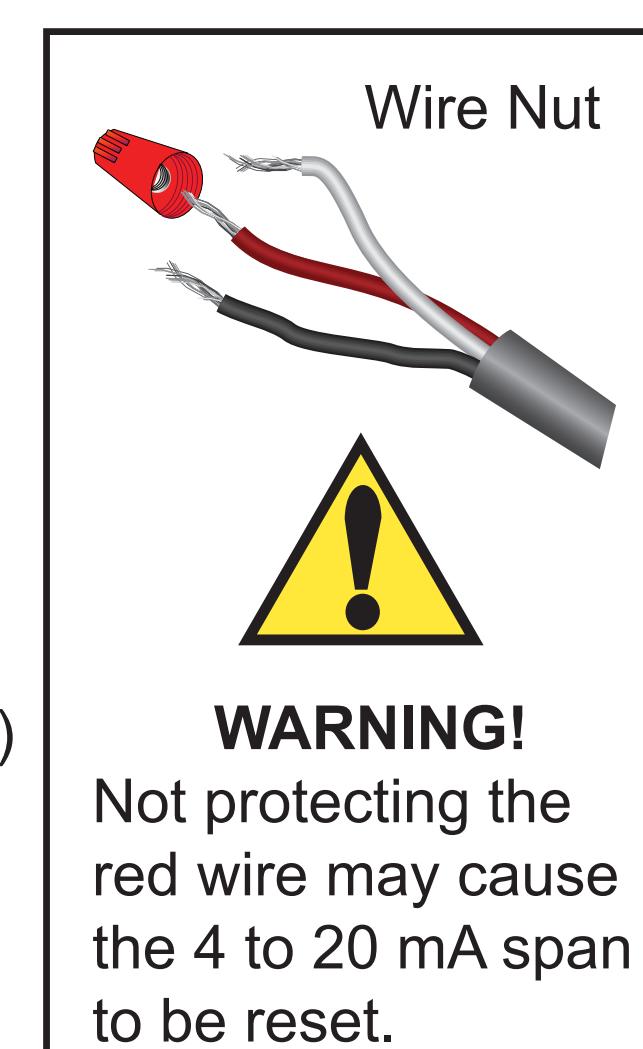
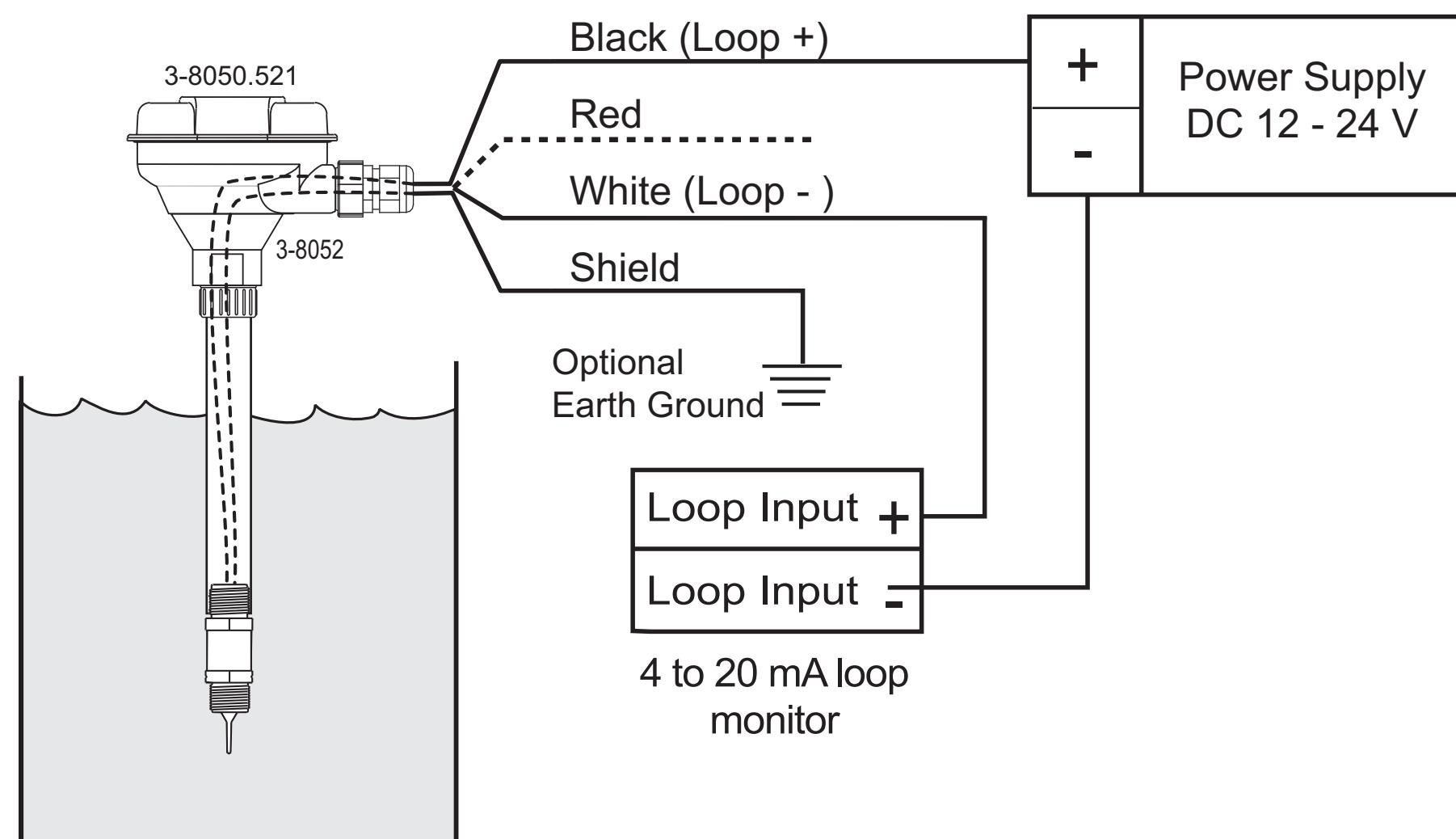
Minimum span is $\pm 2\%$ of maximum range.

- After adjusting the 4 to 20 mA span, protect the red wire by installing the provided wire nut.
- For easier re-spanning use the Signet 0250 USB to Digital (S³L) Configuration/Diagnostic Tool.

6.3 To restore the factory setting:

- Disconnect power to the sensor. Wait 10 seconds for circuit to discharge.
- Connect the RED wire to the WHITE wire.
- Apply power as described in Section 5, but with the RED wire connected to the WHITE wire for 15 seconds.
(After about 10 seconds the output will drop to 3.6 mA and remain there until the RED wire is disconnected.)
- Disconnect the RED wire from the WHITE wire; factory settings have been restored.

Mfr. Part No. Factory Span
3-2350-3 4 to 20 mA = 0 °C to 100 °C



7. Ordering Information

Mfr. Part No.	Code	Description
3-2350-1	159 000 021	Temperature sensor, (S ³ L) output, 3/4 in. NPT, 4.6 m (15 ft) cable
3-2350-3	159 000 920	Temperature sensor, 4 to 20 mA output, 3/4 in. NPT, 4.6 m (15 ft) cable
Accessories		
Mfr. Part No.	Code	Description
3-8050-1	159 000 753	Universal mount junction box
3-8052	159 000 188	3/4 in. Integral mounting kit
3-8052-1	159 000 755	3/4 in. NPT mount junction box
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 piece)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG13.5 (1 piece)
5523-0322	159 000 761	*Cable, 3 conductor + shield, 22 AWG, black/red/white/shield
3-0250	159 001 538	USB to digital (S ³ L) configuration/diagnostic tool

*Custom length available, contact the factory.

+GF+

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For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090
For the most up-to-date information, please refer to our website at www.gfsignet.com

Signet 2350 Temperature Sensor

Blind Transmitter or Digital (S³L) Sensor

Features

- 4 to 20 mA or digital (S³L) output
- Standard ¾ in. NPT process connection
- One-piece injection molded PVDF body
- PT1000 platinum RTD in extended tip for quick response
- Easy installation
- Threaded for in-line or submersible installation

Description

The Signet 2350 Temperature Sensor has a one piece injection molded PVDF body that is ideal for use in high purity applications. It also outlasts metal sensors in aggressive liquids and eliminates the need for costly custom thermowells. These sensors are available with a proprietary digital output (S³L) or field-scaleable 4 to 20 mA output.

Dual threaded ends (¾ in. NPT) allow submersion in process vessels, or in-line installation with conduit connection. An integral adapter kit (sold separately) may be used to create a compact assembly with field mount versions of the Signet 8350 Temperature Transmitter.

Applications

- Plating Bath Temperature Control
- Heat Exchange Monitor
- R.O. and D.I. System Monitor
- Hot/Cold Mixing System Monitor
- Data Acquisition
- Cooling Loops
- Effluent Monitoring
- HVAC
- Chemical Processing

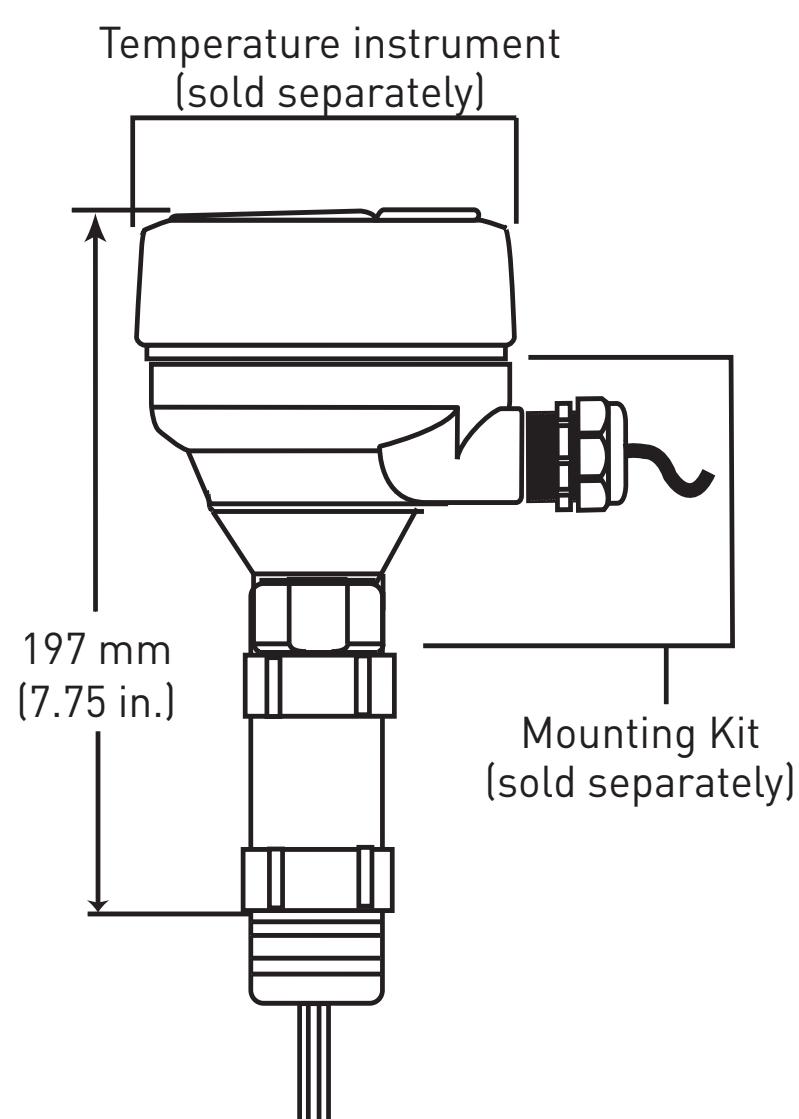
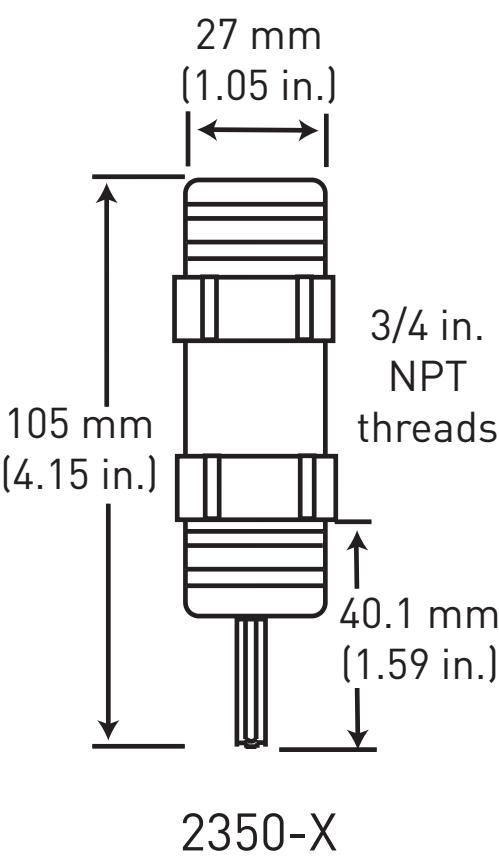
CE

System Overview

In-Line Installation				Submersible Installation*	
Panel Mount Signet 8350 or 8900 Instrument (sold separately)	Pipe, Tank, Wall Mount Signet 8350 Instrument (sold separately)	Integral Mount Signet 8350 Instrument (sold separately)	4 to 20 mA Input Chart Recorder	OR	Panel, Pipe, Tank, Wall Mount Signet 8350 or 8900 Instrument (sold separately)
Signet Universal Adapter Kit (3-8050) (sold separately)	Signet Integral Adapter Kit (3-8052) (sold separately)				Pipe extension or conduit with ¾ in. FNPT threads
Signet 2350 Temperature Sensor				Signet 2350 Temperature Sensor	
In-Line Installation - Fittings (Customer supplied)					

* For tank or wall mount installations, user must use the Universal Adapter Kit (3-8050).

Dimensions



Model 2350

Ordering Notes

Any sensor can be mounted with an instrument in an integral configuration by doing the following:

- 1) Order Integral adapter kit 3-8052 (sold separately) to connect the instrument (sold separately) directly onto the sensor.
- 2) Order an instrument (sold separately). The following instrument part numbers are compatible with the 2350 for integral mounting:
3-8350-1, 3-8350-2

Application Tips

- For submersible sensor mounting, always use a water tight conduit and a cable gland to prevent moisture intrusion.
- To extend the cable, use a 3-conductor shielded cable and junction box.

Please refer to
Wiring, Installation,
and Accessories
sections for more
information.

Specifications

General

Output: Digital (S^3L) output or 4 to 20 mA
 Accuracy: $\pm 0.5^\circ\text{C}$ ($\pm 0.9^\circ\text{F}$)
 Response Time, τ : 10 secs.
 Repeatability: $\pm 0.1^\circ\text{C}$ ($\pm 0.2^\circ\text{F}$)
 Resolution: 0.01 $^\circ\text{C}$ (0.02 $^\circ\text{F}$)
 Sensing-End Connection: 3/4 in. NPT male thread
 Cable-End Connection: 3/4 in. NPT male thread

Wetted Material

- Sensor Housing: PVDF

Electrical

Power Requirements:

Type of output is automatically selected when appropriate power is applied.

- Digital (S^3L): 5 VDC $\pm 10\%$, <1.5 mA
- 4 to 20 mA: 12 to 24 VDC $\pm 10\%$, regulated

Cable Type:

PVC jacketed, 3-conductor with shield
22 AWG, Blk/Red/White/Shld

Cable Length:

- 4.6 m (15 ft)
- 15.2 cm (6 in.); cable length can also be extended up to 121 m (400 ft)

Digital (S^3L) output:

- Serial ASCII, TTL Level 9600 bps.
- Reverse polarity and short circuit protected.

Electrical (continued)

- 4 to 20 mA Output:
- Accuracy: $\pm 32 \mu\text{A}$
 - Resolution: $<5 \mu\text{A}$
 - Span:
4 to 20 mA factory calibrated
 0°C to 100°C (32°F to 212°F)
 - Max. Loop Impedance:
50 Ω @ 12 V
325 Ω @ 18 V
600 Ω @ 24 V
 - Update Rate: <100 ms

Max. Temperature/Pressure Rating

Operating Temperature:

- In-line Mounting:
 -10°C @ 16 bar to 100°C @ 7.5 bar
(14°F @ 232 psi to 212°F @ 108 psi)
- Submersible Mounting:
 -10°C @ 16 bar to 85°C @ 7.5 bar
(14°F @ 232 psi to 185°F @ 108 psi)

Storage Temperature:

-55°C to 100°C (-67°F to 212°F)

Relative Humidity:
0 to 95% non-condensing

See Temperature and Pressure graphs for more information.

Shipping Weight 0.22 kg 0.5 lb

Standards & Approvals

- CE
- Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management

Ordering Information

Sensor Part Number		
3-2350	Temperature Sensor	
	Output and Cable Length - Choose One	
	-1	Digital (S^3L) and 4.6 m (15 ft) cable
	-3	Current (4 to 20 mA) and 4.6 m (15 ft) cable
3-2350	-1	Example Part Number

Mfr. Part No.	Code
3-2350-1	159 000 021
3-2350-3	159 000 920

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
5523-0322	159 000 761	Sensor cable (per ft), 3 cond. plus shield, 22 AWG
3-8052	159 000 188	3/4 in. Integral mounting kit
3-8052-1	159 000 755	3/4 in. NPT mount junction box with one liquid tight connector and cap with junction terminals
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 connector)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG 13.5 (1 connector)
3-0250	159 001 538	USB to digital (S^3L) configuration/diagnostic tool

Wind Speed & Direction Sensor



Key Features

- Wind Speed & Direction Sensor
- 0-60m/s (116 knots) Wind Speed
- 0-359° Wind Direction
- NMEA output
- Low Power consumption
- Fast start-up
- Solid-state – maintenance-free
- Corrosion Free

The Gill WindSonic is a low-cost anemometer, which utilises Gill's proven ultrasonic technology to provide wind speed and direction data via one serial or two analogue outputs. To confirm correct operation, outputs are transmitted together with an instrument status code.

With a robust, corrosion-free polycarbonate housing, this small, lightweight wind sensor is recommended for use in harsh environmental conditions and is particularly suited to marine & offshore (ships, data buoys) and land based installations. The WindSonic has no moving parts, offering maintenance-free operation in a wide range of applications.



Wind Speed

Range	0 - 60 m/s (116 knots)
Accuracy	±2% @12 m/s
Resolution	0.01 m/s (0.02 knots)
Response Time	0.25 seconds
Threshold	0.01 m/s

Power Requirement

Anemometer	5-30VDC Option 1 & 2
	7-30VDC Option 3
	9-30VDC Option 4
	From 5.5mA @ 12V
	Start up time < 5 seconds

Direction

Range	0 - 359° (No dead band)
Accuracy	±3° @12 m/s
Resolution	1°
Response Time	0.25 seconds

Mechanical

External Construction	LURAN S KR 2861/1C ASA/PC
Size	142mm x 160mm
Weight	0.5kg

Measurement

Ultrasonic Output Rate	0.25, 0.5, 1, 2 or 4 Hz
Parameters	Wind Speed & Direction or U and V (vectors)
Units of Measure	m/s, knots, mph, kph, ft/min

Environmental

Protection Class	IP65
Operating Temperature	-35°C to +70°C
Storage Temperature	-40°C to +80°C
Operating Humidity	< 5% to 100% RH
EMC	EN 61326: 1998

Outputs

Option 1	RS232
Option 2	RS232 + RS422 + RS485 + NMEA*
Option 3	RS232 + RS422 + RS485 + NMEA* 0-5V or, 0-20mA or 4-20mA
Option 4	SDI-12 (refer to manual or separate datasheet for technical specification)
Baud Rate	2400 to 38400
Anemometer Status	Supplied as part of standard message

Operational

MTBF	15 years
Warranty	2 years
Factory Calibration	Traceable to National Standards

Accessories

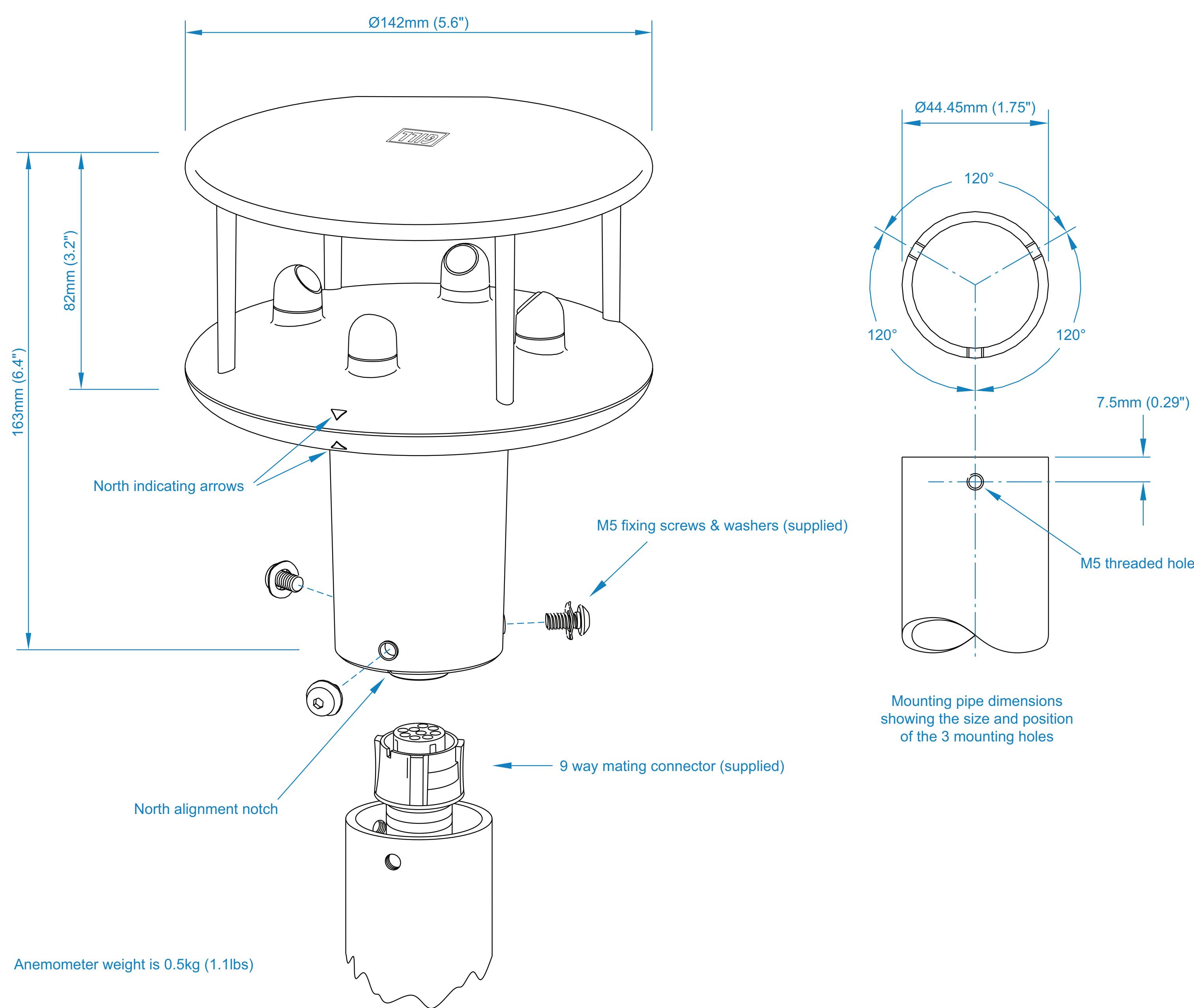
Pipe Mounting	44.45mm (1.75 in) diameter
Wind Software	Display / Logging**
Cables	Available to match output options
Display	See Gill Display datasheet

* NMEA 0183

** Download software free from www.gill.co.uk

Typical Applications

- Remote weather monitoring stations
- Building controls
- Data buoys
- Marine vessels
- Small airports & helipads
- Road & rail tunnels
- Environmental field sites
- Ports & harbours
- Mobile weather monitoring vehicles
- Coastal weather monitoring stations



Specifications may be subject to change without prior notice.



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Humidity & Temperature Sensors

The Global Water WE600 Humidity Sensor is a precise, durable unit. Humidity sensors are composed of a solid state capacitative element with a linear amplifier. The humidity sensor output is 4-20 mA with a three wire configuration. The Global Water WE700 Temperature Sensor is a high quality, rugged instrument, precision RTD calibrated to US National Standards. The temperature sensor output is 4-20 mA with a two wire configuration. Each sensor is mounted on 25 ft of marine grade cable, with lengths up to 500 ft available upon request. The electronics are completely encapsulated in marine grade epoxy within a stainless steel housing.

- 4-20 mA output
- Marine grade cable with strain relief
- Fully encapsulated electronics

What is Relative Humidity?

Air moisture content is typically described by a relative humidity measurement. Relative humidity is the ratio of the water vapor content to the concentration of water vapor that the atmosphere could hold. In general, the relative humidity will vary inversely with air temperature so that the relative humidity is highest when the temperature is lowest, and vice versa. Typically after sunrise, when the air warms, the relative humidity falls. Relative humidity is typically given in a percentage reading. The vapor in the air is considered at 100% relative humidity when the concentration of water vapor in air is equal to the water vapor concentration at saturation.



WE600-700 Rugged Humidity & Temperature Sensors with optional Solar Shield

Why Measure Relative Humidity?

Relative humidity has a major effect on the environment. Humidity readings provide a chance to control these effects. Effects include causing discomfort in people or animals, damaging materials in warehouses or other storage facilities, affecting the climates for optimal production processes, impacting the quality of construction materials and many others.

What is Temperature and How is it Affected?

Temperature is typically measured in degrees Celsius or Fahrenheit. To accurately measure temperature the temperature sensor should be shielded from direct sunlight or precipitation and it should be adequately ventilated. Usually "surface" air temperature is measured approximately two meters above the surface.

The factors that affect temperature sensors include latitude, the movement of air masses, solar radiation, and nearby bodies of water or land. Typically solar radiation and latitude are the biggest influences on the temperature reading.

www.globalw.com/products/we700.html

T: 800.876.1172/979.690.5560

globalw@globalw.com



Specifications

Humidity Sensor

Type	Capacitance
Output	4-20 mA
Range	0 to 100% RH
Accuracy	±2% RH
Operating Voltage	10-36 VDC
Current Draw	3mA plus sensor output
Warm Up Time	3 seconds minimum
Operating Temp	-40 to +131°F (-40 to +55°C)
Operating Temperature	14 to 122°F (-10 to +50°C) (Sensor); 32 to 122°F (0 to +50°C) (Meter)
Sensor Size	1-1/8 inch diameter x 7 inch (2.9 cm dia. x 18 cm)
Weight	0.5 lb. (227 g)

Temperature Sensor

Type	Precision RTD
Output	4-20 mA
Range	-58 to +122°F (-50 to +50°C)
Accuracy	±0.2°F or ±0.1°C
Operating Voltage	10-36 VDC
Current Draw	Same as sensor output
Warm Up Time	3 seconds minimum
Storage Temperature	-58 to +212°F (-50 to +100°C)
Sensor Size	3/4 inch diameter x 4-1/2 inch (2 cm diameter x 11.4 cm)
Weight	0.5 lb. (227 g)

For Ordering information and Options; please visit www.globalw.com/products/WE700.html





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Global Water

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Barometric Pressure: WE100
Solar Radiation: WE300
Wind Speed: WE550
Wind Direction: WE570
Humidity: WE600
Temperature Sensor: WE700
Solar Shield: WE770

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Publication Number 38320112

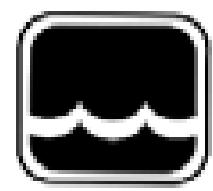
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Congratulations on your purchase of the Global Water Weather Sensor. This instrument has been quality tested and approved for providing accurate and reliable measurements. We are confident that you will find the sensor to be a valuable asset for your application. Should you require assistance, our technical staff will be happy to help.

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I. Sensor Checklist

- a. Weather Sensor
- b. Weather Sensor Manual

II. Inspection

- a. Your Weather sensor was carefully inspected and certified by our Quality Assurance Team before shipping. If any damage has occurred during shipping, please notify Global Water Instrumentation, Inc. and file a claim with the carrier involved.

Use the checklist to ensure that you have received everything needed to operate the weather instrument(s).





III. General Sensor Installation

- a. Weather sensors have many applications and therefore many installation options. The sensors should be located in a clear area on a level surface.
- b. Install your Weather sensor so that it is easily accessible for calibration purposes. You may need to remove and reinstall it in the future, so plan ahead!
- c. All Global Water Weather sensors produce a 4-20 mA output signal. 4-20 mA is an industrial standard signal for process control monitoring. Most PLCs (Programmable Logic Controller), RTUs (Remote Telemetry Unit), and data acquisition systems accept this signal directly. If the system only accepts voltage signals, the sensor output must be converted to a voltage signal by reading the voltage across a precision resistor in series with the signal wire. Since Ohms Law states that $V = IR$, if the 4-20 mA signal is dropped across a 250 ohm resistor, the output will be 1 to 5 volts DC. If the 4-20 mA signal is dropped across a 125 ohm resistor, the output will be halved to 0.5 to 2.5 VDC. The 4-20 signal wire is connected to the datalogger voltage input terminal. The resistor is placed between this input and the ground terminal of the datalogger's battery. The power (or voltage to the sensor) must be connected to positive battery terminal of the datalogger.
- d. The sensors may be pulsed on or turned on by the logging system prior to taking a reading. Use a warm up time appropriate to the Weather sensor you are using to assure that the sensor is fully on. The sensors can run continuously for real time applications. Each sensor draws between 4 and 20 mA depending on whether the sensor is reading at the minimum or maximum of its range.
- e. Weather sensors may be stored without any special provisions. Place the sensor inside a bag to keep the sensor clean and store on a shelf or hang it on a wall.



IV. Barometric Pressure Sensor

a. Barometric Pressure sensor specifications.

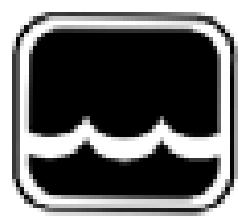
Output:	4-19mA
Range:	800-1100 millibars
Accuracy:	$\pm 1\%$ of full scale
Operating Voltage:	10-36VDC
Current Draw:	Same as sensor output
Warm Up Time:	3 seconds minimum
Operating Temperature:	-40° to +55°C
Size of Probe:	3"x2"x1"
Weight:	.13 lb.

- b. The sensor is a two-wire sensor using the red wire for power and the black wire for the output signal. **Warning: Always connect the sensor with the power turned off.**
- c. The barometric pressure sensor may be stored without any special provisions. Place the sensor inside a bag to keep the sensor clean and store on a shelf or hang it on a wall.
- d. When you read a barometer the reading directly from it is the "station pressure."

Two things affect the barometer's reading, the high or low air pressure caused by weather systems, and the air pressure caused by the station's elevation, or how high it is above sea level. No matter what weather systems are doing, the air's pressure decreases with height. If you're trying to draw a weather map of air pressure patterns, you need a way to remove the effects of the station's elevation. That is, you want to see what the pressure would be at the station if it were at sea level.

You need to calculate, sea-level pressure, which is defined as: "A pressure value obtained by the theoretical reduction of barometric



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pressure to sea level. Where the Earth's surface is above sea level, it is assumed that the atmosphere extends to sea level below the station and that the properties of that hypothetical atmosphere are related to conditions observed at the station." To do this, you have to take into account the barometric reading at the station, the elevation above sea level, and the temperature.





V. Solar Radiation Sensor

a. Solar Radiation sensor specifications.

Output:	4-20mA
Range:	0-3000 Wm ²
Accuracy:	1% of full scale
Operating Voltage:	10-36VDC
Current Draw:	Same as sensor output
Warm Up Time:	3 seconds minimum
Operating Temperature:	-40°C to +55°C
Size of Probe:	3" diameter x 1 1/2" high
Weight:	1/4 lb.

- b. The sensor is a two-wire sensor using the red wire for power and the black wire for the output signal. **Warning: Always connect the sensor with the power turned off.**
- c. Ensure that the sensor is placed on a level surface, use the alignment bolts to adjust the sensor until it is level. Remove the red cap to begin taking readings.
- d. The solar radiation sensor or pyranometer is an instrument for measuring solar radiation received from a whole hemisphere. It is suitable for measuring global sun plus sky radiation. Solar radiation varies significantly among regions. Season and time of day are major considerations, but surrounding terrain elevation, man-made obstructions, and surrounding trees can also cause large variations in locations with a small area. Often, the required measurement is, energy flux density of both direct beam and diffuse sky radiation passing through a horizontal plane of known unit area (i.e., global sun plus sky radiation).
- e. Calibration should be confirmed annually.





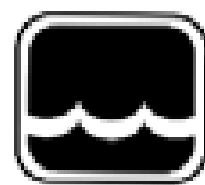
VI. Wind Speed Sensor

a. Wind Speed sensor specifications.

Output:	4-20mA
Range:	0-110 MPH
Accuracy:	.2 MPH over the range 11 to 55 MPH
Operating Voltage:	10-36VDC
Current Draw:	Same as sensor output
Warm Up Time:	3 seconds minimum
Operating Temp:	-40° to +55°C
Size of Probe:	7" diameter x 8 1/2" long
Weight:	1 lb.

- b. The sensor is a two-wire sensor using the red wire for power and the black wire for the output signal. **Warning: Always connect the sensor with the power turned off.**
- c. The sensor comes with a stainless steel elbow that can be mounted on a 1" diameter tube. For best results ensure that the sensor is mounted parallel to the ground surface.
- d. The wind speed sensor or anemometer produces a sine wave voltage signal with a frequency that changes linearly with the wind speed. The frequency is transformed into a 4-20 mA sensor signal output.





VII. Wind Direction Sensor

- a. Wind Direction sensor specifications.

Output:	4-19 mA
Range:	0 to 360° (352° electrical, 8° open)
Accuracy:	1% of full scale
Operating Voltage:	10-36VDC
Current Draw:	Same as sensor output
Warm Up Time:	3 seconds minimum
Operating Temp:	-40° to +55°C
Size:	8 ½" diameter x 10 ½" long
Weight:	1 lb.

- b. The sensor is a two-wire sensor using the red wire for power and the black wire for the output signal. **Warning: Always connect the sensor with the power turned off.**
- c. The ridge on the fixed portion of the sensor represents the 0° direction of the sensor. The sensor comes with a stainless steel elbow that can be mounted on a 1" diameter tube. For best results ensure that the sensor is mounted parallel to the ground surface.
- d. A wind direction sensor produces a ratiometric voltage signal. That voltage signal is transformed into a 4-19 mA sensor output signal.





VIII. Humidity Sensor

- a. Humidity sensor specifications.

Output:	4-19mA
Range:	0-100% RH
Accuracy:	± 2% RH
Operating Voltage:	10-36VDC
Current Draw:	3 mA plus sensor
Warm Up Time:	3 seconds minimum
Operating Temp:	-40° to +55°C
Size of Probe:	1 ½" diameter x 7" long
Weight:	½ lb.

- b. The humidity sensor is a three-wire sensor. Three wire sensors use the red wire for positive voltage, the white wire for the output signal, and the black wire for ground. **Warning: Always connect the sensor with the power turned off.**
- c. Do not install the humidity sensor in direct sunlight.
- d. A humidity sensor utilizes a thin polymer that varies in dielectric constant directly proportional to changes in the amount of water vapor at the sensor element. The element provides a linear voltage output that is converted into a 4-19 mA sensor output signal.





IX. Temperature Sensor

a. Temperature sensor specifications.

Output:	4-19mA
Range:	-50° C to + 50° C
Accuracy:	±0.2° F or ±0.1° C
Operating Voltage:	10-36VDC
Current Draw:	Same as sensor output
Warm Up Time:	5 seconds minimum
Operating Temperature:	-50°C to +100°C
Size of Probe:	¾" diameter x 4 ½" long
Weight:	½ lb.

- b. The sensor is a two-wire sensor using the red wire for power and the black wire for the output signal. **Warning: Always connect the sensor with the power turned off.**
- c. Do not install the temperature sensor in direct sunlight.
- d. To check the temperature sensor calibration you will need:

1 thermometer
3 containers of water
1 power supply
1 current meter
Connecting wires as necessary

Connect the sensor to the power supply and current meter in the following way. Attach the black wire to the positive input of the current meter. Connect the ground terminal of the power supply to the ground of the current meter. Attach the red wire to the positive terminal of the power supply. **Warning: Always connect the sensor with the power turned off.**

See Appendix A for the temperature calibration worksheet.





X. Solar Shield

a. Solar Shield specifications.

Size: 4" diameter x 8 1/2" long
Weight: 1 lb.

- b. The solar shield is used to protect sensors, typically humidity and temperature, from direct sunlight. Insert a sensor into one of the two holes located on the underside of the shield. The shield provides a friction lock so the sensors will not accidentally fall out. The sensors can be removed by firmly twisting and pulling them out of the solar shield.
- c. The shield comes with a stainless steel elbow that can be mounted on a 1" diameter tube. For best results ensure that the shield is mounted vertically.

XI. Maintenance

- a. Global Water recommends confirming the calibration annually.
- b. The sensors should be cleaned periodically. Sensors can be cleaned using a damp cotton cloth. NOTE: DO NOT submerge sensors. The sensors are water resistant, not water proof.





XII. Trouble Shooting

Issue: Sensor reading incorrectly

- a. Verify power source is supplying correct voltage.
- b. Clean the sensor.
- c. Confirm the sensor's calibration.

Other issues

- d. Call Global Water for tech support: 800-876-1172 or 979-690-5560 (many problems can be solved over the phone). Fax: 979-690-0440 or Email: globalw@globalw.com.

When calling for tech support, please have the following information ready:

1. Model #.
2. Unit serial number.
3. P.O.# the equipment was purchased on.
4. Our sales number or the invoice number.
5. Repair instructions and/or specific problems relating to the product.

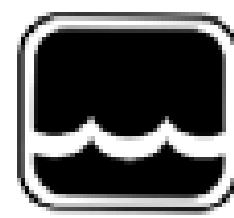
Be prepared to describe the problem you are experiencing including specific details of the application, installation, and any additional pertinent information.

- e. In the event that the equipment needs to be returned to the factory for any reason, please call to obtain an RMA# (Return Material Authorization). Do not return items without an RMA# displayed on the outside of the package.

Clean and decontaminate the sensor if necessary.

Include a written statement describing the problems.

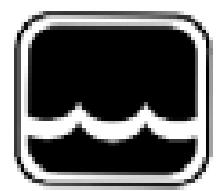




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Send the package with shipping prepaid to our factory address. Insure your shipment, Global Water's warranty does not cover damage incurred during transit.

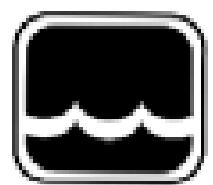




XIII. Warranty

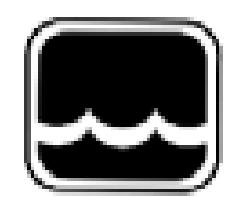
- a. Global Water Instrumentation, Inc. warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from factory. Global Water's obligations under this warranty are limited to, at Global Water's option: (I) replacing or (II) repairing; any products determined to be defective. In no case shall Global Water's liability exceed the products original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by Global Water Instrumentation, Inc., or which has been subject to misuse, negligence or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.
- b. The warranty begins on the date of your invoice.





XIV. Appendix A: Temperature Calibration check

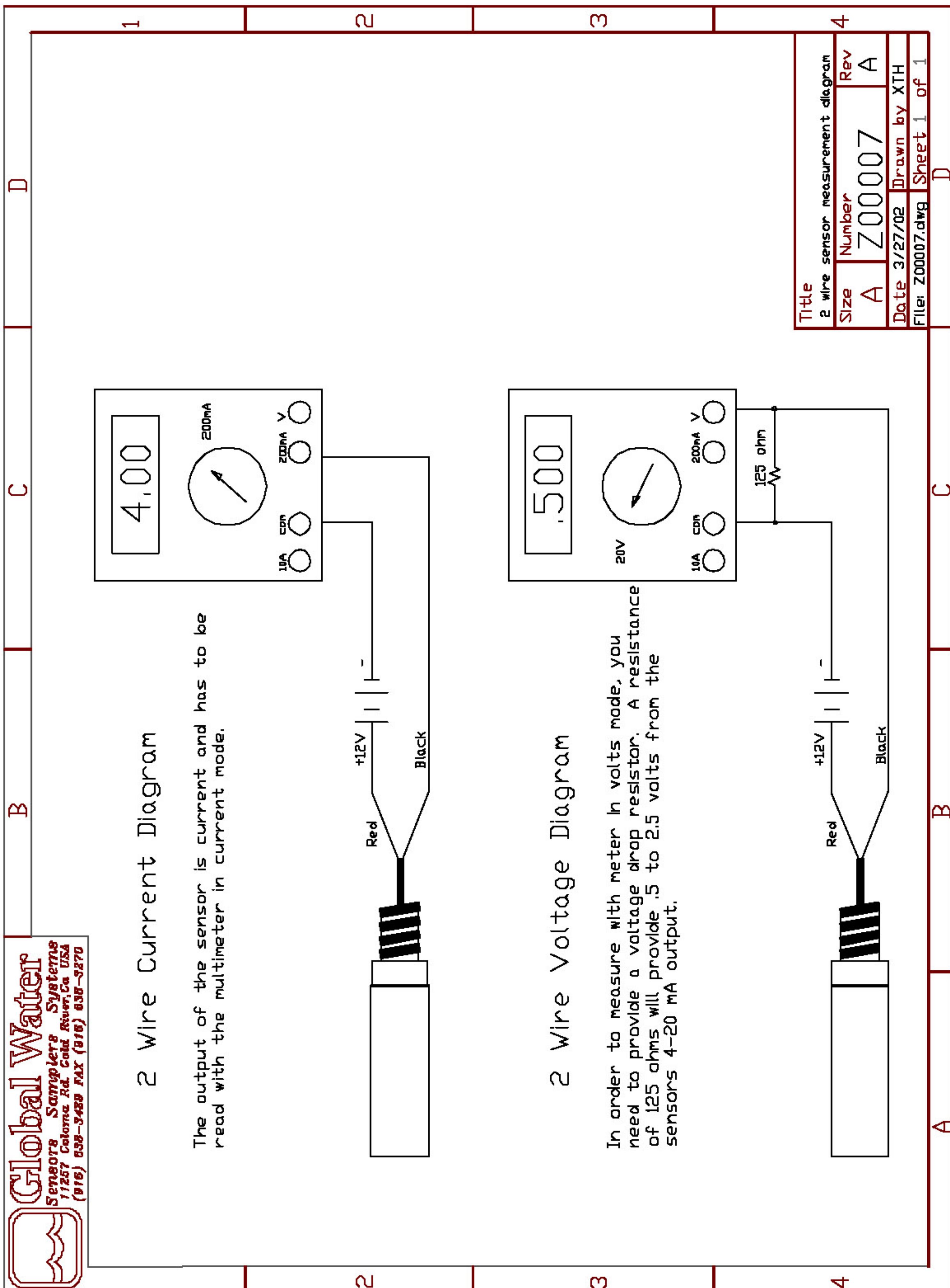
- Step 1) Fill a container of water with enough ice that it will not melt quickly.
- Step 2) Place the temperature sensor and thermometer into the container. Turn on the power supply and the current meter. Let the sensor stabilize for 30 minutes before taking any measurements.
- Step 3) Record the ice bath temperature, $I_T = \underline{\hspace{2cm}}$, and record the output current of the sensor, $I_C = \underline{\hspace{2cm}}$.
- Step 4) Fill a container with enough warm water that it will not cool down quickly.
- Step 5) Place the temperature sensor and thermometer into the container. Turn on the power supply and the current meter. Let the sensor stabilize for 30 minutes before taking any measurements.
- Step 6) Record the warm water temperature, $W_T = \underline{\hspace{2cm}}$, and record the output current of the sensor, $W_C = \underline{\hspace{2cm}}$.
Subtract I_C from W_C , $W_C - I_C = \underline{\hspace{2cm}} = C$.
- Step 7) Subtract I_T from W_T , $W_T - I_T = \underline{\hspace{2cm}} = T$.
- Step 8) Calculate B. $W_C - (C/T)(W_T) = \underline{\hspace{2cm}} = B$.
- Step 9) Find the low current value for the sensor. $-(C/T)(50) + B = \underline{\hspace{2cm}} = L_C$. This current is the output current the sensor would produce if the temperature were -50°C .
- Step 10) Find the high current value for the sensor. $(C/T)(50) + B = \underline{\hspace{2cm}} = H_C$. This current is the output current the sensor would produce if the temperature were 50°C .
- Step 11) Use these new current values to recalibrate the system that is monitoring the sensor output.



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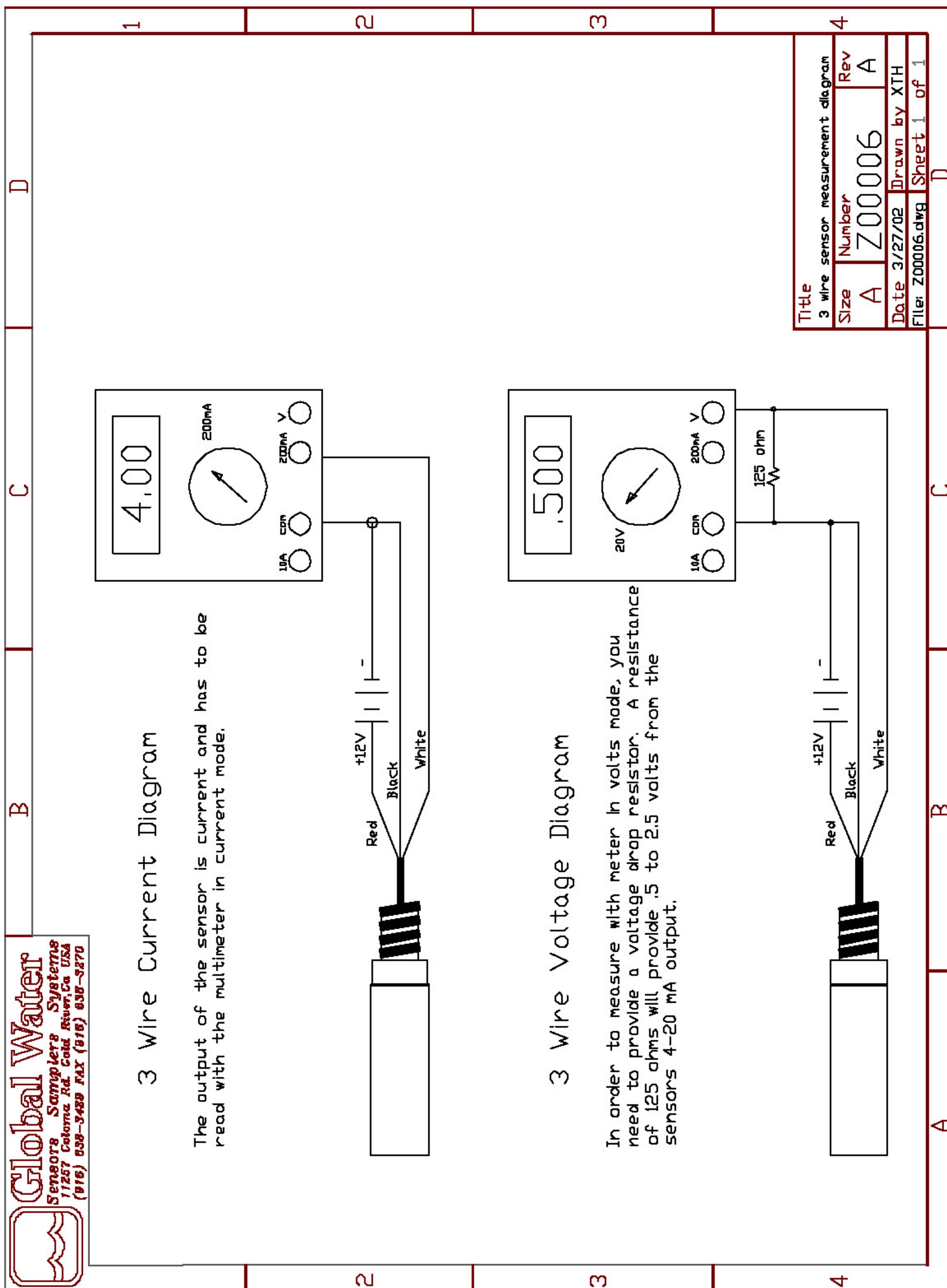
XV. Appendix B: 2 Wire Sensor Measurement Diagram





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XVI. Appendix C: 3 Wire Sensor Measurement Diagram





625S

Model D

Parts List

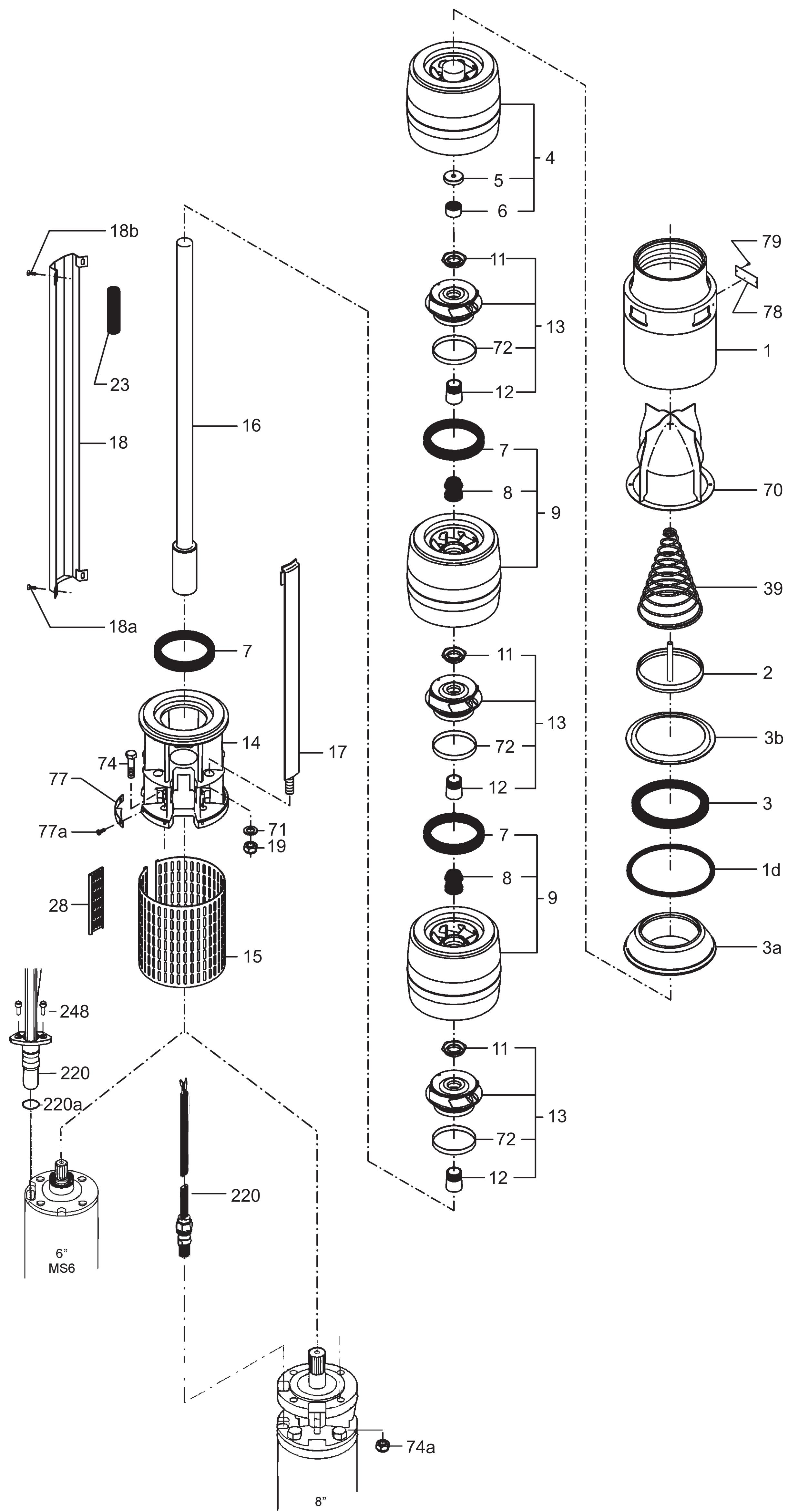
6•8•10" Submersibles

Contents

- Parts List
- Special Tools
- Standard Tools
- Part Dimensions



Exploded View 625S



Pos. No.	Part Description	MODEL HP x 10 Stages			No. Used	Comments/Dimensions	B.O.M. Ref. No.	Material No.	Included in kits ?
PARTS LIST									
1	Valve Housing	150-1000	1A-5	1	304 SS, 6" NPT		175136	95062161	NO
1d	O-ring for Valve Housing	1250-1500	6AA-7	1	304 SS, 6" NPT		175137		NO
		150-1500	1A-7	1	NBR, 164.5 x 3mm		96417830		YES
		150-1500	1A-7	1	FKM, 164.5 x 3mm		96426567		NO
2	Check Valve Cup	150-1500	1A-7	1	304 SS		175148		NO
3	Check Valve Seat	150-1500	1A-7	1	NBR		170143	96591622	YES
		150-1500	1A-7	1	FKM		170153		NO
3a	Lower Valve Seat Retainer	150-1000	1A-5	1	316 SS		170675		NO
		1250-1500	6AA-7	1	316 SS		170677		NO
3b	Upper Valve Seat Retainer	150-1500	1A-7	1	304 SS		170144		NO
4	Top Chamber cpl.w/pos.5 & 6	150-1500	1A-7	1	304 SS, NBR		175152	96551495	NO
		150-1500	1A-7	1	304 SS, FKM		175155		NO
5	Stop Disk	150-1500	1A-7	1	HY22		170137	96551236	YES
6	Upper Bearing	150-1500	1A-7	1	316 SS, NBR		175607	96591607	YES
		150-1500	1A-7	1	316 SS, FKM		175649		YES
7	Neck Ring	150-1500	1A-7	# stages	NBR		175115	95061620	YES
		150-1500	1A-7	# stages	FKM		175150		YES
8	Intermediate Bearing	300-1500	2AA-7	# stgs-1	NBR		170201	95061494	YES
		300-1500	2AA-7	# stgs-1	FKM		170255		YES
9	Intermediate Chamber cpl.w/pos.7 & 8	300-1500	2AA-7	#stgs-1	304 SS, NBR, (96591608= 1 pc)		175102	96591608	NO
		300-1500	2AA-7	#stgs-1	304 SS, NBR, (97757881= 5 pc)		175102	97757881	NO
		300-1500	2AA-7	#stgs-1	304 SS, FKM		175156		NO
11	Split Cone Nut	150-1500	1A-7	#stgs	316 SS		170570		YES
12	Split Cone	150-1500	1A-7	#stgs	316 SS		170214		YES
13	Impeller	250-1500	1-7	#stgs-red.	Full dia. w/ pos. 11 , 12 & 72, 304 SS (97506694 = 1 pc)		175153	97506694	NO
		250-1500	1-7	#stgs-red.	Full dia. w/ pos. 11 , 12 & 72, 304 SS (97506697 = 5 pc)		175153	97506697	NO
		150-1500	1A-7	max.2 red.	A Red. dia. w/pos. 11, 12 & 72, 304 SS (97506727 = 1 pc)		175154	97506727	NO
		150-1500	1A-7	max.2 red.	A Red. dia. w/pos. 11, 12 & 72, 304 SS (97506741 = 5 pc)		175154	97506741	NO
14	Suction Interconnector (Inlet), 6" motor	150-600	1A-3	1	304C15 Cast SS		170683	96551493	NO
	Suction Interconnector (Inlet), 8" motor	300-1500	2AA-7	1	304C15 Cast SS		170685		NO
15	Strainer	150-1500	1A-7	1	304 SS		170014	95062191	NO
		150-1500	1A-7	1	304 SS, Y-Delta		170016		NO
16	Shaft, for 6" motor	150-250	1	1	431 SS, Tip to tip Length=320.5mm		00176A01		NO
		300-400	2	1	431 SS, Tip to tip Length=476.0mm		00176A02		NO
		500-600	3	1	431 SS, Tip to tip Length=631.5mm		00176A03	96591620	NO
	Shaft, for 8" motor	300-400	2	1	431 SS, Tip to tip Length=475.5mm		00176C02		NO
		500-600	3	1	431 SS, Tip to tip Length=631.0mm		00176C03		NO
		750	4	1	431 SS, Tip to tip Length=786.5mm		00176C04		NO
		1000	5	1	431 SS, Tip to tip Length=942.0mm		00176C05		NO
		1250	6	1	431 SS, Tip to tip Length=1097.5mm		00176C06		NO
		1250-1500	7AA-7	1	431 SS, Tip to tip Length=1253.0mm		00176E07		NO
17	Strap	150-250	1	4	304 SS, Length= 454.5 (Tip to tip Length= 494.5mm)		208001		NO
		300-400	2	4	304 SS, Length= 610.0 (Tip to tip Length= 650.0mm)		208002		NO
		500-600	3	4	304 SS, Length= 765.5 (Tip to tip Length= 805.5mm)		208003		NO
		750	4	4	304 SS, Length= 921.0 (Tip to tip Length= 961.0mm)		208004		NO
		1000	5	4	304 SS, Length=1076.5 (Tip to tip Length= 1116.5mm)		208005		NO
		1250	6	4	304 SS, Length=1232.0 (Tip to tip Length= 1272.0mm)		208206		NO
		1250-1500	7AA-7	4	304 SS, Length=1387.5 (Tip to tip Length= 1427.5mm)		208207		NO
18	Cable Guard, for 6" Motor	150-250	1	1	316 SS, Length= 569.5mm		208501		NO
		300-400	2	1	316 SS, Length= 725.0mm		208502		NO
		500-600	3	1	316 SS, Length=880.5mm		208503		NO
	Cable Guard, for 8" Motor	300-400	2	1	316 SS, Length=725.0mm		208602		NO
		500-600	3	1	316 SS, Length=880.5mm		208603		NO
		750	4	1	316 SS, Length=1036.0mm		208604		NO
		1000	5	1	316 SS, Length=1191.5mm		208705		NO
		1250	6	1	316 SS, Length=1347.0mm		208706		NO
		1250-1500	7AA-7	1	316 SS, Length=1502.5mm		208707		NO
18a	Screw for Cable Guard	150-1500	1-7	4	M5 x 10mm, A4 (316 SS)		96413437		NO
19	Strap Nut	150-1500	1-7	4	M16 - NV22, 316 SS w/delta seal		96438759		NO
22a	Lock Washer	150-600	1-3	4	1/2" Helical, 18-8SS, for 6" Motor		00UW0006		YES
		300-1500	2-7	8	5/8" Helical, 18-8SS, for 8" Motor		00UW0002		YES
23	Rubber Motor Lead Guard for 6" motor	150-600	1-3	1	Ø20 x 0.7		130043		YES
	Rubber Motor Lead Guard for 8" motor	300-1500	2-7	1	Ø38 x 1		130099		YES
28	Lock for Strainer	150-1500	1-7	1	304 SS		160038		NO
39	Spring	150-1500	1-7	1	904L		170967		NO
70	Check Valve Guide	150-1500	1-7	1	304 SS, NBR		175142		NO
		150-1500	1-7	1	304 SS, FKM		175158		NO
71	Washer	150-1500	1-7	4	M16, Ø28 x Ø17, 2.5mm, 316 SS		160021		NO
72	Impeller Wear Ring	150-1500	1-7	#stgs	304SS (96535350= 2 pc)		170207	96535350	YES*
74	Motor Bolt	150-600	1-3	4	1/2" 20-UNF, NV19 x 1-3/4" SS, for 6" Motor		00UB0006		YES
74a	Staybolt	300-1500	2-7	4	5/8"-11 x 8.8 CM 18-8 SS, for 8" Motor		1800011		YES
77	Cover, Suction Interconnector	150-1500	1-7	8	5/8"-11 UNC, NV24, 18-8SS, for 8" Motor		0ID00164		YES
77a	Screw	150-1500	1-7	1	316 SS		200628		NO
78	Nameplate	150-1500	1-7	2	M5 x 10mm, A4 (316 SS)		96413437		NO
79	Rivet	150-1500	1-7	1	316 SS, 28mm x 97mm		984461		NO
		150-1500	1-7	2	304 SS, 3 x 5mm		96022882		NO

 Due to part changes over time, all position numbers (1-203) may not be used.

 This column indicates which pump model uses the spare part. If blank, the part is used in all models.

NOTES:

The "B.O.M. Ref. No." is the material number for the component used in the pump. The "Material Number" (if listed) is the item as a saleable packaged spare. Items which are not included in a kit, marked as "No" should be ordered by the Material Number. If a Material Number is not listed, then the item can be ordered by the "B.O.M. Ref. No." Items which are in a kit, marked as "YES" should be ordered in kit form. YES* (the asterisk) indicates the item in the kit is of upgraded materials.

arts List & Kits 625S

Key to Symbols

KITS Recommended spare part
Ø Diameter
CPL Complete Assembly – these parts consist of more than one component
FKM Fluoro Elastomer (generic for Viton)
HY22 Carbon & graphite filled PTFE
M International standard thread size designation (thread diameter in mm)
mm Millimeter
N Stamp code for 316 SS or similar
NBR Buna - N (also known as Nitrile) – an elastic substance similar to rubber
NPT National Pipe Thread
PTFE Teflon
R 904L
SS Stainless Steel
UNC Unified National Coarse – a standard for threads on bolts

Spare Part Kits

Since certain pump parts can be expected to exhibit wear at the same time as related pump parts, they have been grouped into the following kits for your convenience. The numbers indicate the quantity of the part within each kit. Please order these kits using the kit material number at the top of the columns.

Repair Kit - NBR

Kit: 1-4 stage

Kit No. 96440262

Kit: 5-6 stage

Kit No. 96440264

Kit: 7-10 stage

Kit No. 96440266

Pos. No.	Description	Material No.	Qty. Included in each Kit		
1d	O-ring, 134.5 x 3mm, NBR	96417830	1	1	1
3	Valve Seat, NBR	170143	1	1	1
5	Stop Ring Washer, HY22	170137	1	1	1
6	Bearing (upper), NBR, 904L	179991	1	1	1
7	Neck Ring, NBR	175115	4	6	10
8	Intermediate Bearing, NBR	170201	3	5	9
72	Wear Ring, 904L	170978	4	6	10

Repair Kit - FKM*

Kit: 1-4 stage

Kit No. 96440263

Kit: 5-6 stage

Kit No. 96440265

Kit: 7-10 stage

Kit No. 96440267

Pos. No.	Description	Material No.	Qty. Included in each Kit		
1d	O-ring, 134.5 x 3mm, NBR	96417830	1	1	1
5	Stop Ring Washer, HY22	170137	1	1	1
6	Bearing (upper), 316 SS, FKM	175649	1	1	1
7	Neck Ring, FKM	175150	4	6	10
8	Intermediate Bearing, FKM	170255	3	5	9
72	Wear Ring, 316 SS	170612	4	6	10

*FKM Kit does not include pos.3 - Check Valve Seat FKM 190097. Order separately, if needed.

Bolt - Nut Kits for attaching pump to motor

6" motor, 15 HP to 60 HP, Models/Stages 1-3

Kit No. 00UB9002

8" motor, 40 HP to 150 HP, Models/Stages 2-7

Kit No. 1800018

Pos. No.	Description	Material No.	Qty. Included in each Kit	
22a	Lock Washer, 1/2" Helical, SS	00UW0006	4	
	Lock Washer, 5/8" Helical, SS	00UW0002		8
23	Rubber Motor Lead Guard, 6" motor	130043	1	
	Rubber Motor Lead Guard, 8" motor	130099		1
74	Bolt, 1/2" 20-UNF, NV19 x 1-3/4" SS	00UB0006	4	
	Staybolt 5/8"-11 x 8.8 CM SS	1800011		4
74a	Nut, Hex 5/8"-11 UNC, NV24, 18-8 SS	0ID00164		8

Split Cone w/ Nut

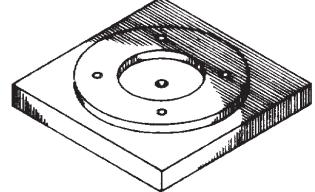
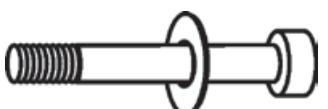
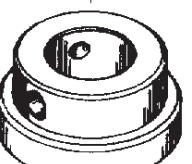
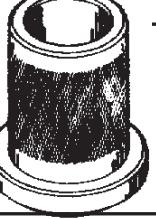
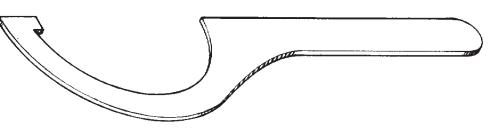
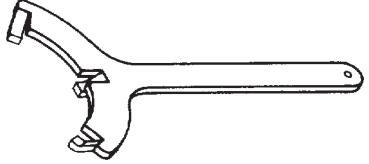
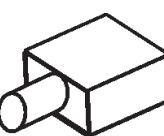
Kit No. 96903149

Pos. No.	Description	BOM Ref. No	Qty.
11	Split Cone Nut, 316 SS	170570	1
12	Split Cone, 316 SS	170214	1



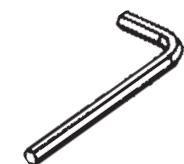
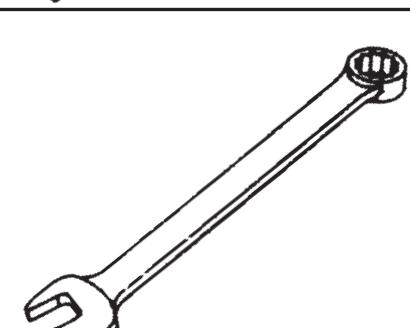
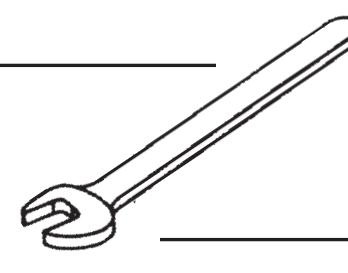
Special Tools

Tools not generally available from normal sources

Mat. No.	Description and Use
00SV0317	Wear Ring Holder 
00SV0049	Building Plate 
00SV0902 0SV00141	Shaft Spacing Pipe For 6" motors, Ø22/10.5 x 70.5 mm For 8" and 10" motors, Ø22/10.5 x 99 mm 
00SV0076 00SV0211	Shaft Holding Bolt For 6" motors, M10 x 110 mm For 8" and 10" motors, M10 x 140 mm 
00SV0874	Socket Spanner 
00SV0875	Split Cone Driver 
00SV5225	Wrench for Valve Seat Retainer 
00SV0137	Counter Tightening Wrench for Impeller 
00SV0402	Tap for Split Cone Nut Wrench 14 x 18 x Ø14 mm 
00SV0315	Punch/Driver for Bearing, Pos. 6, 6b 

Standard Tools

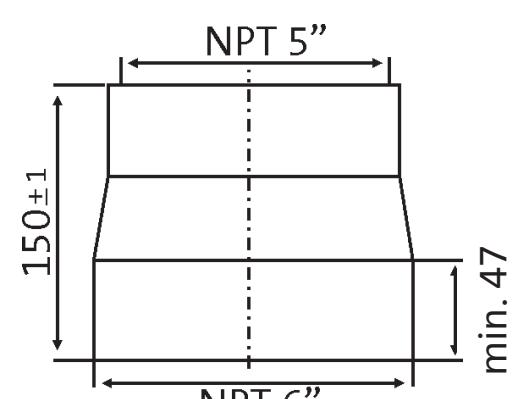
Comparable tools can be purchased through normal sources

Mat. No.	Description
00ID1205	Allen Wrench M10 - NV8, for 6" and 8" motors 
00SV0054 00SV0122 00SV0073 00SV0186	Wrench NV 19, for 6" motors NV 24, for 8" motors NV 30, for 10" M16 - NV 22 
00SV0230	Motor Cable Wrench NV 42 
00SV0500	Torque Wrench 75 - 400 Nm, 14 x 18 
00SV0522 00SV0519 00SV0524 00SV0530	Torque Wrench Socket M16 - NV 22, 14 x 18 for Straps M12 - NV 19, 14 x 18, for 6" motors M16 - NV 24, 14 x 18, for 8" motors M20 - NV 30, 14 x 18, for 10" motors 

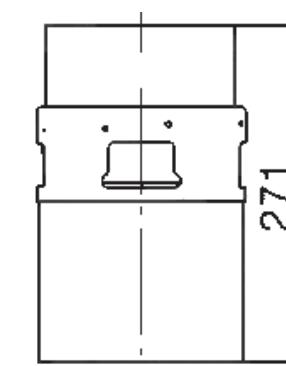
Part Dimensions

By position number. All dimensions in millimeters (mm)

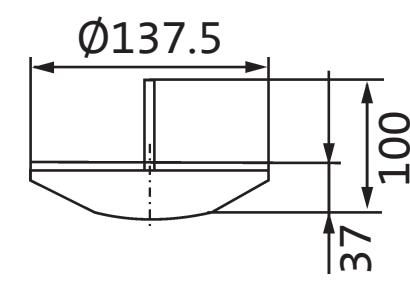
63 - Adapter for Discharge



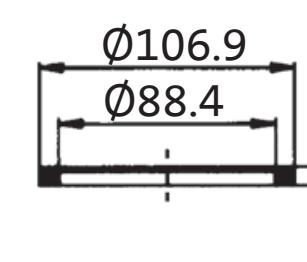
1 - Discharge Valve Housing



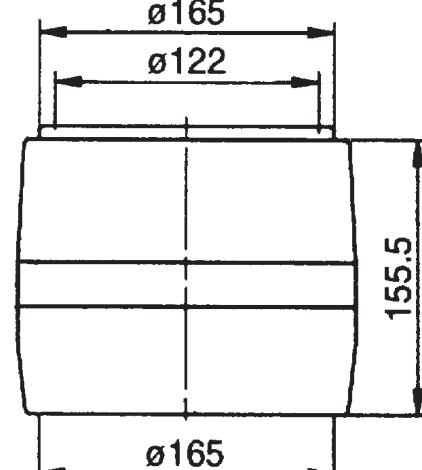
2 - Valve Cone



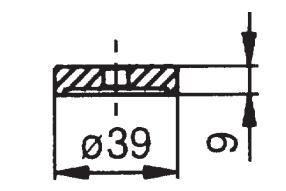
3 - Valve Seat



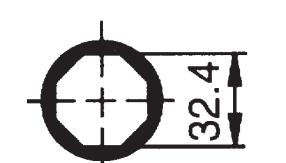
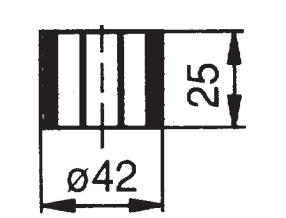
4, 9, 10 - Intermediate Chamber



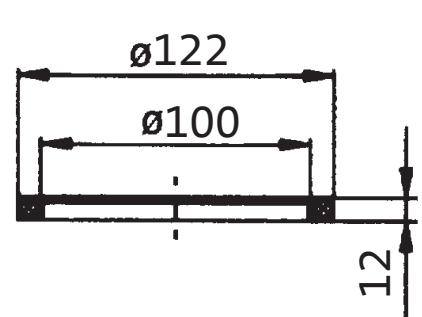
5 - Stop Disk



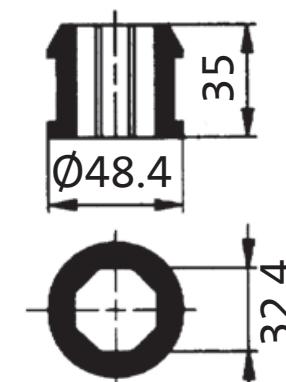
6 - Top Bearing



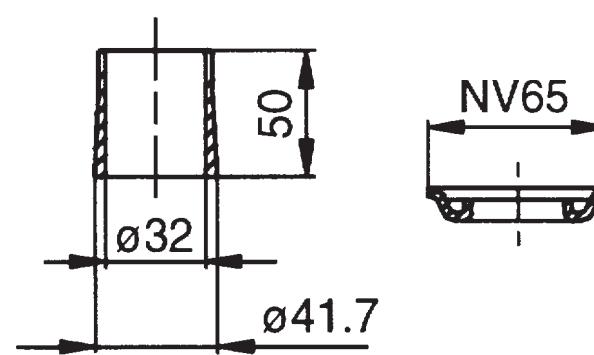
7 - Neck Ring



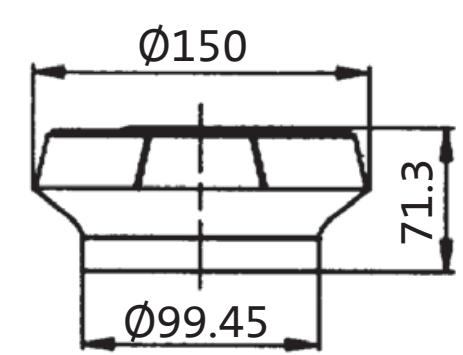
8 - Intermediate Bearing



11, 12 - Split Cone and Nut



13 - Impeller



BE > THINK > INNOVATE >

Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

L-SP-TL-115 09/10 | US
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GRUNDFOS 



SP

Stainless steel submersible pumps

6", 8", and 10"

Installation and operating instructions

(US)



LIMITED WARRANTY

Products manufactured by GRUNDFOS PUMPS CORPORATION (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 18 months from date of installation, but not more than 24 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos' manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Grundfos are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limit actions on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

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**Warning**

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

This booklet should be left with the owner of the pump for future reference and information regarding its operation.

Warning

The use of this product requires experience with and knowledge of the product. Persons with reduced physical, sensory or mental capabilities must not use this product, unless they are under supervision or have been instructed in the use of the product by a person responsible for their safety.

Children must not use or play with this product.

**1. Product introduction****1.1 Symbols used in this document****Warning**

If these safety instructions are not observed, it may result in personal injury!

Caution

If these safety instructions are not observed, it may result in malfunction or damage to the equipment!

Note

Notes or instructions that make the job easier and ensure safe operation.

1.2 Introduction

Your Grundfos SP submersible pump is of the utmost quality. Combined with proper installation, your Grundfos pump will give you many years of reliable service.

To ensure the proper installation of the pump, carefully read the complete manual before attempting to install the pump.

1.3 Delivery and handling**1.3.1 Delivery****Caution**

The pumps should remain in the packing until they are placed in vertical position during installation.

The shipping carton should contain:

- pump end
- motor
- cable
- control box
- nameplate.

Examine the components carefully to make sure no damage has occurred to the pump end, motor, cable or control box during shipment.

1.3.2 Handling

Your Grundfos SP pump should remain in its shipping carton until it is ready to be installed. The carton is specially designed to protect it from damage.

During unpacking and prior to installation, **make sure that the pump is not dropped or mishandled.**

The motor is equipped with an electrical cable.

Caution *Under no circumstance should the electrical cable be used to support the weight of the pump.*

You will find a loose data plate with an adhesive backing with the pump. The nameplate should be completed in pen and attached to the control box.

1.4 Applications

Grundfos Large SP submersible pumps are suitable for:

- Groundwater supply to waterworks
- irrigation in horticulture and agriculture
- groundwater lowering (dewatering)
- pressure boosting
- industrial applications
- domestic water supply.

1.5 Features and benefits

- State-of-the-art hydraulics provide high efficiency and low operating costs.
- 100 % stainless steel components inside and outside for long service life.
- Sand resistant.
- Resistant to aggressive water.
- Motor burnout protection via CU 301.
- Dry-running protection.
- Monitoring, protection and communication via protection unit MP204, and remote control, R100.

1.6 Identification

1.6.1 Type key

Example	475	S	500	-	5	-	A	B
Rated flow rate in gpm								
Type range								
Stainless steel parts of material								
S = AISI 304								
N = AISI 316								
R = AISI 904L								
Hp of motor								
Number of impellers								
First reduced-diameter impeller (A, B or C)								
Second reduced-diameter impeller (A, B or C)								

2. Operating conditions

Flow (Q):	Max. 1,400 gpm (318 m ³ /h)
Head (H):	Max. 2,100 ft (640 m)
Liquid temp:	+ 32 °F to + 140 °F (0 °C to +60 °C)
Install. depth	Max. 1,968 ft (599 m)

3. Installation

3.1 Pre-installation checklist

Before beginning installation, the following checks should be made:

- Condition of the well
- condition of the water
- installation depth
- electrical supply
- wire cable type.

These checks are all critical for the proper installation of this submersible pump.

3.1.1 Condition of the well

If the pump is to be installed in a new well, the well should be fully developed and bailed or blown free of cuttings and sand. The stainless steel construction of the Grundfos submersible make it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy water.

If this pump is used to replace an oil-filled submersible or oil-lubricated line-shaft turbine in an existing well, **the well must be blown or bailed clear of oil.**

Determine the maximum depth of the well, and the draw-down level at the pump's maximum capacity. Pump selection and setting depth should be based on this data.

The inside diameter of the well casing should be checked to ensure that it is not smaller than the size of the pump and motor.

3.1.2 Pumped liquids

Submersible pumps are designed for pumping clear and cold water that is free of air and gasses and clean, thin **non-explosive** liquids without solid particles or fibers. Decreased pump performance and life expectancy can occur if the water is not cold and clear or contains air and gasses.

Maximum water temperature should not exceed +102 °F (+38 °C). Special consideration must be given to the pump and motor if it is to be used to pump water above 102 °F (+38 °C).

The Grundfos stainless steel submersible is highly resistant to the normal corrosive environment found in some water wells. If water well tests determine the water has an excessive or unusual corrosive quality, or exceeds 102 °F (+38 °C), contact your Grundfos representative for information concerning specially designed pumps for these applications.

3.2 Preparation

Warning

Before starting work on the pump, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.



3.2.1 Checking of liquid in motor

The SP submersible motors are factory-filled with a special non-poisonous liquid, which is frost-proof down to -4°F (-20°C).

Note

The level of the liquid in the motor must be checked and the motor must be refilled, if required. Use clean water.

Caution

If frost protection is required, special Grundfos liquid must be used to refill the motor. Otherwise clean water may be used for refilling (however, never use distilled water).

Refilling of liquid is carried out as described below.

3.2.2 Grundfos submersible motors MS 4000 and MS 402

The filling hole for motor liquid is placed in the following positions:

MS 4000: in the top of the motor.

MS 402: in the bottom of the motor.

1. Position the submersible pump as shown in fig. 1.
The filling screw must be at the highest point of the motor.
2. Remove the screw from the filling hole.
3. Inject liquid into the motor with the filling syringe, fig. 1, until the liquid runs back out of the filling hole.
4. Replace the screw in the filling hole and tighten securely before changing the position of the pump.

Torques:

MS 4000: 3.0 Nm.

MS 402: 2.0 Nm.

The submersible pump is now ready for installation.

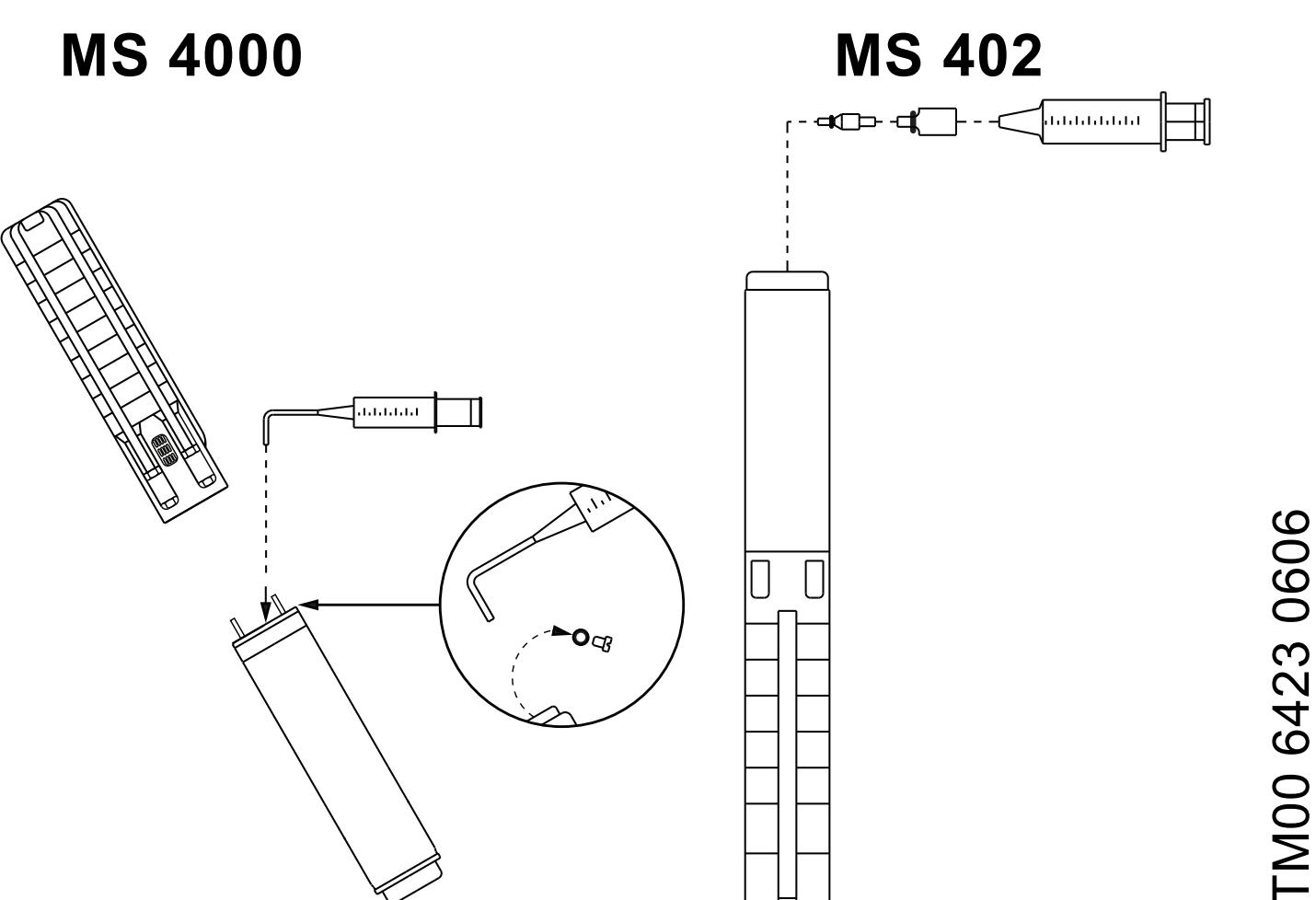


Fig. 1 Pump position during filling – MS 4000 and MS 402

3.2.3 Grundfos submersible motors MS6 and MS 6000

- If the motor is delivered from stock, the liquid level must be checked before the motor is fitted to the pump, see fig. 2.
- On pumps delivered directly from Grundfos, the liquid level has already been checked.

- In the case of service, the liquid level must be checked, see fig. 2.

Filling procedure:

The filling hole for motor liquid is placed at the top of the motor.

1. Position the submersible pump as shown in fig. 2.
The filling screw must be at the highest point of the motor.
2. Remove the screw from the filling hole.
3. Inject liquid into the motor with the filling syringe, fig. 2, until the liquid runs back out of the filling hole.
4. Replace the screw in the filling hole and tighten securely before changing the position of the pump.

Torque: 3.0 Nm.

The submersible pump is now ready for installation.

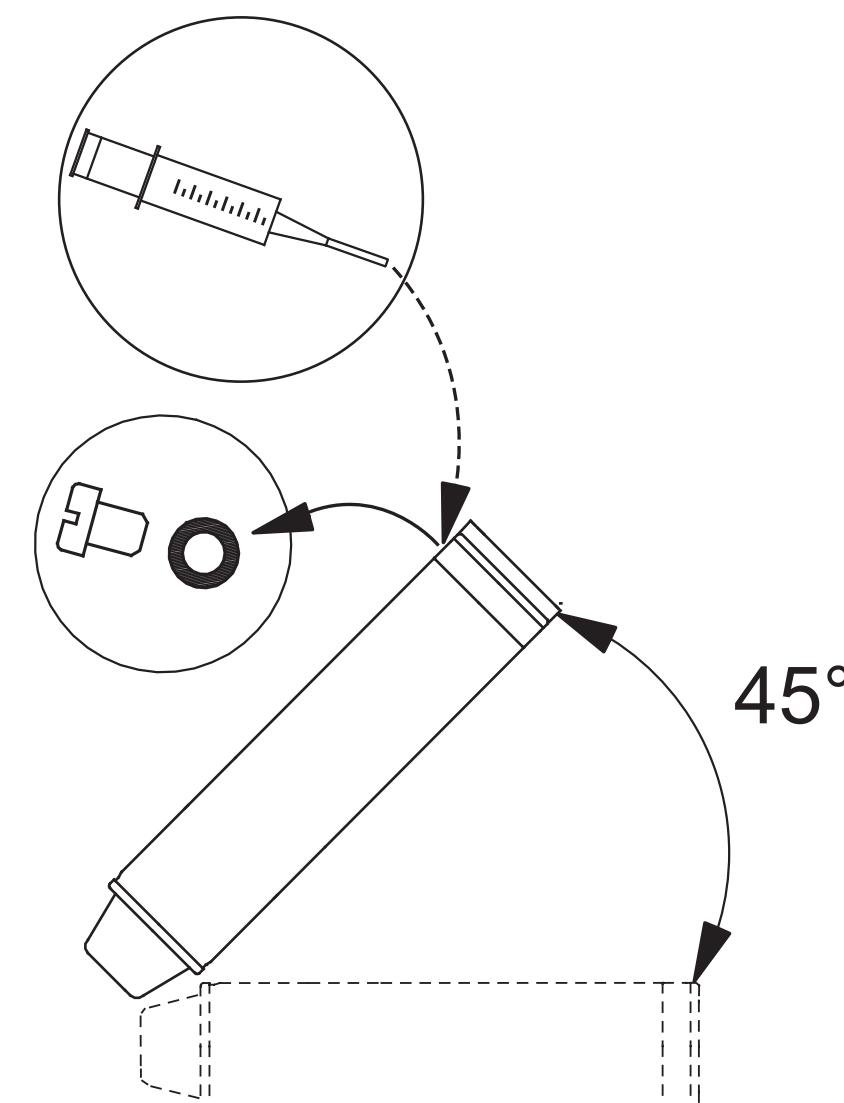


Fig. 2 Motor position during filling – MS6 and MS 6000

3.2.4 Grundfos submersible motors MMS 6000, MMS 8000, MMS 10000 and MMS 12000

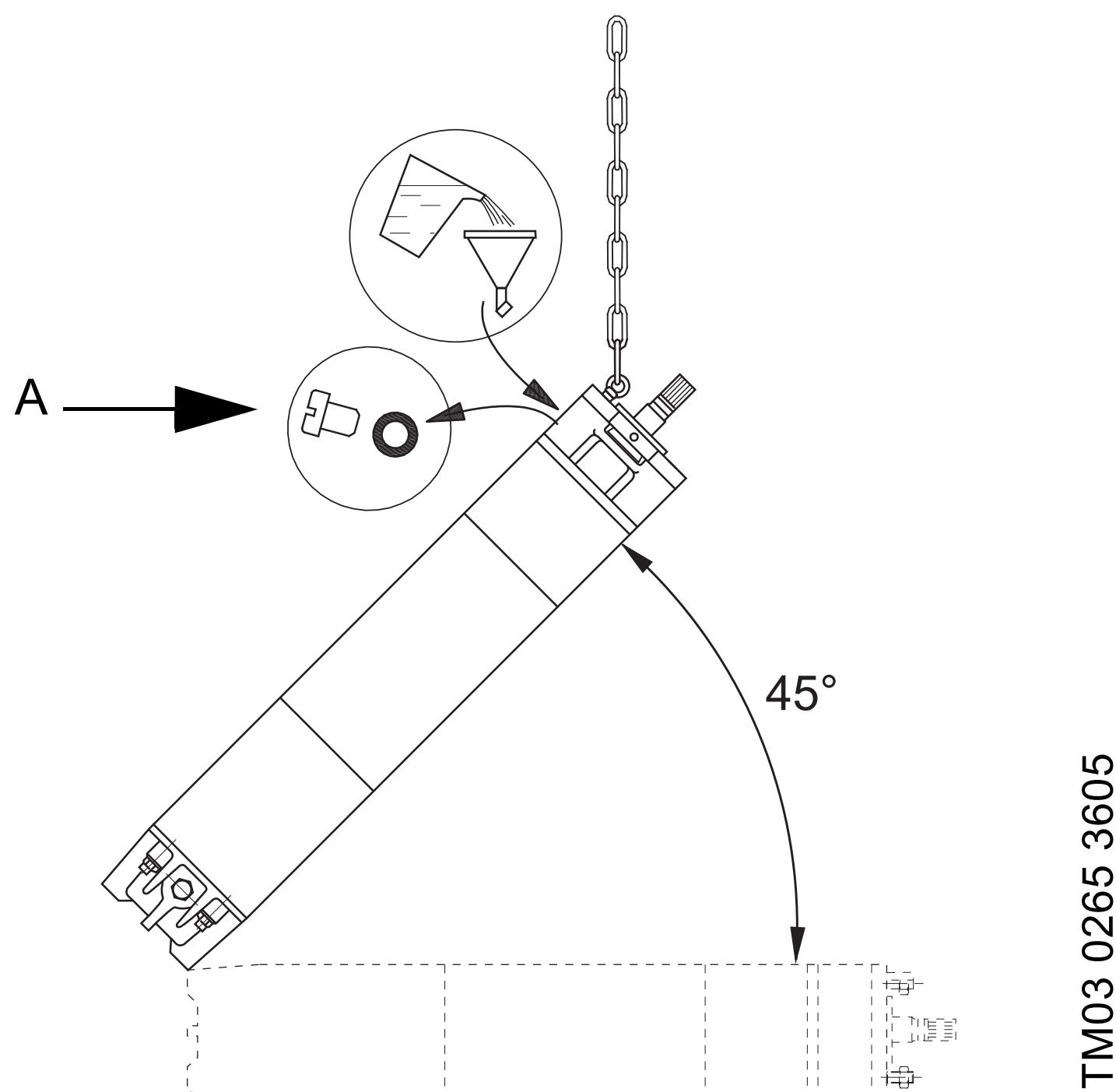
Filling procedure:

1. Place the motor at a 45° angle with the top of the motor upwards, see fig. 3.
2. Unscrew the plug A and place a funnel in the hole.
3. Pour tap water into the motor until the motor liquid inside the motor starts running out at A.
Caution: Do not use motor liquid as it contains oil.
4. Remove the funnel and refit the plug A.

Before fitting the motor to a pump after a long period of storage, lubricate the shaft seal by adding a few drops of water and turning the shaft.

The submersible pump is now ready for installation.

US

**Fig. 3** Motor position during filling – MMS

3.2.5 Installation depth

A check should be made to ensure that the installation depth of the pump will always be at least (5) five to (10) ten feet (1.5 to 3 m) below the maximum draw-down level of the well. For flow rates exceeding 100 gpm (22.7 m³/h), refer to performance curves for recommended minimum submergence.

The bottom of the motor should never be installed lower than the top of the well screen or within five feet of the well bottom.

If the pump is to be installed in a lake, pond, tank or large diameter well, the water velocity passing over the motor must be sufficient to ensure proper motor cooling. The minimum recommended water flow rates which ensure proper cooling are listed in section 7.1 *Minimum water flow requirements for submersible pump motors* on p. 19.

3.2.6 Electrical supply

The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the actual electrical supply.

3.2.7 Wire cable type

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor may be solid or stranded. The cable may consist of individually insulated conductors twisted together, insulated conductors molded side by side in one flat cable or insulated conductors with a round overall jacket.

The conductor insulation should be type RW, RUW, TW, TWU or equivalent and must be suitable for use with submersible pumps. An equivalent Canadian Standards Association certified wire may also be used. See section 7.4 *Submersible pump cable selection chart (60 Hz)* on p. 21 for recommended sizes of cable lengths.

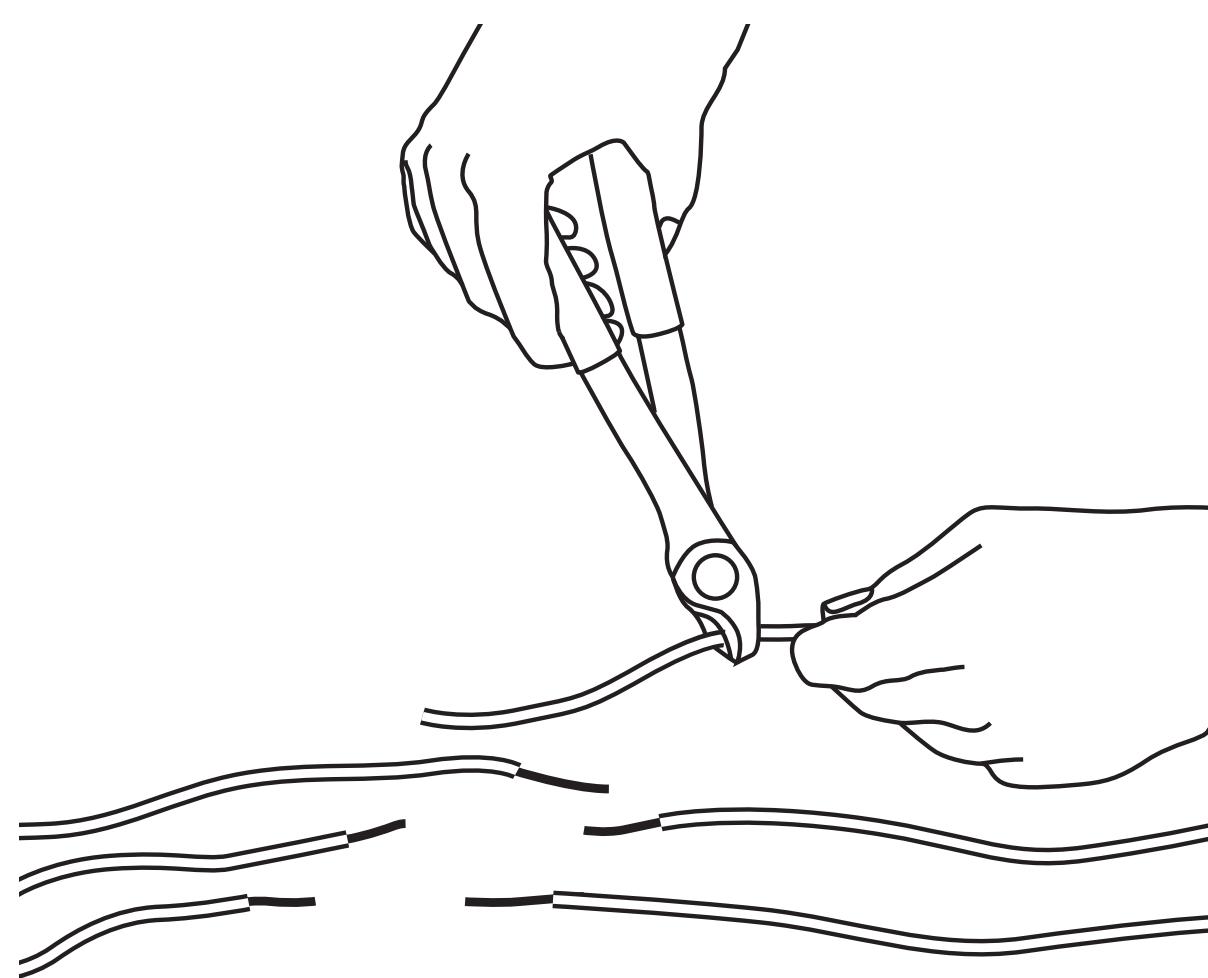
3.3 Splicing the motor cable

Note

A good cable splice is critical to proper operation of the submersible pump and must be done with extreme care.

If the splice is carefully made, it will work as well as any other portion of the cable, and will be completely watertight. Grundfos recommends using a heat shrink splice kit. The splice should be made in accordance with the kit manufacturer's instructions. Typically a heat shrink splice can be made as follows:

1. Examine the motor cable and the drop cable carefully for damage.
2. Cut the motor leads off in a staggered manner. Cut the ends of the drop cable so that the ends match up with the motor leads; see fig. 4. On single-phase motors, be sure to match the colors.
3. Strip back and trim off 1/2 inch of insulation from each lead, making sure to scrape the wire bare to obtain a good connection. Be careful not to damage the copper conductor when stripping off the insulation.
4. Slide the heat shrink tubing on to each lead. Insert a properly sized "Sta-kon" type connector on each lead, making sure that lead colors are matched. Using a "Sta-kon" crimping pliers, indent the lugs; see fig. 5. Be sure to squeeze hard on the pliers, particularly when using large cable.
5. Center the heat shrink tubing over the connector. Using a propane torch, lighter, or electric heat gun, uniformly heat the tubing starting first in the center working towards the ends; see fig. 6.
6. Continue to apply the heat to the tubing using care not to let the flame directly contact the tubing. When the tubing shrinks and the sealant flows from the ends of the tubing, the splice is complete; see fig. 7.



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Fig. 4 Cutting and stripping the motor leads

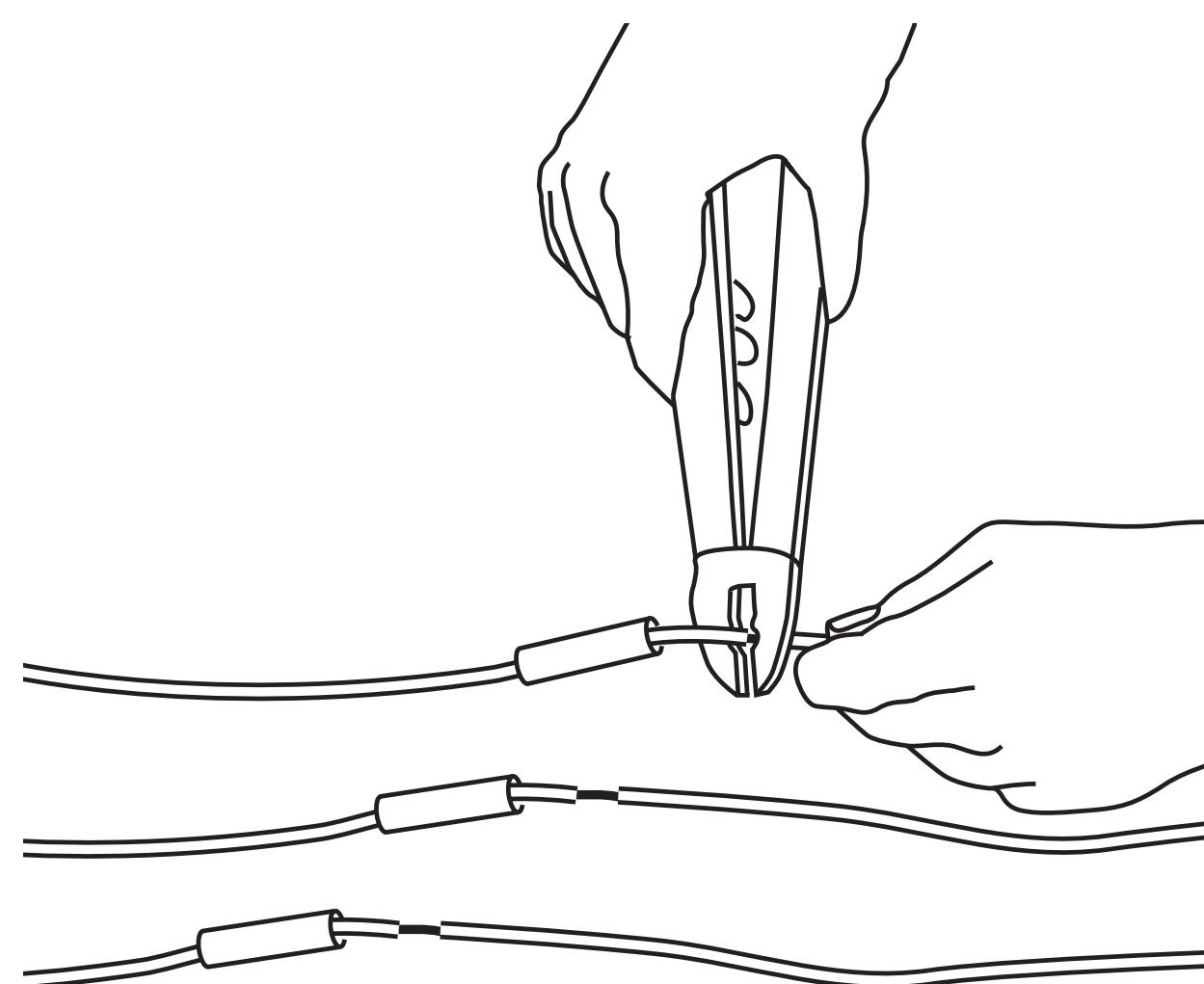


Fig. 5 Crimping the connectors

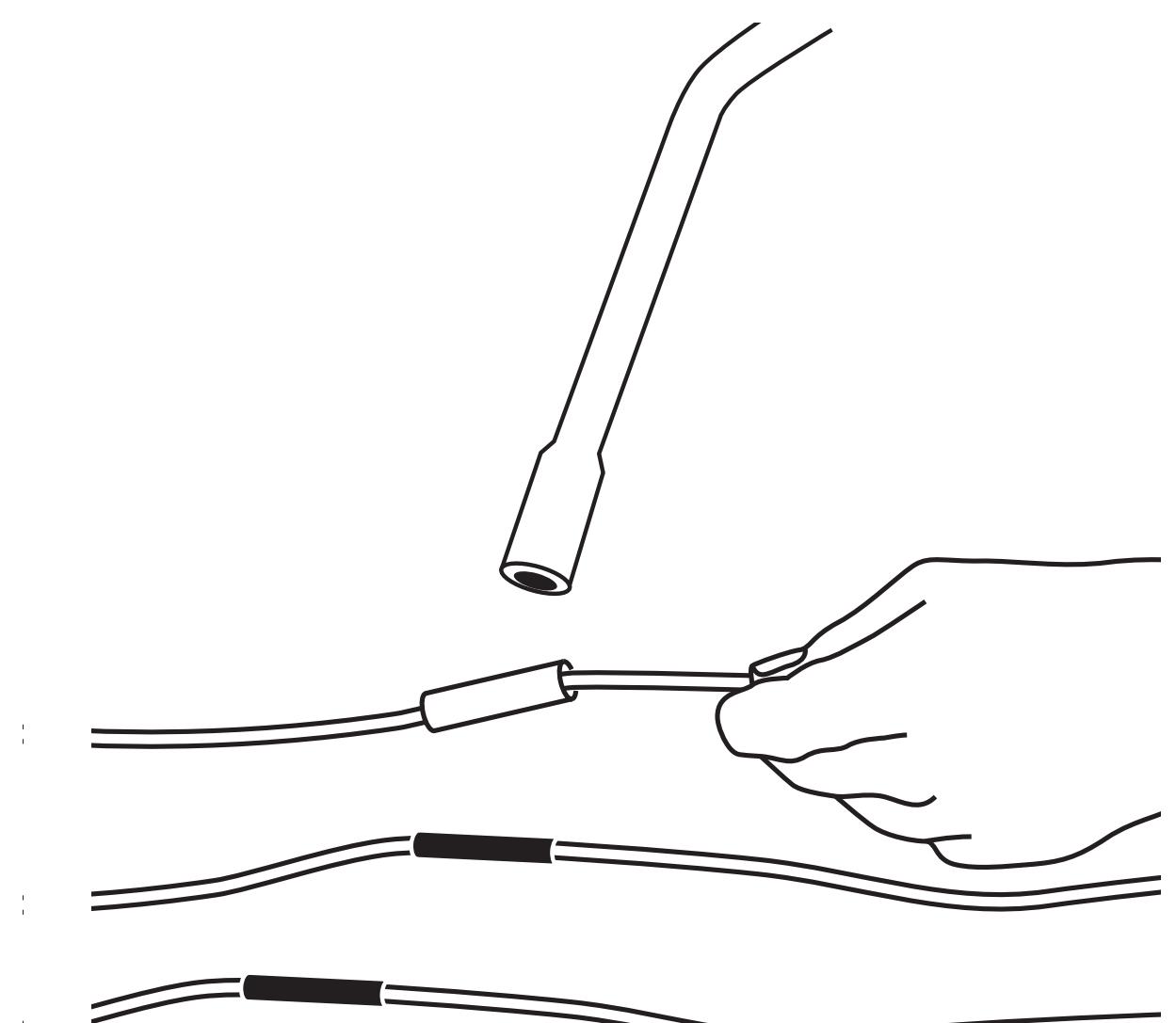


Fig. 6 Applying heat to the connector

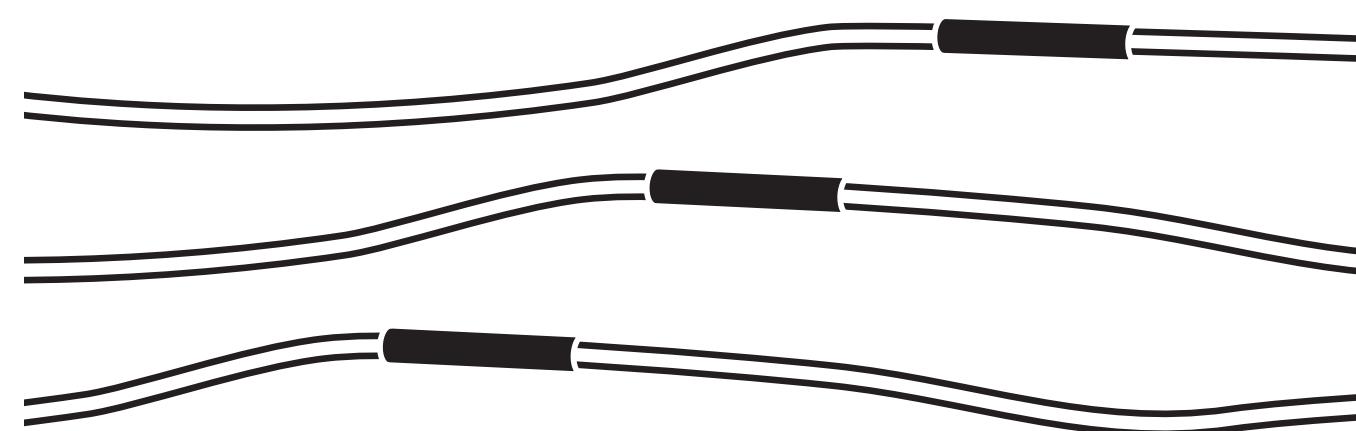


Fig. 7 Completed splices

3.4 Riser pipe

The riser pipe or hose should be properly sized and selected based on estimated flow rates and friction-loss factors.

3.4.1 If an adapter is required

It is recommended to first install the drop pipe to the pipe adapter. Then install the drop pipe with the adapter to the pump discharge.

A back-up wrench should be used when the riser pipe is attached to the pump. The pump should be gripped only by the flats on the top of the discharge chamber. The body of the pump, cable guard or motor should not be gripped under any circumstance.

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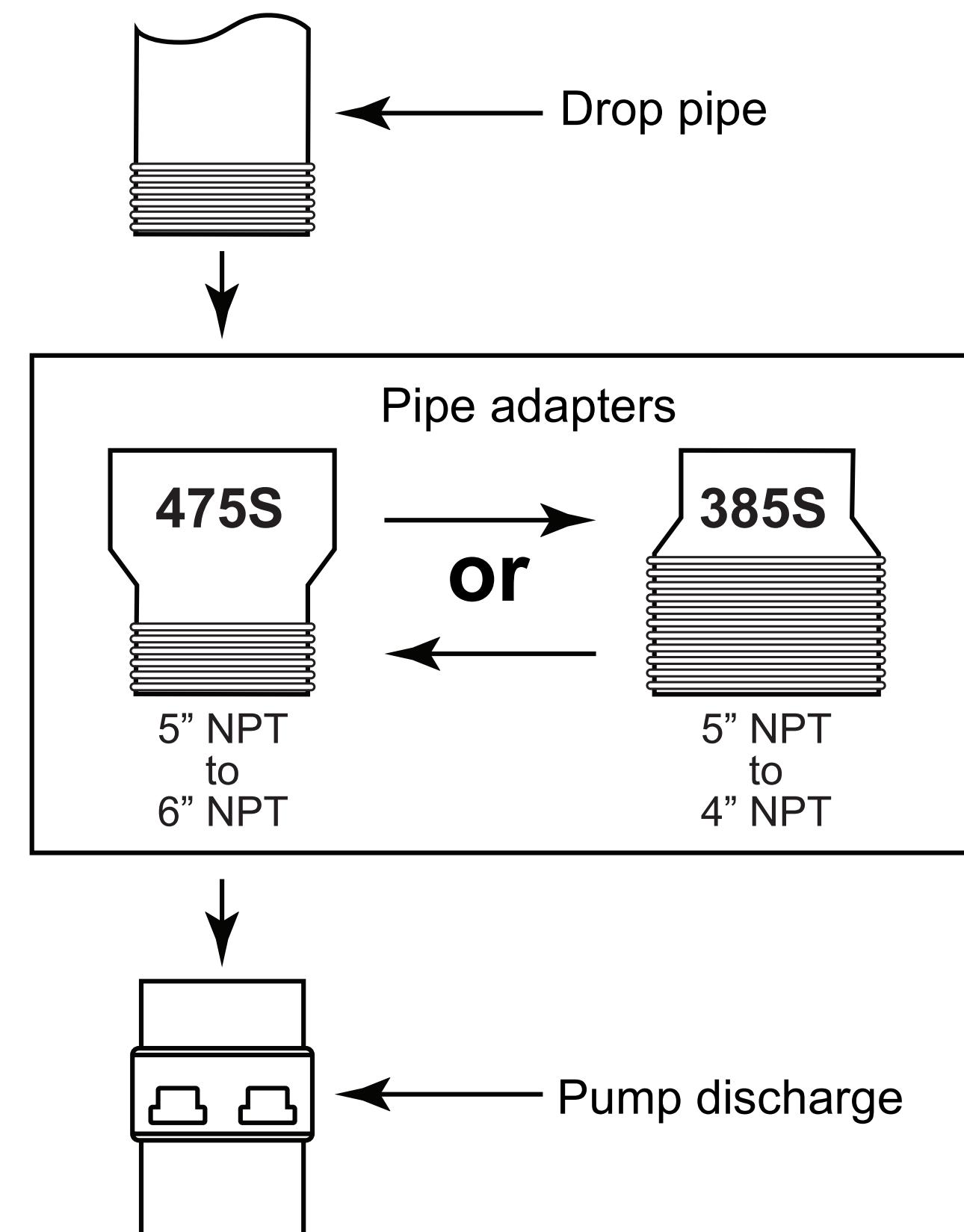


Fig. 8 Pipe adapters

3.4.2 If steel riser pipe is used

We recommend that steel riser pipes always be used with the larger submersibles. An approved pipe thread compound should be used on all joints. Make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joins when stopping and starting.

When tightened, the first section of the riser pipe must not come in contact with the check valve retainer in the discharge chamber of the pump.

After the first section of the riser pipe has been attached to the pump, the lifting cable or elevator should be clamped to the pipe. **Do not clamp the pump.**

When raising the pump and riser section, be careful not to place bending stress on the pump by picking it up by the pump end only.

Make sure that the electrical cables are not cut or damaged in any way when the pump is being lowered in the well.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping or possible cable damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above and below the splice.

3.4.3 If plastic or flexible riser pipe is used

It is recommended that plastic type riser pipe be used only with the smaller domestic submersibles.

When plastic riser pipe is used, it is recommended that a safety cable be attached to the pump to lower and raise it.

Caution

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Warning

Important: Plastic and flexible pipe tend to stretch under load. This stretching must be taken into account when securing the cable to the riser pipe. Leave 3 to 4 inches of slack between clips or taped points to allow for this stretching. This tendency for plastic and flexible pipe to stretch will also affect the calculation of the pump setting depth. As a general rule, you can estimate that plastic pipe will stretch to approximately 2 % of its length. For example, if you installed 200 feet (61 m) of plastic riser pipe, the pump may actually be down 204 feet (62 m). If the depth setting is critical, check with the manufacturer of the pipe to determine who to compensate for pipe stretch.

The pipe manufacturer or representative should be contacted to insure the pipe type and physical characteristics are suitable for this use.

Use the correct joint compound recommended by the pipe manufacturer. In addition to making sure that joints are securely fastened, the use of a torque arrester is recommended when using plastic pipe.

Do not connect the first plastic or flexible riser section directly to the pump. Always attach a metallic nipple or adapter into the discharge chamber of the pump. When tightened, the threaded end of the nipple or adapter must not come in contact with the check valve retainer in the discharge chamber of the pump.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping and possible cable damage. Nylon cable clips or waterproof tape may be used. The cable splice should be protected by securing it with clips or tape just above each joint.

Check valves:

A check valve should always be installed at the surface of the well. In addition, for installations deeper than 200 feet (61 m), check valves should be installed at no more than 200 foot (61 m) intervals.

Protect the well from contamination:

To protect against surface water entering the well and contaminating the water source, the well should be finished off above grade, and a locally approved well seal or pitless adapter unit utilized.

3.5 Electrical

Warning

USA: All electrical work should be performed by a qualified electrician and installed in accordance with the National Electrical Code, local codes and regulations.

**Warning**

Canada: All electrical work should be performed by a qualified electrician and installed in accordance with the Canadian Electrical Code, local codes and regulations.

**Warning**

To reduce the risk of electrical shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump, to the grounding screw provided within the wiring compartment.



Verification of the electrical supply should be made to ensure the voltage, phase and frequency match that of the motor. Motor voltage, phase, frequency and full-load current information can be found on the nameplate attached to the motor. Motor electrical data can be found in section 7.6.1 Grundfos submersible pump motors - 60 Hz on p. 24.

**Warning**

If voltage variations are larger than +/-10%, do not operate the pump.

Direct on-line starting is used due to the extremely fast run-up time of the motor (0.1 second maximum), and the low moment of inertia of the pump and motor. Direct on-line starting current (locked rotor amp) is between 4 and 6.5 times the full-load current.

If direct on-line starting is not acceptable and reduced starting current is required, an autotransformer or resistant starters should be used for 5 to 30 Hp motors (depending on cable length). For motors over 30 Hp, use auto-transformer starters.

3.5.1 Engine-driven generators

If the submersible pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contracted to ensure the proper generator is selected and used. See section 7.2 Guide for engine-driven generators in submersible pump applications on p. 19 for generator sizing guide.

If power is going to be supplied through transformers, section 7.3 Transformer capacity required for three-phase submersible pump motors on p. 20 outlines the minimum KVA rating and capacity required for satisfactory pump operation.

3.5.2 Control box/panel wiring

Single-phase motors

Single-phase motors must be connected as indicated in the motor control box.



A typical single-phase wiring diagram using a Grundfos control box is shown in fig 9.

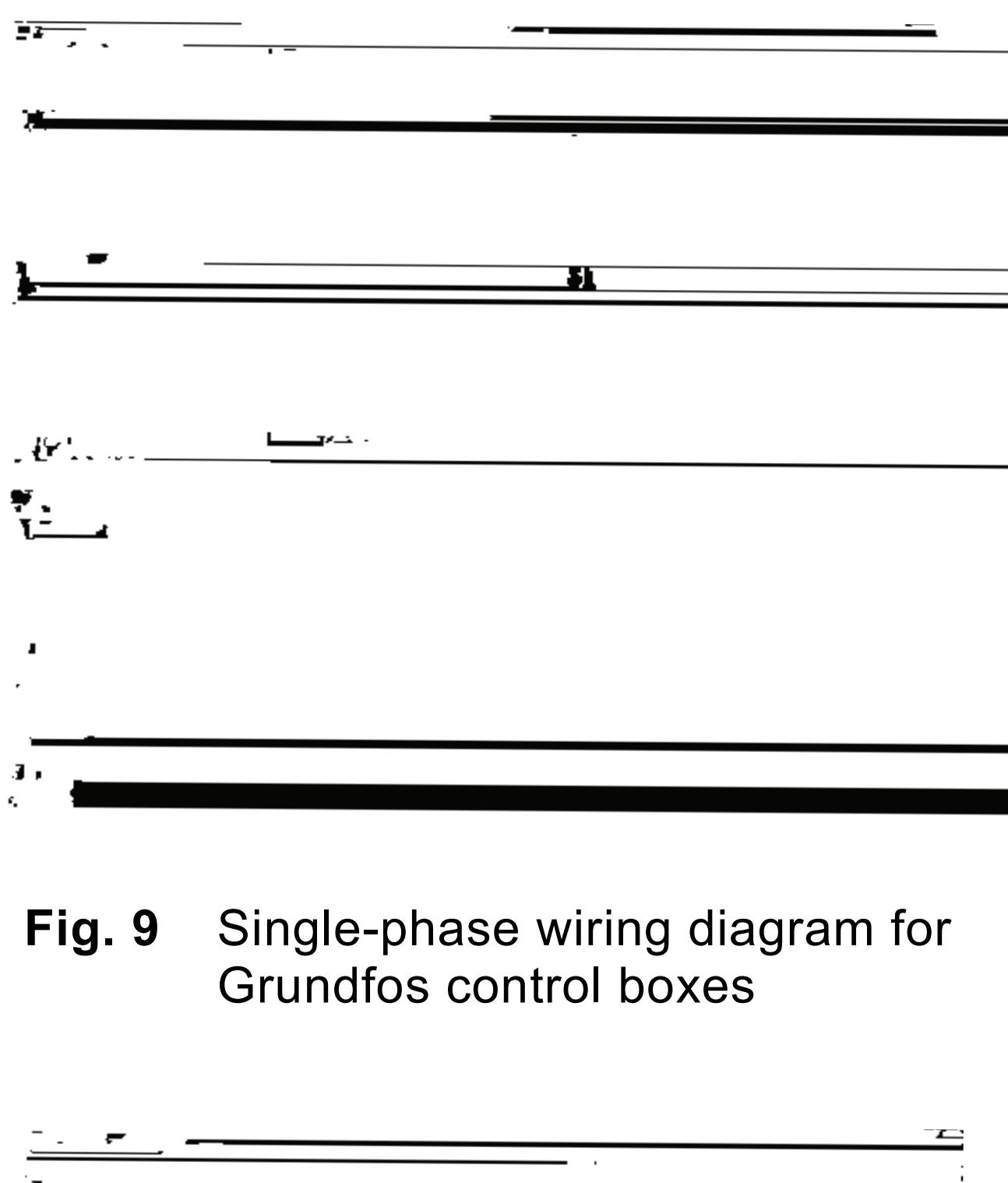


Fig. 9 Single-phase wiring diagram for Grundfos control boxes



Fig. 10 Three-phase wiring diagram for Grundfos and Franklin motors

Three-phase motors

Three-phase motors must be used with the proper size and type of motor starter to ensure the motor is protected against damage from low voltage, phase failure, current unbalance and overload current.

A properly sized starter with ambient-compensated extra quick-trip overloads must be used to give the best possible motor winding protection.

Each of the three motor legs must be protected with overloads. The thermal overloads must trip in less than 10 seconds at locked rotor (starting) current. A three-phase motor wiring diagram is shown in fig. 10.

Pumps should NEVER be started to check rotation unless the pump is totally submerged. Severe damage may be caused to the pump and motor if they are run dry.

3.5.3 High voltage surge arresters

A high voltage surge arrester should be used to protect the motor against lightning and switching surges.

Lightning voltage surges in power lines are caused when lightning strikes somewhere in the area.

Switching surges are caused by the opening and closing of switches on the main high-voltage distribution power lines.

The correct voltage-rated surge arrester should be installed on the supply (line) side of the control box; see fig. 11 and fig. 12. The arrester must be grounded in accordance with the National Electrical Code and local codes and regulations.

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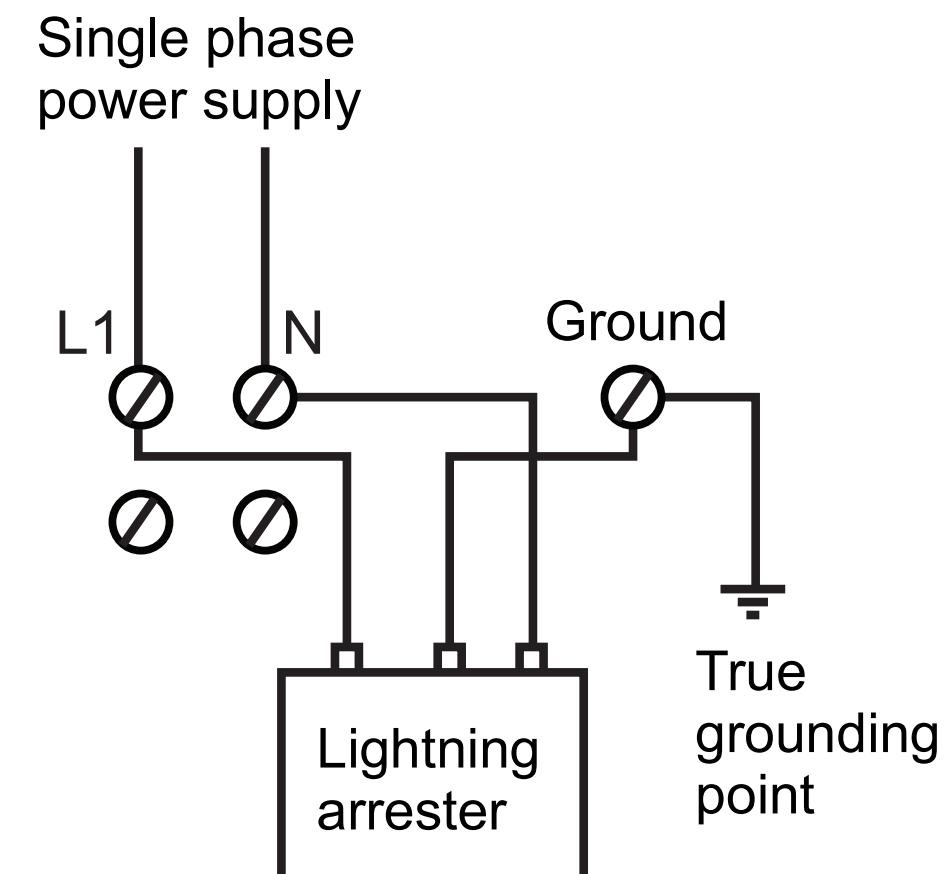


Fig. 11 Single-phase hookup

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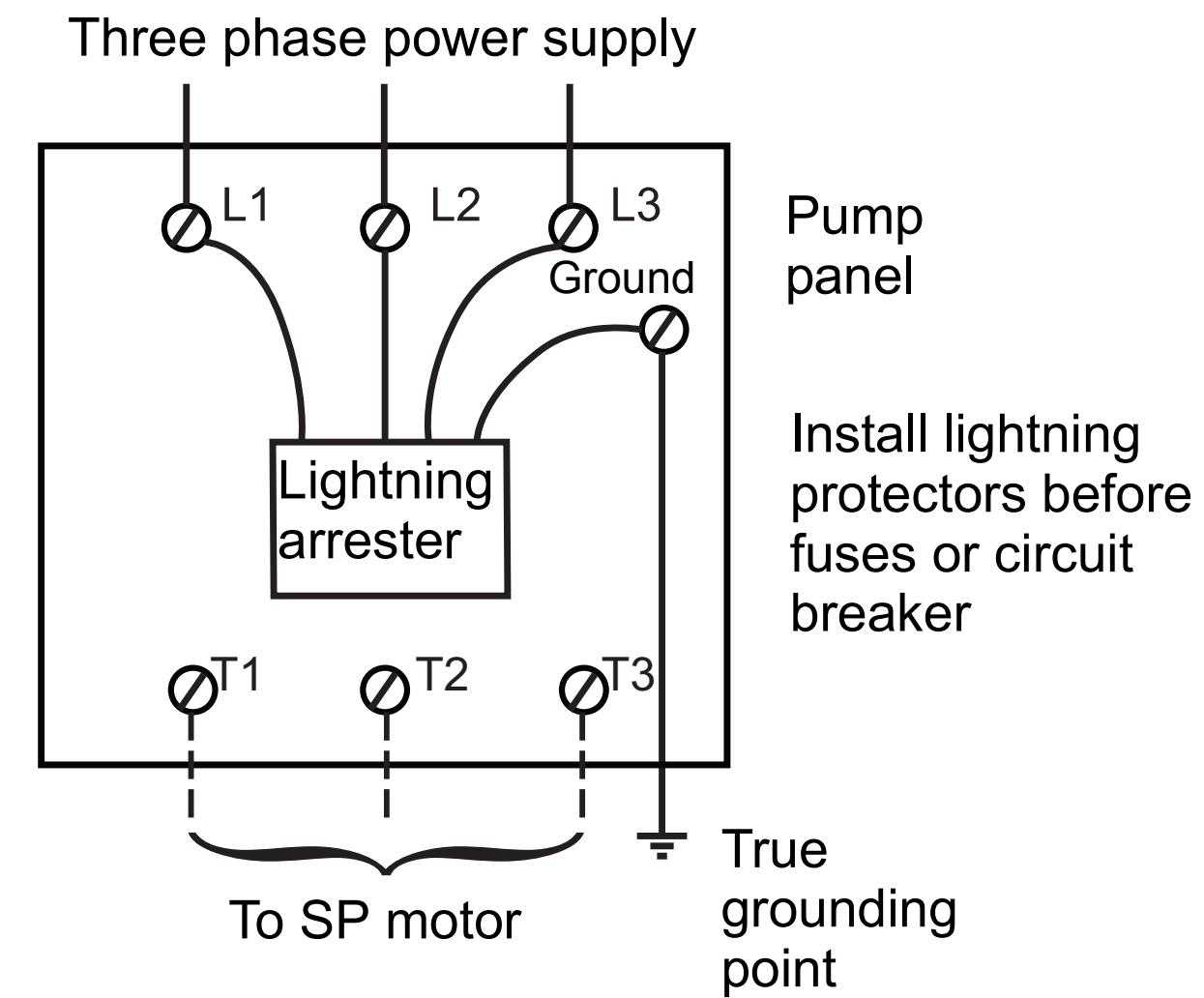


Fig. 12 Three-phase hookup

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The warranty on all three-phase submersible motors is VOID if:

1. **The motor is operated with single-phase power through a phase converter.**
2. **Three-leg ambient compensated extra quick-trip overload protectors are not used.**
3. **Three-phase current unbalance is not checked and recorded; see section 4. Startup on p. 11.**
4. **High voltage surge arresters are not installed.**

3.5.4 Control box/panel grounding

Warning

The control box or panel shall be permanently grounded in accordance with the National Electrical Code and local codes or regulations.



The ground wire should be a bare copper conductor at least the same size as the drop cable wire size.

The ground wire should be run as short a distance as possible and be securely fastened to a true grounding point.

True grounding points are considered to be:

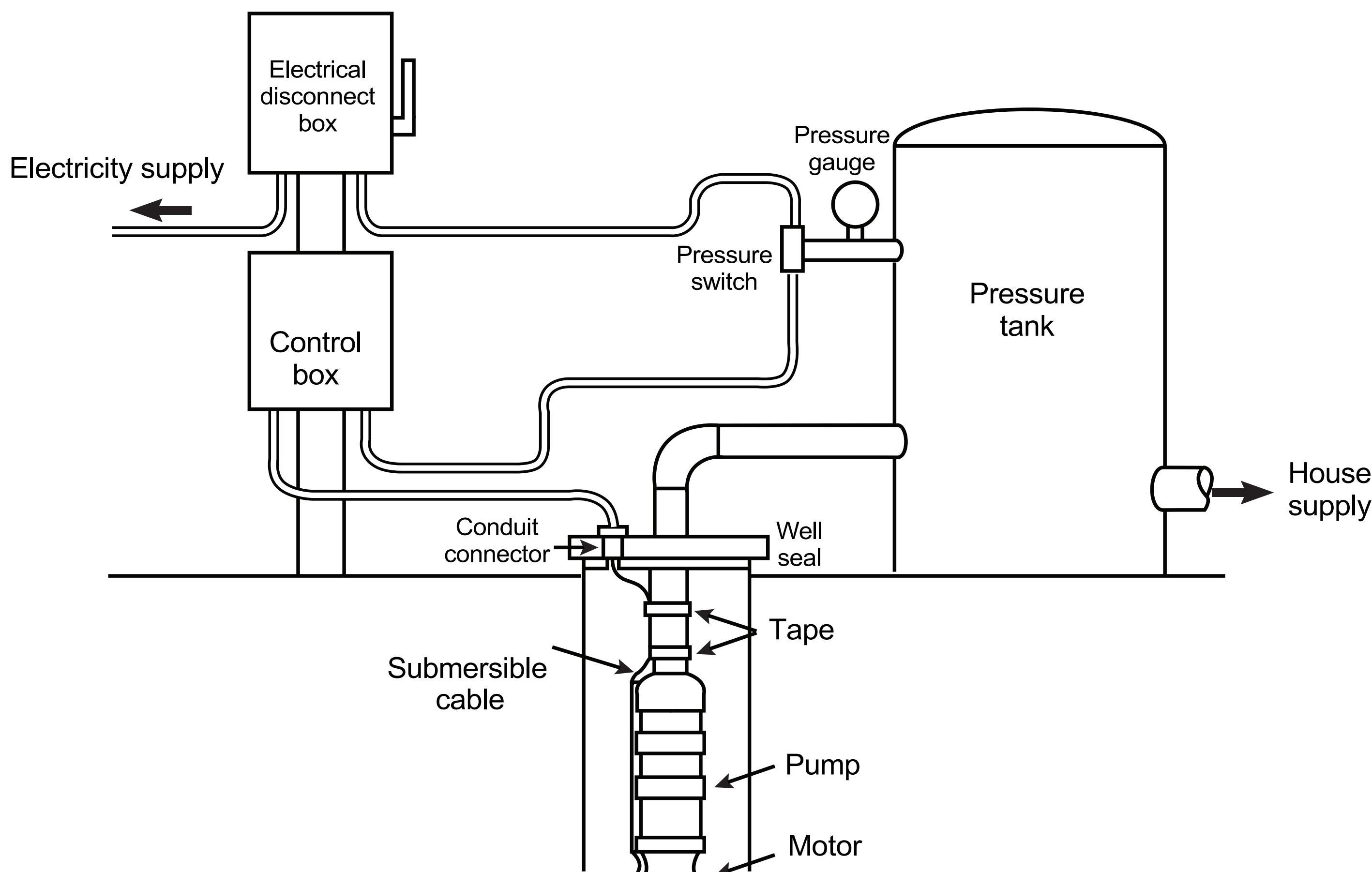
- a grounding rod driven into the water strata
- steel well casing submerged into the water lower than the pump setting level
- steel discharge pipes without insulating couplings.

If plastic discharge pipe and well casing are used or if a grounding wire is required by local codes, a properly sized bare copper wire should be connected to a stud on the motor and run to the control panel.

Warning



***Do not ground to a gas supply line.
Connect the grounding wire to the ground point first and then to the terminal in the control box or panel.***



TM05 0041 0611

Fig. 13 Wiring and installation diagram

3.5.5 Wiring checks and installation

Before making the final surface wiring connection of the drop cable to the control box or panel, it is a good practice to check the insulation resistance to ensure that the cable and splice are good. Measurements for a new installation must be at least 2,000,000 ohm. **Do not start the pump if the measurement is less than this.**

If it is higher than 2,000,000 ohm, the drop cable should then be run through the well seal by means of a conduit connector in such a way as to eliminate any possibility of foreign matter entering the well casing.

Conduit should always be used from the pump to the control box or panel to protect the drop cable; see fig. 13.

Finish wiring and verify that all electrical connections are made in accordance with the wiring diagram.

Check to ensure the control box or panel and high voltage surge arrester have been grounded.

4. Startup

After the pump has been set into the well and the wiring connections have been made, the following procedures should be performed:

1. Attach a temporary horizontal length of pipe with installed gate valve to the riser pipe.
2. Adjust the gate valve one-third of the way open.
3. On three-phase units, check direction of rotation and current unbalance according to the instructions below. For single-phase units proceed directly to *4.1.3 Developing the well* on p. 11.
4. Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

4.1 Startup with three-phase motors

4.1.1 Check the direction of rotation

Three-phase motors can run in either direction depending on how they are connected to the power supply. When the three cable leads are first connected to the power supply, there is a 50 % chance that the motor will run in the proper direction. To make sure the motor is running in the proper direction, carefully follow these procedures:

1. Start the pump and check the water quantity and pressure developed.
2. Stop the pump and interchange any two leads.
3. Start the pump and again check the water quantity and pressure.
4. Compare the results observed. The wire connection which gave the highest pressure and largest water quantity is the correct connection.

4.1.2 Check for current unbalance

Current unbalance causes the motor to have reduced starting torque, overload tripping, excessive vibration and poor performance which can result in early motor failure. It is very important that current unbalance be checked in all three-phase systems. **Current unbalance between the legs should not exceed 5 % under normal operating conditions.**

The supply power service should be verified to see if it is a two or three transformer system. If two transformers are present, the system is an "open" delta or wye. If three transformers are present, the system is true three-phase.

Make sure the transformer ratings in kilovolt amps (KVA) is sufficient for the motor load; see section *7.3 Transformer capacity required for three-phase submersible pump motors* on p. 20.

The percentage of current unbalance can be calculated by using the following formulas and procedures:

$$\text{Average current} = \frac{\text{Total of current values measured on each leg}}{3}$$

$$\% \text{ Current unbalance} = \frac{\text{Greatest amp difference from the average}}{\text{average current}} \times 100$$

To determine the percentage of current unbalance:

1. Measure and record current readings in amps for each leg (Hookup 1). Disconnect power.
2. Shift or roll the motor leads from left to right so the drop cable lead that was on terminal 1 is now on 2, lead on 2 is now on 3, and lead on 3 is now on 1 (Hookup 2). Rolling the motor leads in this manner will not reverse the motor rotation. Start the pump, measure and record current reading on each leg. Disconnect power.
3. Again shift drop cable leads from left to right so the lead on terminal 1 goes to 2, 2 to 3 and 3 to 1 (Hookup 3). Start pump, measure and record current reading on each leg. Disconnect power.
4. Add the values for each hookup.
5. Divide the total by 3 to obtain the average.
6. Compare each single leg reading from the average to obtain the greatest amp difference from the average.
7. Divide this difference by the average to obtain the percentage of unbalance.

Use the wiring hookup which provides the lowest percentage of unbalance. See section *7.6.4 Correcting for three-phase power imbalance* on p. 25 for a specific example of correcting for three-phase power unbalance.

4.1.3 Developing the well

After proper rotation and current unbalance have been checked, start the pump and let it operate until the water runs clear of sand, silt and other impurities.

Slowly open the valve in small increments as the water clears until the desired flow rate is reached. Do not operate the pump beyond its maximum flow rating. **The pump should not be stopped until the water runs clear.**

If the water is clean and clear when the pump is first started, the valve should still be **slowly opened until the desired flow rate is reached**. As the valve is being opened, the drawdown should be checked to ensure the pump is always submerged. **The dynamic water level should always be more than 3 feet (0.9 m) above the inlet strainer of the pump.**

Disconnect the temporary piping arrangements and complete the final piping connections.



US

Caution

Warning

Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.

Start the pump and test the system. Check and record the voltage and current draw on each motor lead.

5. Operation

The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling and operation of controls.

If the pump fails to operate, or there is a loss of performance, refer to section 6. *Troubleshooting* on p. 12.

6. Troubleshooting

The majority of problems that develop with submersible pumps are electrical, and most of these problems can be corrected without pulling the pump from the well. The following chart covers most of the submersible service work. As with any troubleshooting procedure, start with the simplest solution first; always make all the above ground checks before pulling the pump from the well.

Usually only two instruments are needed:

- a combination voltmeter/ammeter
- an ohmmeter.

These are relatively inexpensive and can be obtained from most water systems suppliers.

Warning

**WHEN WORKING WITH
ELECTRICAL CIRCUITS, USE
CAUTION TO AVOID ELECTRICAL
SHOCK.**



It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well.

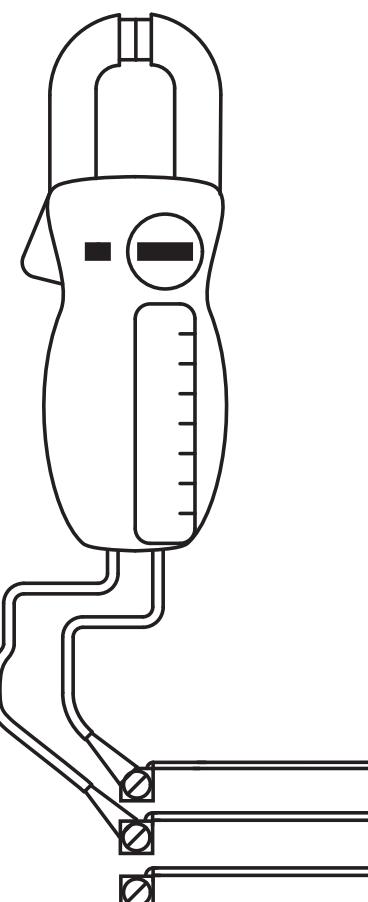
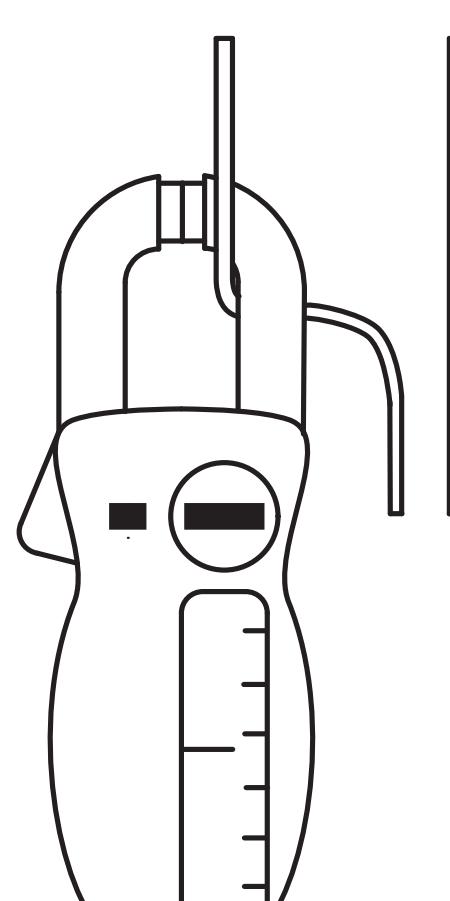
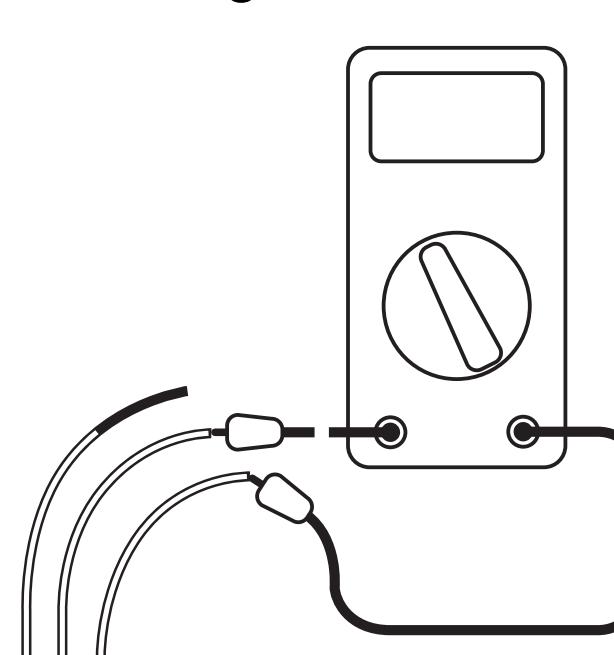
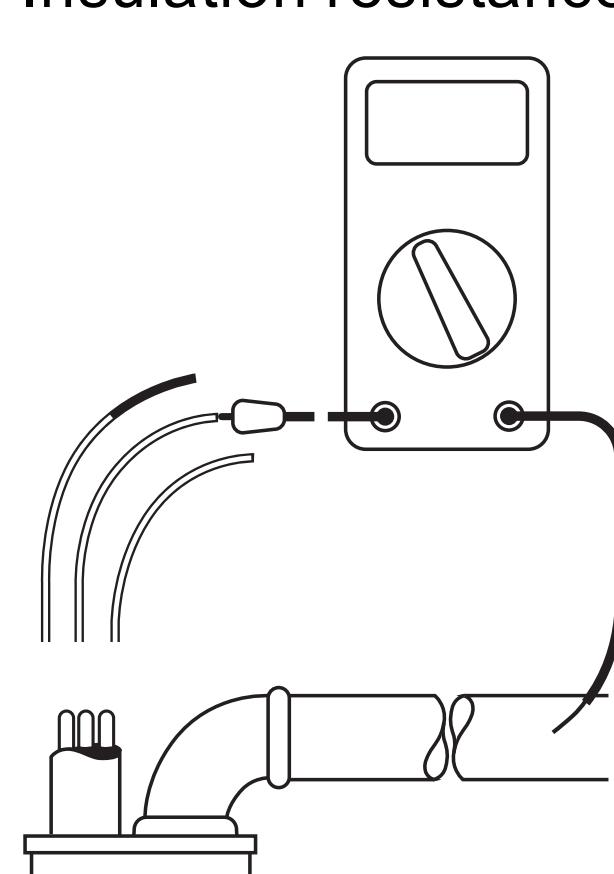
Warning

Submersible motors are intended for operation in a well. When not operated in a well, failure to connect motor frame to power supply ground may result in serious electrical shock.



6.1 Preliminary tests

US

Test	How to measure	What it means
Supply voltage	<p>By means of a voltmeter, which has been set to the proper scale, measure the voltage at the control box or starter.</p> <ul style="list-style-type: none"> • On single-phase units, measure between line and neutral. • On three-phase units, measure between the legs (phases).  <p style="text-align: center;">TM00 1371 5092</p>	<p>When the motor is under load, the voltage should be within $\pm 10\%$ of the nameplate voltage. Larger voltage variation may cause winding damage.</p> <p>Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected. If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.</p>
Current	<ul style="list-style-type: none"> • By use of an ammeter, set on the proper scale, measure the current on each power lead at the control box or starter. See section 7.6 <i>Electrical data</i> on p. 24 for motor amp draw information. • Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.  <p style="text-align: center;">TM00 1372 5082</p>	<p>If the amp draw exceeds the listed service factor amps (SFA) or if the current unbalance is greater than 5 % between each leg on three-phase units, check for the following:</p> <ul style="list-style-type: none"> • Burnt contacts on motor starter. • Loose terminals in starter or control box or possible cable defect. Check winding and insulation resistances. • Supply voltage too high or low. • Motor windings are shorted. • Pump is damaged, causing a motor overload.
Winding resistance	<ul style="list-style-type: none"> • Turn off power and disconnect the drop cable leads in the control box or starter. • Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms. • Zero-adjust the meter and measure the resistance between leads. Record the values. • Motor resistance values can be found in section 7.6 <i>Electrical data</i> on p. 24. Cable resistance values are in section 7.6.5 <i>Total resistance of drop cable (OHMS)</i> on p. 26.  <p style="text-align: center;">TM05 0028 0511</p>	<p>If all the ohm values are normal, and the cable colors correct, the windings are not damaged.</p> <p>If any one ohm value is less than normal, the motors may be shorted.</p> <p>If any one ohm value is greater than normal, there is a poor cable connection or joint. The windings or cable may also be open.</p> <p>If some of the ohm values are greater than normal and some less, the drop cable leads are mixed. To verify lead colors, see resistance values in section 7.6 <i>Electrical data</i> on p. 24.</p>
Insulation resistance	<ul style="list-style-type: none"> • Turn off power and disconnect the drop cable leads in the control box or starter. • Using an ohm or mega ohmmeter, set the scale selector to Rx 100K and zeroadjust the meter. • Measure the resistance between the lead and ground (discharge pipe or well casing, if steel).  <p style="text-align: center;">TM05 0029 0511</p>	<p>For ohm values, refer to section 6.1.1 <i>Ohm value chart</i> on p. 14.</p> <p>Motors of all hp, voltage, phase and cycle duties have the same value of insulation resistance.</p>



6.1.1 Ohm value chart

Ohm value chart			
US	Ohm value	Megaohm value	Condition of motor and leads/recommended procedure
Motor not yet installed	2,000,000 (or more)	2.0	New motor.
	1,000,000 (or more)	1.0	Used motor which can be reinstalled in the well.
	500,000 - 1,000,000	0.5 - 1.0	A motor in reasonably good condition.
	20,000 - 500,000	0.02 - 0.5	A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.
Motor in well (Ohm readings are for drop cable plus motor)			
	10,000 - 20,000	0.01 - 0.02	The pump should be pulled and repairs made to the cable or the motor replaced. The motor will still operate, but probably not for long.
	Less than 10,000	0 - 0.01	A motor which has failed or with completely destroyed cable insulation.
			The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.

6.2 Checking pump performance

The troubleshooting chart on p.15 may require that you test the pump's performance against its curve. To do so, perform these steps:

1. Install pressure gauge
2. Start pump
3. Gradually close the discharge valve
4. Read pressure at shut-off.
5. After taking reading, open valve to its previous position.
6. To calculate pump performance, first convert psi reading to feet.
(For water: PSI x 2.31 = ____ ft.).
7. Add this to the total vertical distance from the pressure gauge to the water level in the well while the pump is running.
8. Refer to the specific pump curve for the shut-off head for that pump model. If the measured head is close to the curve, pump is probably OK.

6.3 Troubleshooting chart

Problem	Possible cause/how to check	Possible remedy
1. Pump does not run.	<p>a) No power at pump panel. How to check: Check for voltage at panel.</p> <p>b) Fuses are blown or circuit breakers are tripped. How to check: Remove fuses and check for continuity with ohmmeter.</p>	If no voltage at panel, check feeder panel for tripped circuits. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation and motor must be checked.
	<p>c) Motor starter overloads are burnt or have tripped out (three-phase only). How to check: Check for voltage on line or load side of starter.</p> <p>d) Starter does not energize (three-phase only). How to check: Energize control circuit and check for voltage at the holding coil.</p>	Replace burnt heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil. If no voltage, check control circuit. If voltage, check holding coil for shorts. Replace bad coil.
	<p>e) Defective controls. How to check: Check all safety and pressure switches for operation. Inspect contacts in control devices.</p>	Replace worn or defective parts.
	<p>f) Motor and/or cable are defective. How to check: Turn off power. Disconnect motor leads from control box. Measure the lead-tolead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values.</p>	If open motor winding or ground is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
	<p>g) Defective capacitor (single-phase only). How to check: Turn off the power, then discharge capacitor. Check with an ohmmeter (Rx100K). When meter is connected, the needle should jump forward and slowly drift back.</p>	If there is no ohmmeter needle movement, replace the capacitor.

US



Problem	Possible cause/how to check	Possible remedy
2. Pump runs but does not deliver water.	<p>a) Groundwater level in well is too low or well is collapsed. How to check: Check well draw-down. Water level should be at least 3 ft. above pump inlet during operation.</p> <p>b) Integral pump check valve is blocked. How to check: Check the pump's performance against its curve; see section <i>6.2 Checking pump performance</i> on page 14.</p> <p>c) Inlet strainer is clogged. How to check: Check the pump's performance against its curve; see section <i>6.2 Checking pump performance</i> on page 14.</p> <p>d) Pump is damaged. How to check: Check the pump's performance against its curve; see section <i>6.2 Checking pump performance</i> on page 14.</p>	If water level is not at least 3 ft. above pump inlet during operation, then lower the pump if possible, or throttle discharge valve and install water level control. If the pump is not operating close to the pump curve, remove pump and inspect discharge section. Remove blockage, repair valve and valve seat if necessary. Check for other damage. Rinse out pump and re-install. If pump is not operating close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and re-install. If pump is damaged, repair as necessary. Rinse out pump and re-install.
3. Pump runs but at reduced capacity.	<p>a) Wrong rotation (three phase only). How to check: Check for proper electrical connection in control panel.</p> <p>b) Draw-down is larger than anticipated. How to check: Check draw-down during pump operation.</p> <p>c) Discharge piping or valve leaking. How to check: Examine system for leaks.</p> <p>d) Pump strainer or check valve are clogged. How to check: Check the pump's performance against its curve; see section <i>6.2 Checking pump performance</i> on page 14.</p> <p>e) Pump is worn. How to check: Check the pump's performance against its curve; see section <i>6.2 Checking pump performance</i> on page 14.</p>	Correct wiring and change leads as required. Lower the pump if possible. If not, throttle discharge valve and install water level control. Repair leaks. If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and re-install. If not close to pump curve, remove pump and inspect.

Problem	Possible cause/how to check	Possible remedy
4. Pump cycles too much.	<p>a) Pressure switch is not properly adjusted or is defective.</p> <p>How to check: Check pressure setting on switch and operation. Check voltage across closed contacts.</p> <p>b) Level control is not properly set or is defective.</p> <p>How to check: Check setting and operation.</p> <p>c) Insufficient air charging or leaking tank or piping.</p> <p>How to check: Pump air into tank or diaphragm chamber. Check diaphragm for leak. Check tank and piping for leaks with soap and water solution. Check air to water volume.</p> <p>d) Plugged snifter valve or bleed orifice.</p> <p>How to check: Examine valve and orifice for dirt or corrosion.</p> <p>e) Tank is too small.</p> <p>How to check: Check tank size. Tank volume should be approximately 10 gallons for each gpm or pump capacity.</p>	<p>Re-adjust switch or replace if defective.</p> <p>Re-adjust setting (refer to manufacturer data.) Replace if defective.</p> <p>Repair or replace damaged component.</p> <p>Clean and/or replace snifter valve or bleed orifice if defective.</p> <p>If tank is too small, replace with proper size tank.</p>
5. Fuses blow or circuit breakers trip	<p>a) High or low voltage.</p> <p>How to check: Check voltage at pump panel. If not within $\pm 10\%$, check wire size and length of run to pump panel.</p> <p>b) Three-phase current unbalance.</p> <p>How to check: Check current draw on each lead. Unbalance must be within $\pm 5\%$.</p> <p>c) Control box wiring and components (single-phase only).</p> <p>How to check: Check that control box parts match the parts list. Check to see that wiring matches wiring diagram. Check for loose or broken wires or terminals.</p>	<p>If wire size is correct, contact power company. If not, correct and/or replace as necessary.</p> <p>If current unbalance is not within $\pm 5\%$, contact power company.</p> <p>Correct as required.</p>



Problem	Possible cause/how to check	Possible remedy
5. Fuses blow or circuit breakers trip (con't).	d) Defective capacitor (single-phase only). How to check: Turn off power and discharge capacitor. Check using an ohmmeter (Rx100K). When the meter is connected, the needle should jump forward and slowly drift back.	If there is no ohmmeter needle movement, replace the capacitor.
	e) Starting relay (Franklin single-phase motors only). How to check: Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective starting relay.

7. Technical data

7.1 Minimum water flow requirements for submersible pump motors

Motor diameter	Casing or sleeve I.D. [inches]	Min. flow past the motor [gpm]
4"	4	1.2
	5	7
	6	13
	7	21
	8	30
6"	6	10
	7	28
	8	45
	10	85
	12	140
8"	14	198
	16	275
	8	10
	10	55
	12	110
10"	14	180
	16	255
	10	30
	12	85
	14	145
16	16	220
	18	305

Notes:

- A flow inducer or sleeve must be used if the water enters the well above the motor or if there is unsufficient water flow past the motor.
- The minimum recommended water velocity over 4" motors is 0.25 feet (0.08 m) per second.
- The minimum recommended water velocity over 6", 8", and 10" motors is 0.5 (0.15 m) feet per second.

7.2 Guide for engine-driven generators in submersible pump applications

Motor - 1 or 3 ph [hp]	Generator [kW]	
	Externally regulated	Internally regulated
0.33	1.5	1.2
0.5	2.0	1.5
0.75	3.0	2.0
1	4.0	2.5
1.5	5.0	3.0
2	7.5	4.0
3	10.0	5.0
5.0	15.0	7.5
7.5	20.0	10.0
10.0	30.0	15.0
15.0	40.0	20.0
20.0	60.0	25.0
25.0	75.0	30.0
30.0	100.0	40.0
40.0	100.0	50.0
50.0	150.0	60.0
60.0	175.0	75.0
75.0	250.0	100.0
100.0	300.0	150.0
125.0	375.0	175.0
150.0	450.0	200.0
200.0	600.0	275.0

Notes:

- Table is based on typical 176 °F (80 °C) rise continuous duty generators with 35 % maximum voltage dip during start-up of single-phase and three-phase motors.
- Contact the manufacturer of the generator to assure the unit has adequate capacity to run the submersible motor.
- If the generator rating is in KVA instead of kilowatts, multiply the above ratings by 1.25 to obtain KVA.



7.3 Transformer capacity required for three-phase submersible pump motors

US

3-phase motor [hp]	Minimum total KVA required*	Minimum KVA rating for each transformer	
		2 transformers Open Delta or Wye	3 transformers Delta or Wye
1.5	3	2	1
2	4	2	1.5
3	5	3	2
5	7.5	5	3
7.5	10	7.5	5
10	15	10	5
15	20	15	7.5
20	25	15	10
25	30	20	10
30	40	25	15
40	50	30	20
50	60	35	20
60	75	40	25
75	90	50	30
100	120	65	40
125	150	85	50
150	175	100	60
200	230	130	75

Notes:

- Pump motor KVA requirements only, and does not include allowances for other loads.

7.4 Submersible pump cable selection chart (60 Hz)

The following tables list the recommended copper cable sizes and various cable lengths for submersible pump motors.

These tables comply with the 1978 edition of the National Electric Table 310-16, Column 2 for 167 °F (75 °C) wire. The ampacity (current carrying properties of a conductor) have been divided by 1.25 per the N.E.C., Article 430-22, for motor branch circuits based on motor amps at rated horsepower.

To assure adequate starting torque, the maximum cable lengths are calculated to maintain 95 % of the service entrance voltage at the motor when the motor is running at maximum nameplate amps. Cable sizes larger than specified may always be used and will reduce power usage.

Caution

The use of cables smaller than the recommended sizes will void the warranty. Smaller cable sizes will cause reduced starting torque and poor motor operation.

Single-phase motor maximum cable length [ft]
(Motor to service entrance) (2)

Volts	Hp	Wire size												
		14	12	10	8	6	4	2	0	00	000	0000	250	300
115	.33	130	210	340	540	840	1300	1960	2910					
	.5	100	160	250	390	620	960	1460	2160					
	.33	550	880	1390	2190	3400	5250	7960						
	.5	400	650	1020	1610	2510	3880	5880						
	.75	300	480	760	1200	1870	2890	4370	6470					
	1	250	400	630	990	1540	2380	3610	5360	6520				
	1.5	190	310	480	770	1200	1870	2850	4280	5240				
	2	150	250	390	620	970	1530	2360	3620	4480				
	3	120	190	300	470	750	1190	1850	2890	3610				
	5			180	280	450	710	1110	1740	2170				
230	7.5			200	310	490	750	1140	1410					
	10				250	390	600	930	1160					

Notes:

1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25 % of the total maximum length to assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.



7.5 Three-phase motor maximum cable length

Caution *Use of wire size smaller than listed will void warranty.*

US

**Three-phase motor maximum cable length [ft]
(Motor to service entrance) (2)**

Volts	Hp	Wire size												
		14	12	10	8	6	4	2	0	00	000	0000	250	300
208	1.5	310	500	790	1260									
	2	240	390	610	970	1520								
	3	180	290	470	740	1160	1810							
	5		170	280	440	690	1080	1660						
	7.5			200	310	490	770	1180	1770					
	10				230	370	570	880	1330	1640				
	15					250	390	600	910	1110	1340			
	20						300	460	700	860	1050	1270		
	25							370	570	700	840	1030	1170	
	30								310	470	580	700	850	970
230	1.5	360	580	920	1450									
	2	280	450	700	1110	1740								
	3	210	340	540	860	1340	2080							
	5		200	320	510	800	1240	1900						
	7.5			230	360	570	890	1350	2030					
	10				270	420	660	1010	1520	1870				
	15					290	450	690	1040	1280	1540			
	20						350	530	810	990	1200	1450		
	25							280	430	650	800	970	1170	1340
	30								350	540	660	800	970	1110
460	1.5	1700												
	2	1300	2070											
	3	1000	1600	2520										
	5	590	950	1500	2360									
	7.5	420	680	1070	1690	2640								
	10	310	500	790	1250	1960	3050							
	15		540	850	1340	2090	3200							
	20		410	650	1030	1610	2470	3730						
	25			530	830	1300	1990	3010	3700					
	30				430	680	1070	1640	2490	3060	3700			
	40					790	1210	1830	2250	2710	3290			
	50						640	980	1480	1810	2190	2650	3010	
	60							830	1250	1540	1850	2240	2540	2890
	75								1030	1260	1520	1850	2100	2400
	100									940	1130	1380	1560	1790
	125										1080	1220	1390	
	150											1050	1190	
	200											1080	1300	
	250												1080	

Three-phase motor maximum cable length [ft] (Motor to service entrance) (2)

Caution *Use of wire size smaller than listed will void warranty.*

Notes:

- If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
 - The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25 % of the total maximum length to assure reliable starter operation. Single-phase control boxes may be connected at any point of the total cable length.
 - Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

7.6 Electrical data

7.6.1 Grundfos submersible pump motors - 60 Hz

US

Grundfos submersible pump motors - 60 Hz

Hp	Ph	Volt [V]	S.F.	Circuit breaker or fuses		Amperage		Full load		Max. thrust [lbs]	Name-plate number	Product number
				Std.	Delay	Start [A]	Max. [A]	Eff. [%]	Power factor			
4-inch, single-phase, 2-wire motors (control box not required)												
.5	1	230	1.60	15	7	34.5	6.0	62	76	750	79952102	96465616
.75			1.50	20	9	40.5	8.4	62	75	750	79952103	96465618
1			1.40	25	12	48.4	9.8	63	82	750	79952104	96465620
1.5			1.30	35	15	62.0	13.1	64	85	750	79952105	96465622
4-inch, single-phase, 3-wire motors												
.5	1	230	1.60	15	7	21.5	6.0	62	76	750	79453102	96465606
.75			1.50	20	9	31.4	8.4	62	75	750	79453103	96465608
1			1.40	25	12	37.0	9.8	63	82	750	79453104	9646510
1.5			1.30	35	15	45.9	11.6	69	89	750	79453105	96465612
4-inch, three-phase, 3-wire motors												
1.5	3	230	1.30	15	8	40.3	7.3	75	72	750	79302005	96465629
		460	1.30	10	4	20.1	3.7	75	72	750	79362005	96465651
		575	1.30	10	4	16.1	2.9	75	72	750	79392005	96465630
		230	1.25	20	10	48	8.7	76	75	750	79302006	96465652
2	3	460	1.25	10	5	24	4.4	76	75	750	79362006	791539066
		575	1.25	10	4	19.2	3.5	76	75	750	79392006	791539066
		230	1.15	30	15	56	12.2	77	75	1000	79304507	96405801
		460	1.15	15	7	28	6.1	77	75	1000	79354507	96405810
3	3	575	1.15	15	6	22	4.8	77	75	1000	79394507	96405815
		230	1.15	40	25	108	19.8	80	82	1000	79304509	96405802
		460	1.15	20	12	54	9.9	80	82	1000	79354509	96405811
		575	1.15	15	9	54	7.9	80	82	1000	79394509	96405816
5	3	230	1.15	60	30	130	25.0	81	82	1000	79305511	96405805
		460	1.15	35	15	67	13.2	81	82	1000	79355511	96405814
		575	1.15	30	15	67	10.6	81	82	1000	79395511	96405819
6-inch, three-phase, 3-wire motors												
7.5	3	230	1.15	60	35	119	26.4	80.5	76	1000	78305511	96405781
		460	1.15	30	15	59	13.2	80.5	76	1000	78355511	96405794
10	3	230	1.15	80	45	156	34.0	82.5	79	1000	78305512	96405782
		460	1.15	40	20	78	17.0	82.0	79	1000	78355512	96405795
15	3	230	1.15	150	80	343	66.0	84.0	81	4400	78305516	96405784
		460	1.15	60	30	115	24.5	82.5	82	4400	78305514	96405796
20	3	230	1.15	150	80	343	66.0	84	81	4400	78305516	96405784
		460	1.15	80	40	172	33.0	84	82	4400	78355516	96405797
25	3	460	1.15	100	50	217	41.0	84.5	80	4400	78355517	96405798
30	3	460	1.15	110	60	237	46.5	85	83	4400	78355518	96405799
40	3	460	1.15	150	80	320	64.0	85	82	4400	78355520	96405800

7.6.2 Other motor manufacturers

Hitachi motors

Refer to the Hitachi submersible motors application maintenance manual.

7.6.3 Franklin motors

Refer to the Franklin submersible motors application maintenance manual.

7.6.4 Correcting for three-phase power imbalance

Example: Check for current unbalance for a 230 volt, three-phase, 60 Hz submersible pump motor, 18.6 full load amps.

Solution: Steps 1 to 3 measure and record amps on each motor drop lead for Hookups 1, 2 and 3.

Observe that Hookup 3 should be used since it shows the least amount of current unbalance. Therefore, the motor will operate at maximum

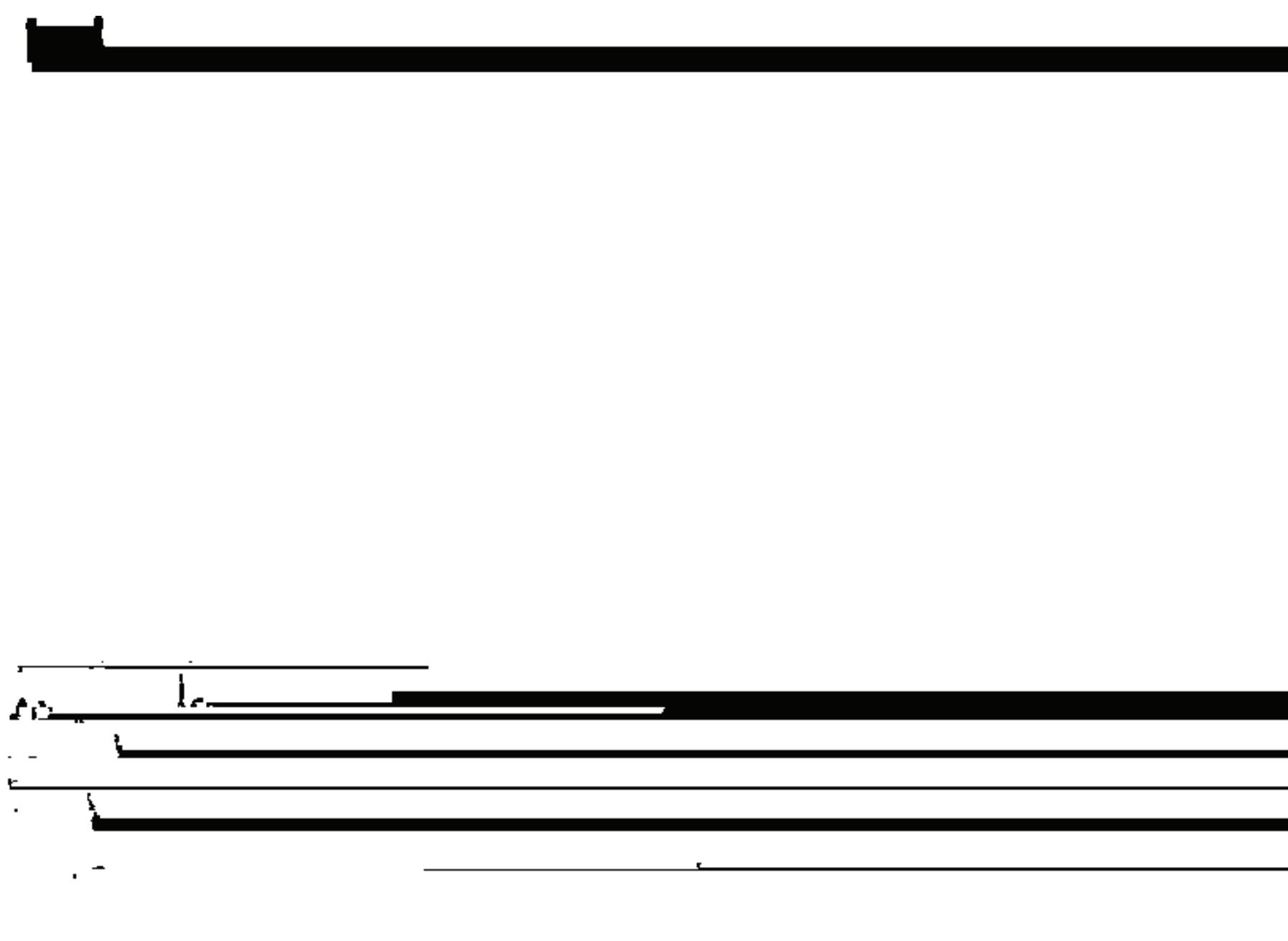
efficiency and reliability.

By comparing the current values recorded on each leg, you will note the highest value was always on the same leg, L₃. This indicates the unbalance is in the power source. If the high current values were on a different leg each time the leads were changed, the unbalance would be caused by the motor or a poor connection.

If the current is greater than 5 %, contact your power company for help.

*For a detailed explanation of three-phase balance procedures, see section 4.1 Startup with three-phase motors on p. 11.

	Step 1 (Hookup 1)	Step 2 (Hookup 2)	Step 3 (Hookup 3)
(T ₁)	DL ₁ = 25.5 amps	DL ₃ = 25 amps	DL ₂ = 25.0 amps
(T ₂)	DL ₂ = 23.0 amps	DL ₁ = 24 amps	DL ₃ = 24.5 amps
(T ₃)	DL ₃ = 26.5 amps	DL ₂ = 26 amps	DL ₁ = 25.5 amps
Step 4	Total = 75 amps	Total = 75 amps	Total = 75 amps
Step 5	Average Current =	<u>total current =</u> 3 readings	$\frac{75}{3} = 25$ amps
Step 6	Greatest amp difference from the average:	(Hookup 1) = 25-23 = 2 (Hookup 2) = 26-25 = 1 (Hookup 3) = 25.5-25 = .5	
Step 7	% Unbalance	(HOOKUP 1) = 2/25 X 100 = 8 (HOOKUP 2) = 1/25 X 100 = 4 (HOOKUP 3) = .5/25 X 100 = 2	



Hookup 1

Hookup 2

Hookup 3

TM05 0042 0611

Fig. 14

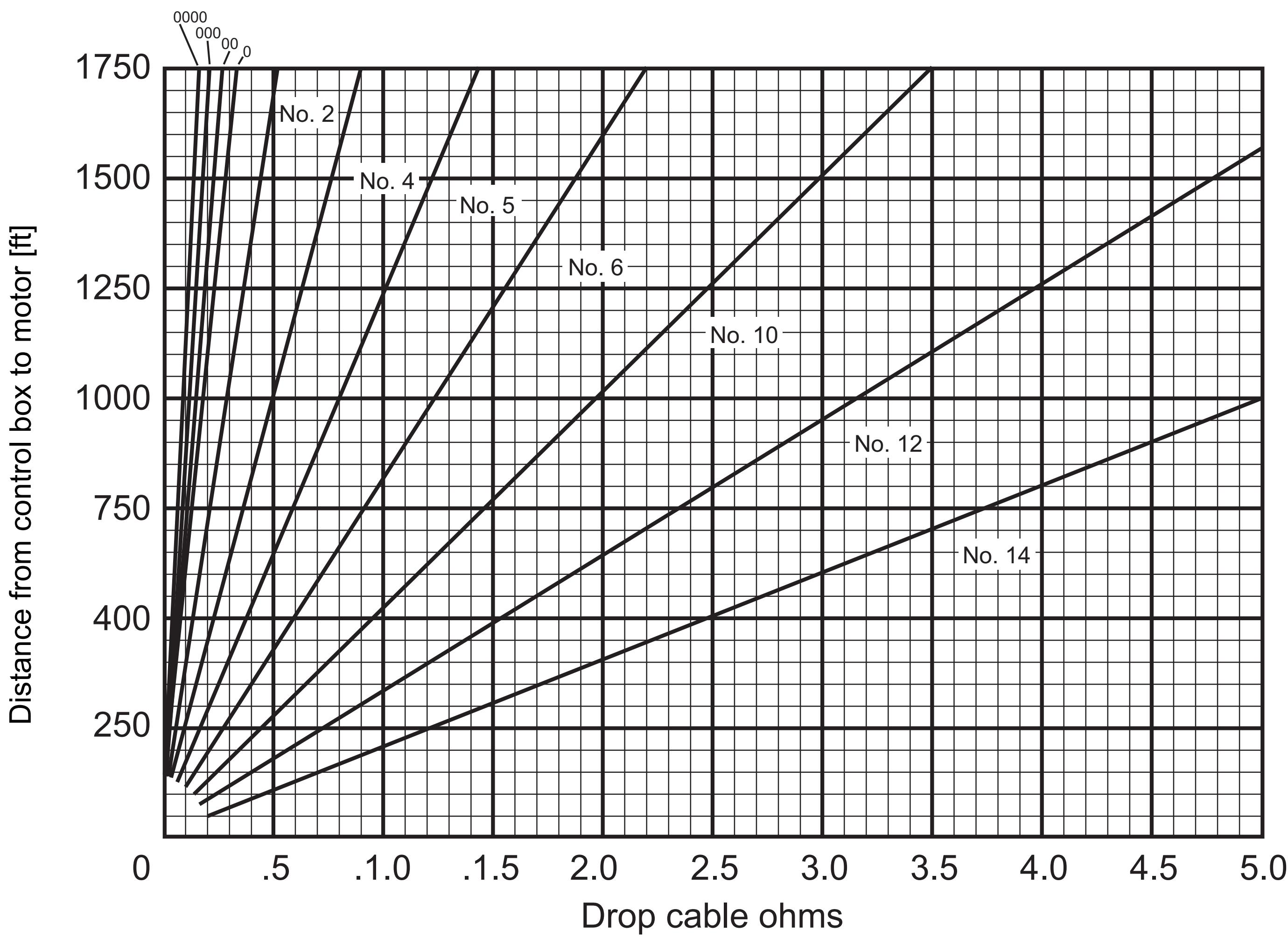
Subject to alterations.

7.6.5 Total resistance of drop cable (OHMS)

The values shown in this table are for copper conductors. Values are for the total resistance of drop cable from the control box to the motor and back.

To determine the resistance:

1. Disconnect the drop cable leads from the control box or panel.
2. Record the size and length of drop cable.
3. Determine the cable resistance from the table.
4. Add drop cable resistance to motor resistance.
Motor resistances can be found in section 7.6 *Electrical data* on p. 24.
5. Measure the resistance between each drop cable lead using an ohmmeter. Meter should be set on Rx1 and zero-balanced for this measurement.
6. The measured values should be approximately equal to the calculated values.



TM05 0043 0611

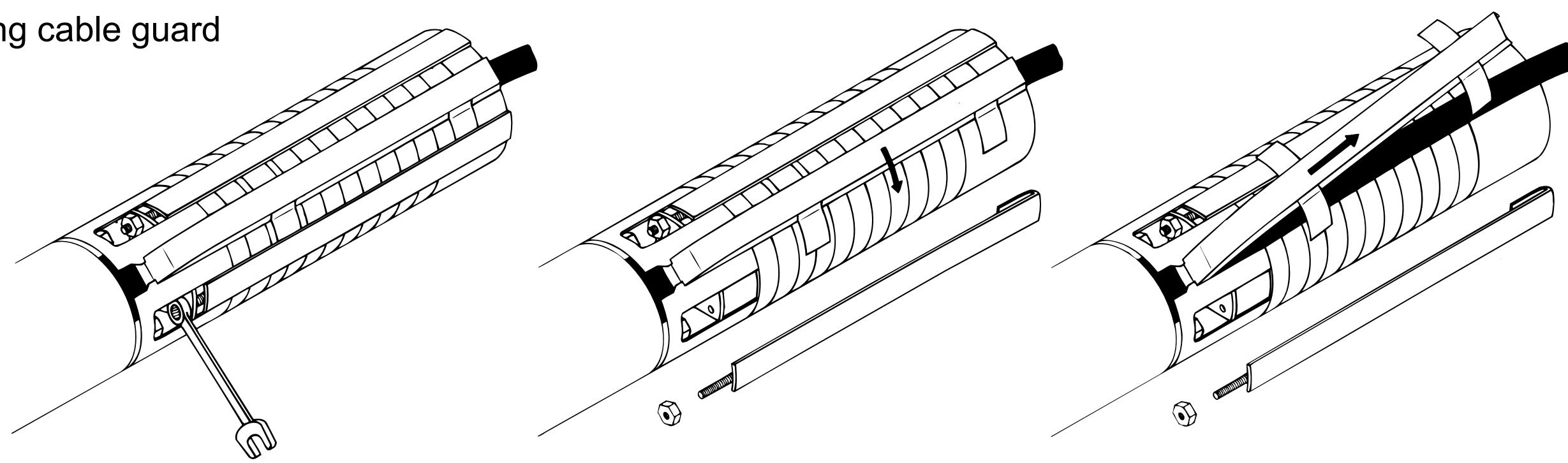
8. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

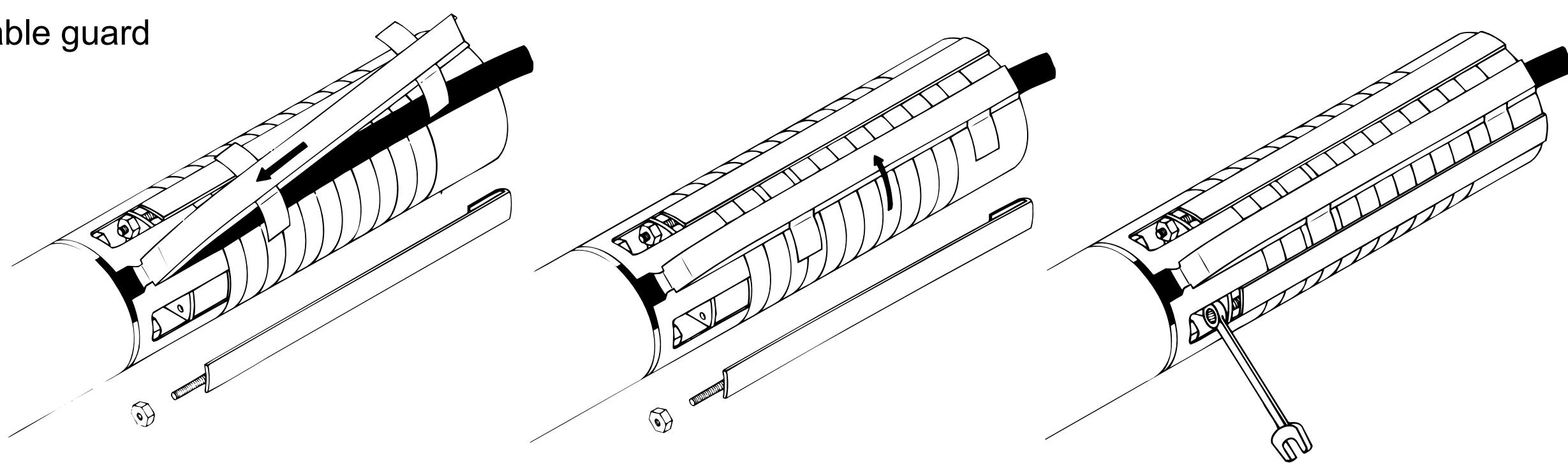
9. Removal and fitting of cable guard

Removing cable guard



US

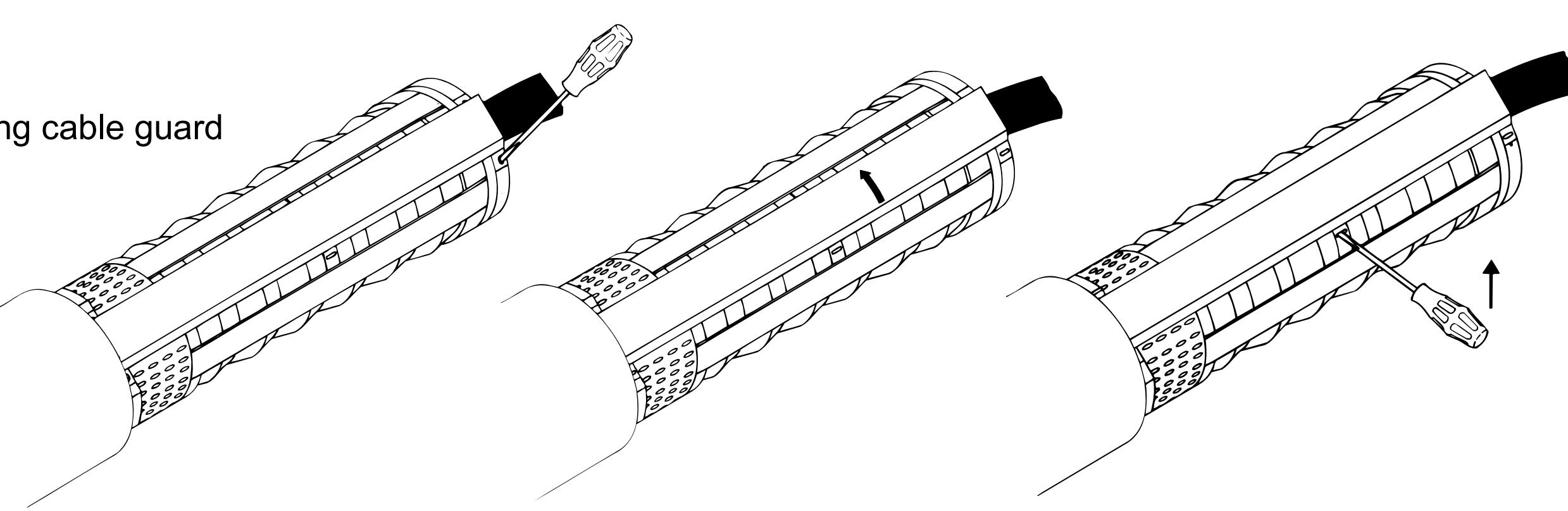
Fitting cable guard



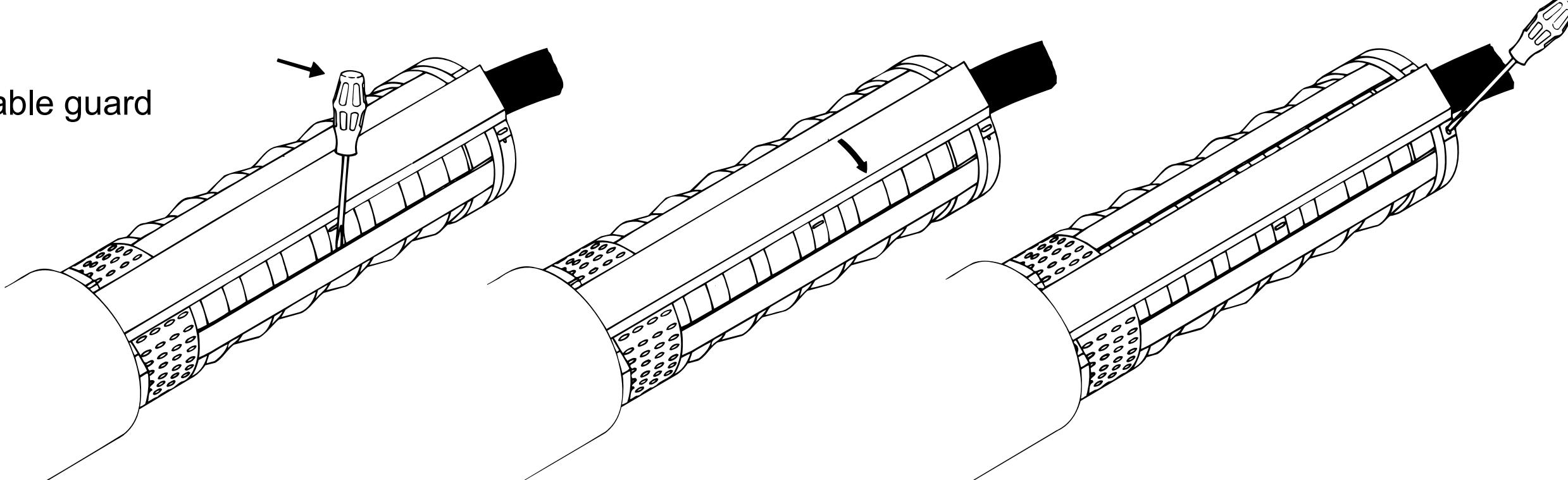
TM00 1325

Fig. 15 Removal and fitting o cable guard for SP 85S, 150S, 230S, and 300S

Removing cable guard



Fitting cable guard



TM00 1326

Fig. 16 Removal and fitting of cable guard for SP 385S, 475S, 625S, 800S, and 1100S

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Subject to alterations.

Screw Compressors

ASD Series

Capacities from: 72 to 192 cfm
Pressures from: 80 to 217 psig

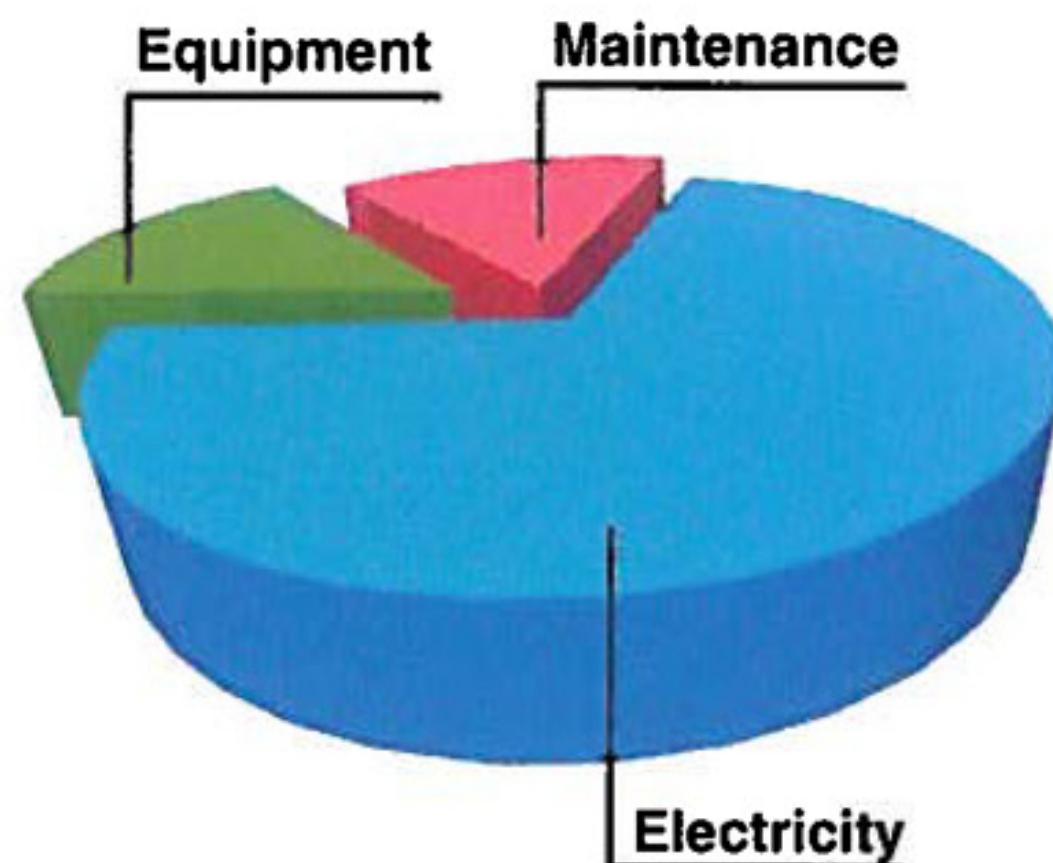


Built for a lifetime

Maximum efficiency and reliability have long been synonymous with Kaeser Compressors. Our commitment to excellence drives us to continually enhance and optimize our compressed air system solutions. With a cutting edge research and development team committed to producing industry leading products, Kaeser constantly strives to offer lasting solutions for our customers' compressed air needs. The ASD series rotary screw compressor delivers on all accounts.

Kaeser's unique Sigma Profile airend and intelligent Sigma Control 2™ system, combined with the latest one-to-one drive technology mean that our ASD compressors can guarantee exceptional energy savings, without compromising on durability or ease of maintenance. Our customers expect excellence and we make it happen.

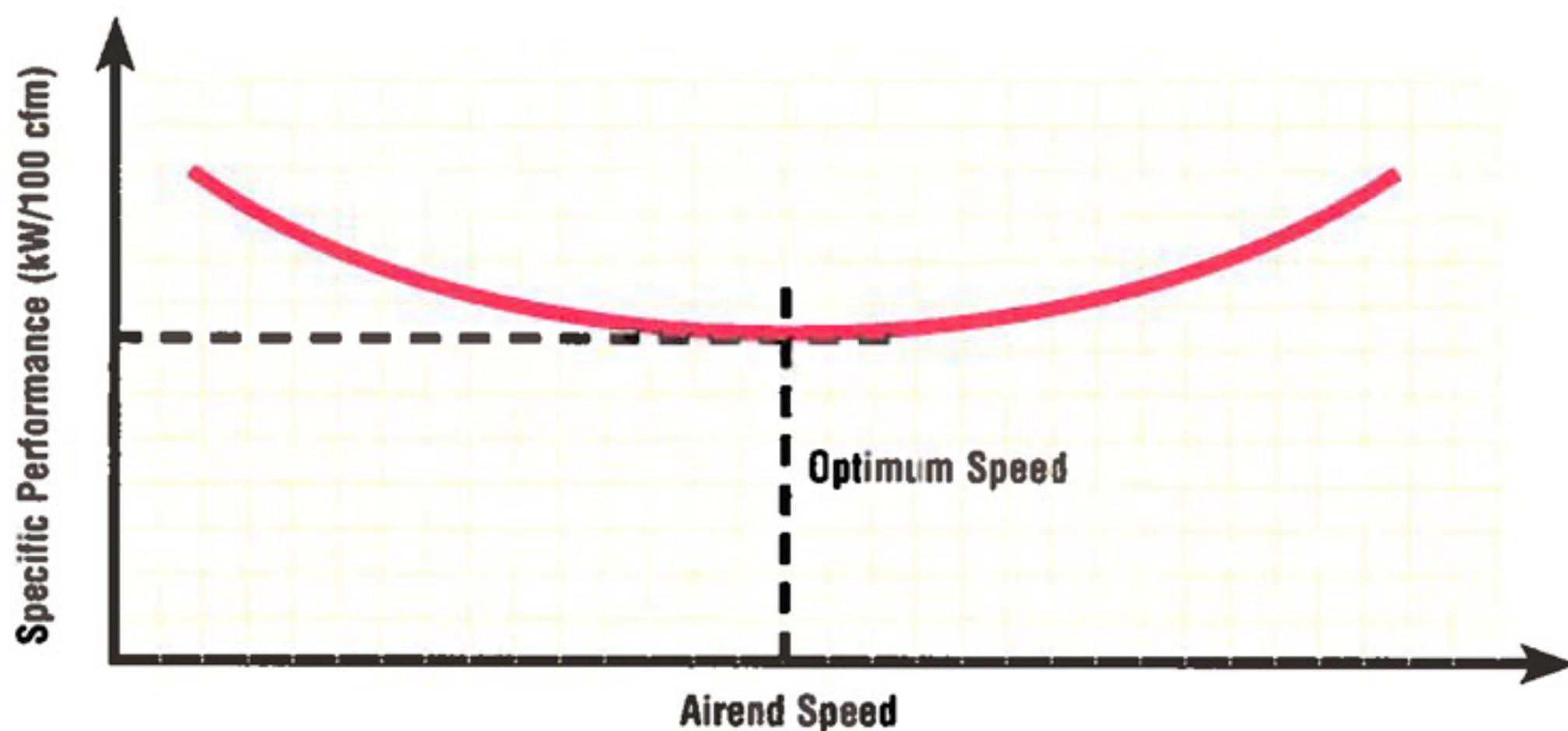
Built to perform. Built to last. Kaeser compressors are built for a lifetime.



70% of Your Long Term Compressor Cost is Electricity

Analyze the total cost of a compressed air system and you'll realize that power cost is significant. In just one year it could exceed the price of the compressor itself. Over a period of ten years, this could consume 70% of your overall air system costs. That's why it is important to investigate energy efficiency when considering a new compressor or designing an air system.

A Perfect Match



Unlike the competition, Kaeser Compressors makes many different airennds so that we can apply them at their optimal speed and performance.

1 Sigma Profile Airend

Our single-stage, flooded rotary screw airend delivers pressures up to 217 psig, and features our power saving Sigma Profile™ design. Our airennds are precision machined and optimized in size and profile to match the airend speeds with their best specific performance (see *A Perfect Match* curve).

2 True Direct Drive

In our design, the motor is directly connected to the airend with a one-to-one coupling, providing maximum transmission efficiency. This true direct drive eliminates gear drive components, heat, and power losses. It is also maintenance free, increasing reliability and uptime. A cast housing is doweled and pinned to ensure perfect alignment.

3 Premium Efficiency Drive Motor

Kaeser uses only premium efficiency Totally Enclosed Fan Cooled (TEFC) motors with class F insulation for extra protection from heat and contaminants. Remote grease fittings make maintenance a breeze. 208-230/460 V or 575 V, 3-phase, 60 Hz. Other voltages are available.

4 Reduced Voltage Starting

Magnetic Wye-Delta reduced voltage starting is standard. This energy saving feature ensures low starting current and smooth acceleration.



ASD Series



5 Inlet Filter

We protect our compressors with a two-stage, 1 micron air intake filter. This extends airend life and fluid change intervals. The filter may be cleaned several times before replacement and is easily serviced with no tools required.



6 Fluid Separation System

A combined fluid reservoir and separator tank with 3-stage separation system ensures very low fluid carry-over and pressure drop. Centrifugal action combined with two-stage coalescing doubles filter service life and the net carry over is only 1-3 ppm.

Our no-leak design features rigid steel piping, flexible connections, and vibration isolators. Each pressure vessel is ASME coded (CRN in Canada) and includes wet side/dry side fittings for manual check of differential pressure, an easy to read fluid level indicator, and our unique quick drain system.



Unique Air Flow Design Enhances Cooling

In Kaeser's "split-cooling" design, two separate cooling air inlet zones for the coolers and drive motor ensure optimum cooling. Drawing ambient air directly across the coolers and motor through separate zones eliminates pre-heating and results in longer lubricant life and a cooler running motor. This also results in much lower approach temperatures, improving moisture separation and air quality.

To increase reliability and reduce maintenance costs, the coolers are conveniently located on the outside of the unit, where dust and dirt build-up are easily seen and can be removed without dismantling the cooler.

Powerful radial fans pull air through the



Optimized Efficiency

In ASD packages, one-to-one drive reduces the number of components needed compared to a gear drive unit thus increasing reliability and service life.

Kaeser has selected oversized airends specifically matched to produce the required output in flow and pressure. Compared to compressors using small, high-speed gear-driven airends, the ASD one-to-one drive provides triple savings: no-loss power transmission, improved power consumption, and reduced maintenance and related downtime costs.

coolers and create a vacuum within the cabinet that effectively cools the motor even under severe operating conditions. Top exhaust allows for convenient ducting and reduces the system footprint.

Intelligent Control and Protection

To protect your investment and ensure the most efficient operation possible, we control this compressor with our Sigma Control 2™. This intelligent



controller comes standard with multiple pre-programmed control profiles so you can select the one that best fits your application. Sigma Control 2 monitors more than 20 critical operating parameters, shuts the unit down to prevent damage and signals if immedi-

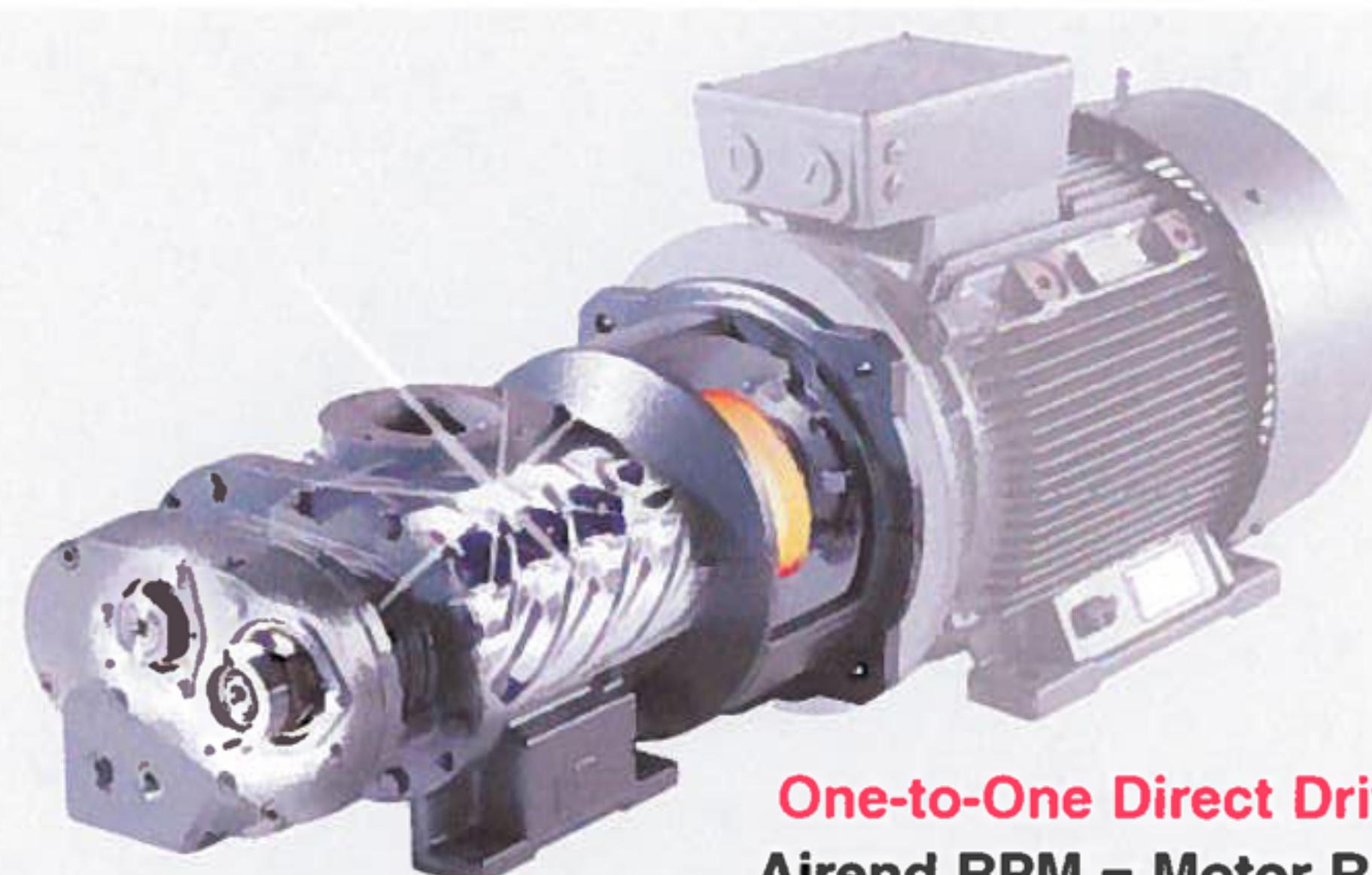
ate service is required. It also tracks preventive maintenance intervals and provides notice when PMs are due. An RFID sensor provides secure access and simplifies maintenance.

Sigma Control 2 has superior communications capabilities. An Ethernet port and built-in web-server enable remote access. ModBus, Profibus, Devicenet and other industrial communications interfaces are also available as plug in options for seamless integration into plant control/monitoring systems. See our Sigma Control 2 brochure for details.

Extremely Low Sound and Vibration

All ASD models come standard with Kaeser's superior cabinet that features complete metal enclosures with sound proofing liners and heavy-duty vibration isolation. Using one-to-one direct drive and our unique cooling airflow design with radial fans greatly reduces internal noise and vibration.

As a result, the ASD series is about 10 dB(A) quieter than conventional compressors of equal performance with sound levels as low as 66 dB(A).



One-to-One Direct Drive
Airend RPM = Motor RPM

Options

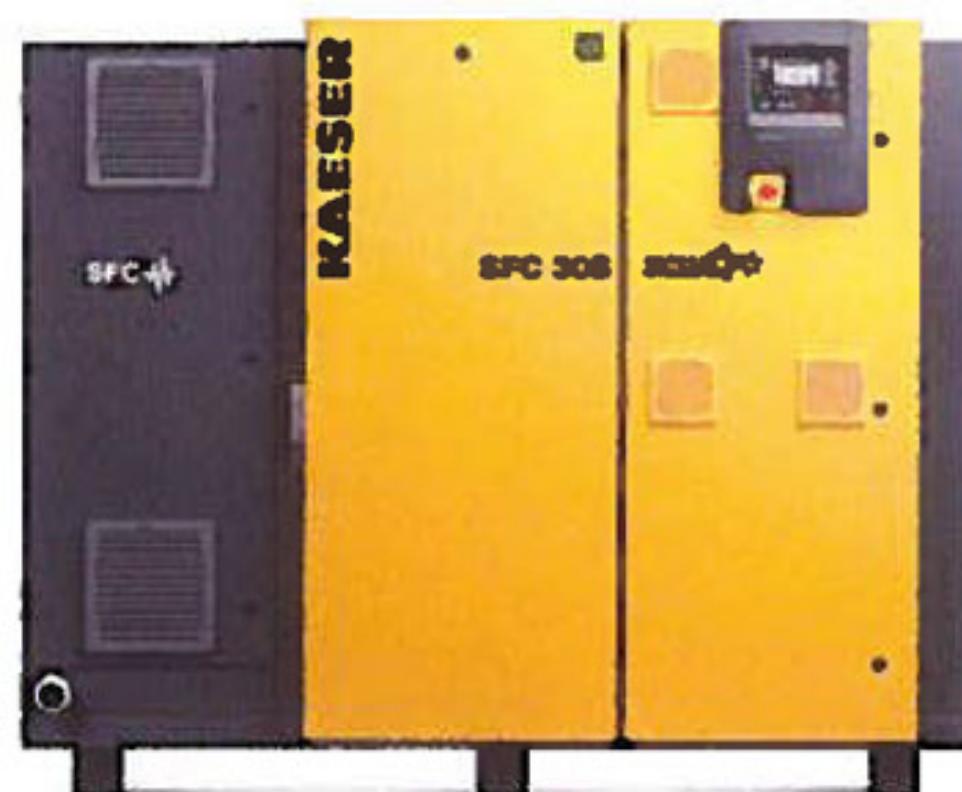
All units are available with optional refrigerated dryer and/or SFC variable frequency drive.

SFC Option*

- Superior part load efficiency
- Stable system pressure
- Siemens drive system technology for reliability and efficiency
- Drive includes EMI filter, contactor for galvanic separation, and a line reactor
- Drive cabinet cooling fans



**Not available on ASD 40 model*



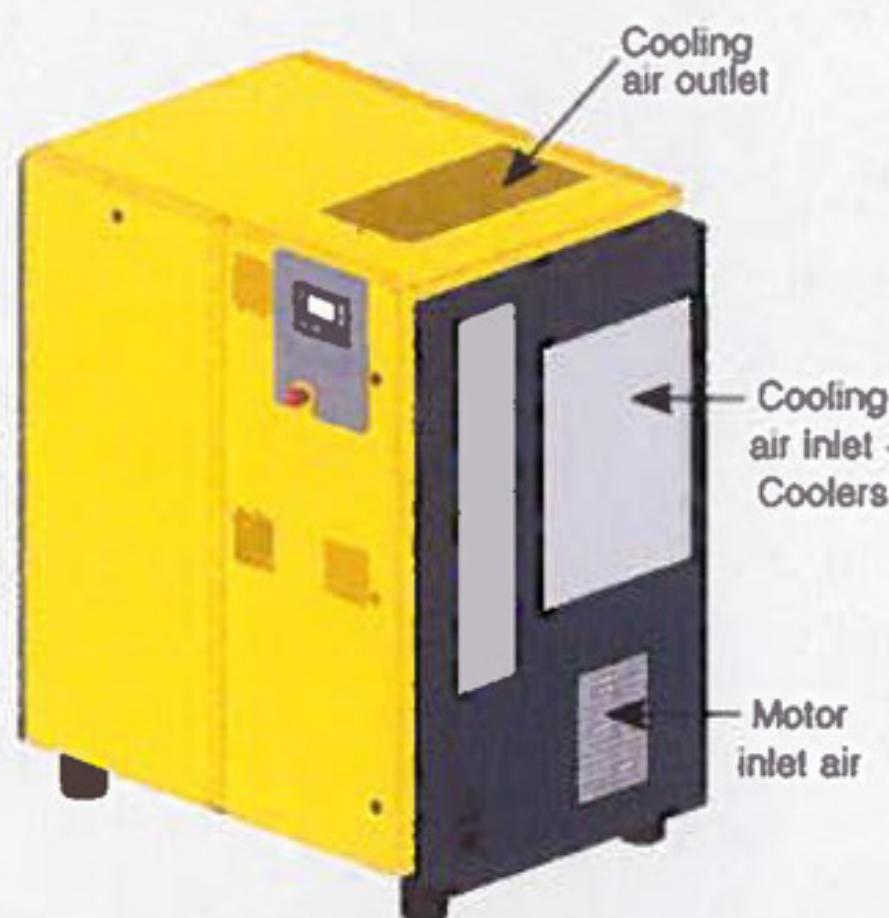
Optional SFC shown

Refrigerated Dryer Option

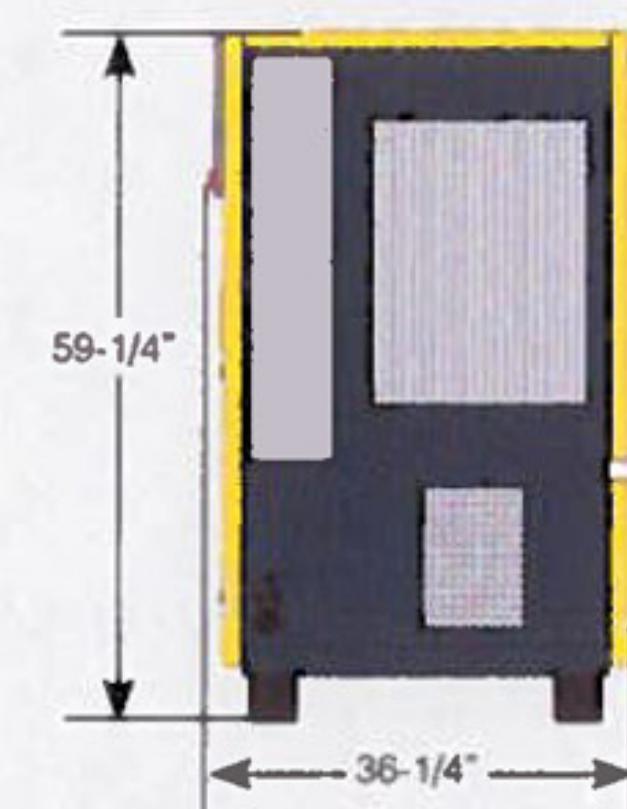
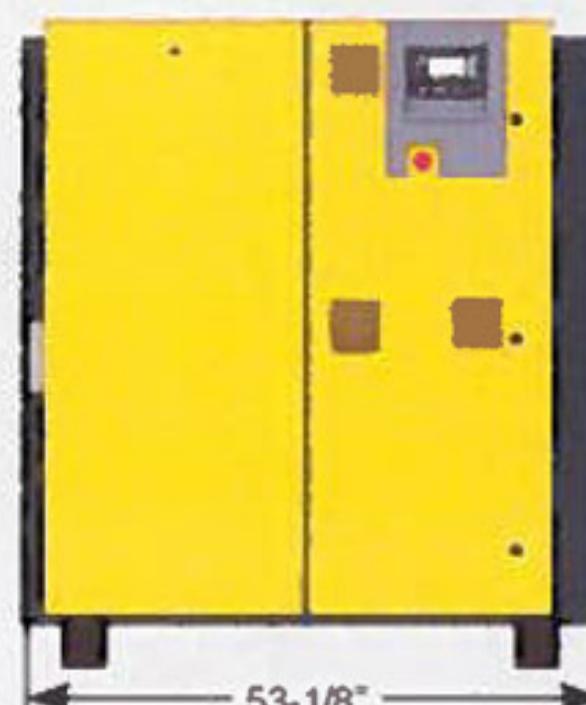
- Single point hook-up integrated dryer
- CFC-free R134a refrigerant
- Moisture separators and Eco-Drains
- Completely piped and ready for installation
- Stainless steel plate type heat exchangers

Dimensions

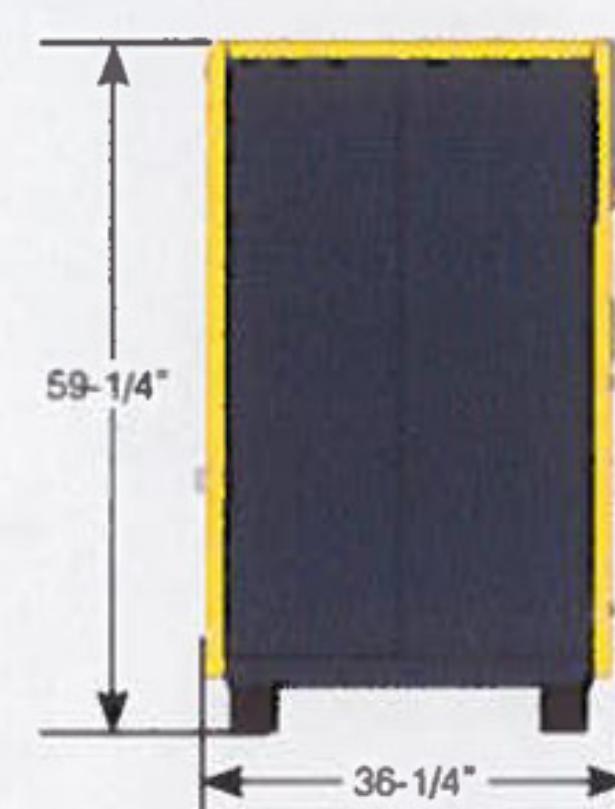
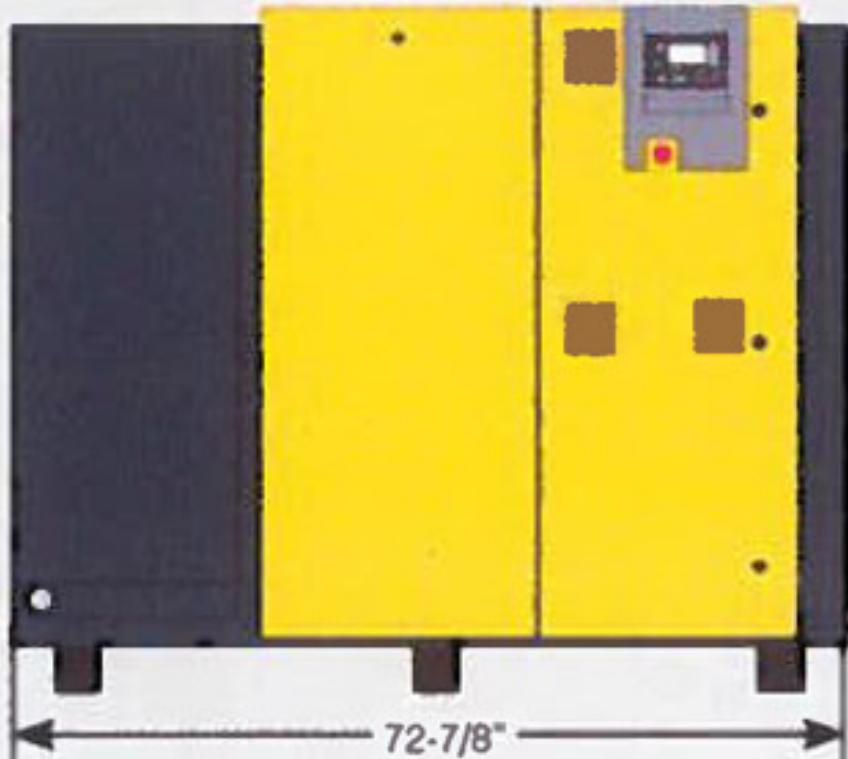
Standard Version



Optional SFC and/or Dryer



Air Discharge
NPT 1-1/4"



Dryer models only

Air Discharge NPT 1-1/4"
(dryer models only)

Dimensions are for reference only — please contact Kaeser for dimensional drawings.

CAGI Certified Performance

Our compressors' energy efficiency has been tested and confirmed by an independent laboratory as part of the Compressed Air and Gas Institute's *Rotary Screw Compressor Performance Verification Program*.



To find CAGI data sheets for this compressor, scan this QR code with your Smartphone or go to www.kaeser.com/cagi.

ASD Series - Technical Specifications for Standard Units*

Model	Pressure Range (psig)	Capacity (cfm) ⁽¹⁾	Rated Motor Power (hp)	Dimensions (in.)	Weight (lb.) ⁽²⁾	Sound Level dB(A) ⁽³⁾
ASD 25	125	112	25	53 ¹ / ₈ x 36 ¹ / ₄ x 59 ¹ / ₄	1280	66
	175	89				
	217	72				
ASD 30	125	132	30	53 ¹ / ₈ x 36 ¹ / ₄ x 59 ¹ / ₄	1440	67
	175	110				
	217	85				
ASD 40S	125	162	40	53 ¹ / ₈ x 36 ¹ / ₄ x 59 ¹ / ₄	1470	67
	175	127				
	217	106				
ASD 40	125	191	40	53 ¹ / ₈ x 36 ¹ / ₄ x 59 ¹ / ₄	1480	69
	175	159				
	217	123				

(1) Performance rated in accordance with CAGI/ISO 1217 test code. (2) Weights may vary slightly depending on airend model. (3) Per ISO 2151 using ISO 9614-2.

NOTE: Other pressures available from 80 to 217 psig.

* For units with SFC and/or dryer, please contact your local authorized KAESER distributor.

Specifications are subject to change without notice.

Compressed Air System Design

Kaeser's team of engineers are always at your service to help design or optimize your compressed air system.

Using our Air Demand Analysis (ADA) and Kaeser Energy Saving System (KESS) we can evaluate your existing installation and demonstrate how proposed changes will improve your system performance.

Kaeser can also produce two-dimensional and three-dimensional drawings of the proposed system. This is a huge benefit in project planning. It helps visualize new equipment and how it will fit into the building along with existing equipment, piping, walls, vents, etc. This facilitates installation planning.

From complex installations to challenging environments to limited space, Kaeser can design a system to meet your specific requirements for performance and reliability.

KAESER COMPRESSORS

Built for a lifetime™

www.kaeser.com

Kaeser Compressors, Inc.
511 Sigma Drive
Fredericksburg, VA 22408 USA
Telephone: 540-898-5500
Toll Free: 800-777-7873
info.usa@kaeser.com



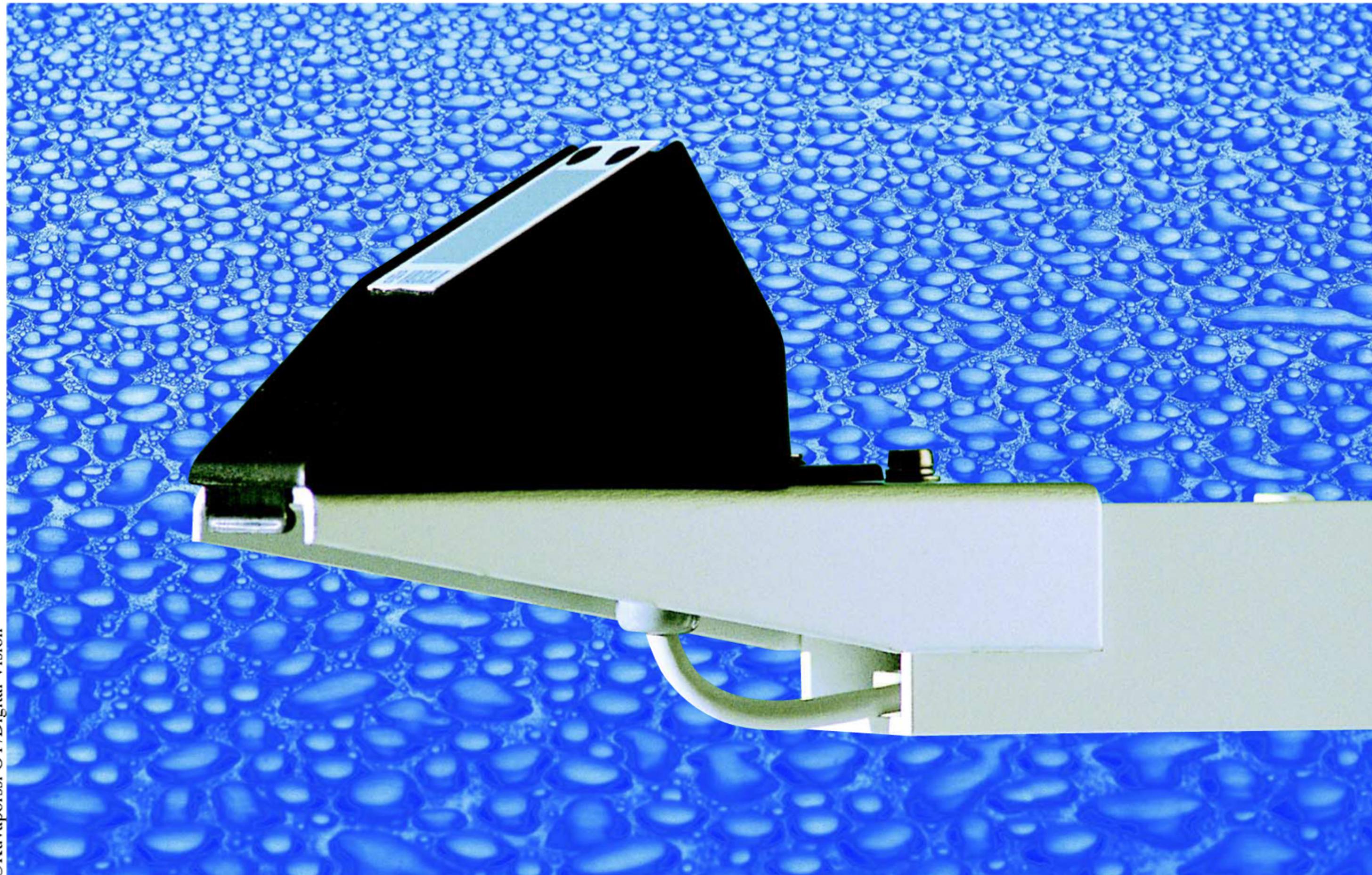
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01012-Guatemala City
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info.guatemala@kaeser.com

DRD11A

RAIN DETECTOR



©Kuvapörssi OY/Digital Vision

- Fast and accurate precipitation detection (ON/OFF)
- Rain intensity measurement with processing unit
- Maintenance free
- Heating element for keeping sensor free of snow and condensed moisture, and for quick drying

Rain and snow are quickly and accurately detected with the DRD11A Rain Detector. The DRD11A operates via droplet detection rather than by signal level threshold.

A special delay circuitry allows about two-minute interval between raindrops before assuming an OFF (no rain) position. This enables the sensor to accurately distinguish between rain cessation and light rain.

The DRD11A also features an analog Rain Signal for estimating rain intensity. Since this signal is proportional to the percentage of moist or wet

area on the sensor plate, rain intensity has a direct impact on the amplitude and variation of this analog signal.

The DRD11A sensor is positioned at a 30° angle. This design, together with the internal heating element, ensures that the surface dries quickly, an essential factor in calculating intensity. The same heating element also protects the surface from fog and condensed moisture, and is activated at low temperatures in order to melt snow, thus allowing snow detection. Sensor performance is not affected by reasonable amounts of dirt and dust due to droplet detection.

The DRD11L is a low heating power model of the DRD11A. It is intended to be used in areas with only rain or wet/moist snow precipitation.

TECHNICAL DATA

SENSOR

Capacitive principle, thick layer sensor
RainCap™ with a thin glass shield. Integrated heater element.

SENSITIVITY OF RAIN DETECTION

Minimum wet area	0.05 cm ²
OFF-delay (active)	< 5 min

PHYSICAL

Sensor plate	
Sensing area	7.2 cm ²
Angle	30°
Housing material	Polypropylene
Windshield and support bracket	Aluminum
Moisture shield	Polyurethane
Dimensions	(h × w × l)
With wind shield	110 × 80 × 175 mm
Without wind shield	90 × 46 × 157 mm
Weight	500 g
Cable length	4 m

ELECTRICAL

Supply voltage	12 VDC ± 10 %
Supply current	
Typical less than	150 mA
Maximum	260 mA
Heater OFF	25 mA
Sensor plate	
Heating power	0.5 ... 2.3 W

OUTPUT

Rain ON/OFF
Open collector, active low signal corresponds to rain.

Maximum voltage	15 V
Maximum current	50 mA

Analog output	1...3 V (wet...dry)
Frequency output	1500...6000 Hz, non-calibrated

INPUT

Control to switch heater OFF
Open circuit input enables the heater.
Connection to GND disables the heater.
Contact rating min. 15 V, 2 mA

GROUND WIRING

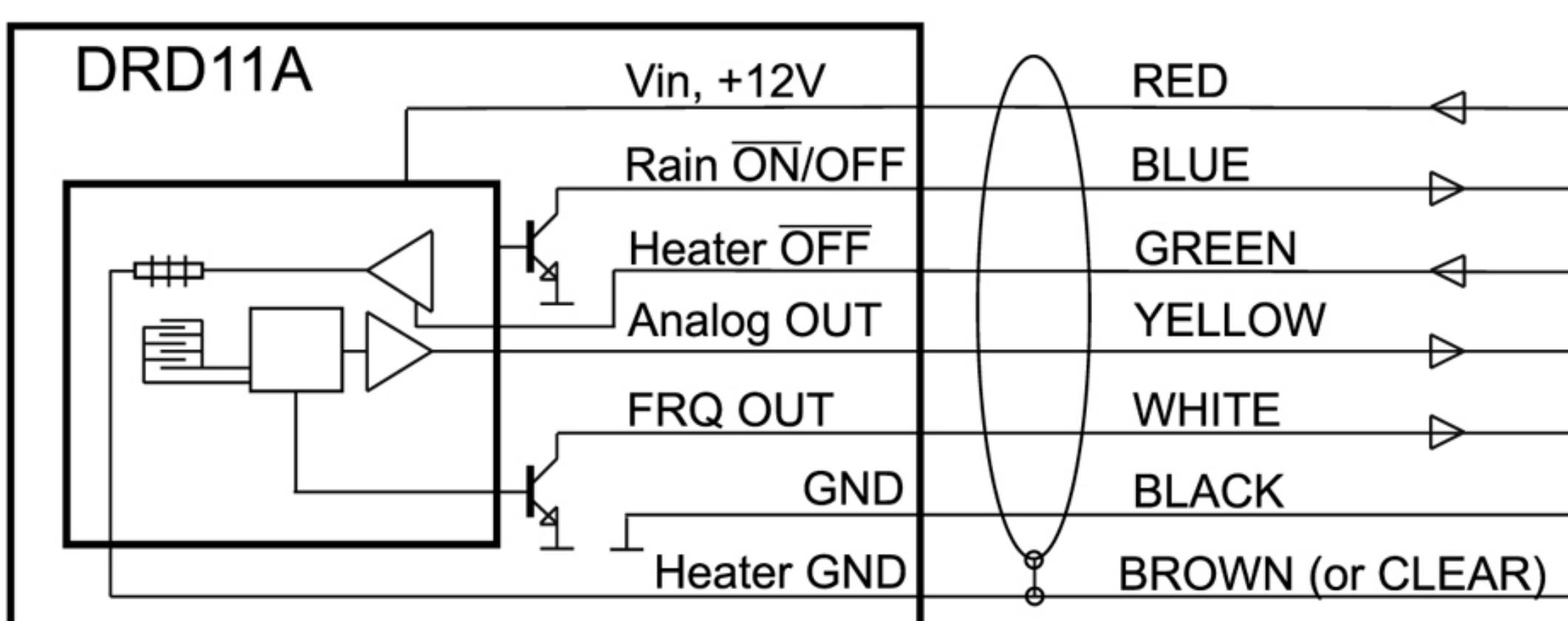
Separate ground wires for signal and heater

TEMPERATURE RANGE

Operating	-15...+55 °C (+5...+131 °F)
Storage	-40...+65 °C (-40...+149 °F)

MOUNTING

By one screw (M5 x 20 mm) to sensor arm.



WILKERSON®

Richland, MI 49083

Tel: (269) 629-5000

Installation & Service Instructions

84-007-000

Regulator Model R30**With Variations and Accessories****ISSUED: April, 2006****Supersedes: May, 2004**

Doc.# 84007000, ECN# 060299, Rev. 5

! WARNING

To avoid unpredictable system behavior that can cause personal injury and property damage:

- Disconnect electrical supply (when necessary) before installation, servicing, or conversion.
- Disconnect air supply and depressurize all air lines connected to this product before installation, servicing, or conversion.
- Operate within the manufacturer's specified pressure, temperature, and other conditions listed in these instructions.
- Medium must be moisture-free if ambient temperature is below freezing.
- Service according to procedures listed in these instructions.
- Installation, service, and conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversion, air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or the product does not operate properly, do not put into use.
- Warnings and specifications on the product should not be covered by paint, etc. If masking is not possible, contact your local representative for replacement labels.

! WARNING

Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed maximum primary pressure rating.

! WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from The Company, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or systems in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by The Company and its subsidiaries at any time without notice.

EXTRA COPIES OF THESE INSTRUCTIONS ARE AVAILABLE FOR INCLUSION IN EQUIPMENT / MAINTENANCE MANUALS THAT UTILIZE THESE PRODUCTS. CONTACT YOUR LOCAL REPRESENTATIVE.

INSTALLATION

1. Refer to WARNING prior to installation.
2. Maximum pressure rating is 300 psig (21 bar). Temperature range is 32°F to 150°F (0°C to 66°C).
3. Install the unit ahead of and as close as possible to where regulated air is needed.
4. Install the unit with the air flowing through the body in the direction indicated by the arrow.
5. Install the same pipe size unit as the pipe size in use. Avoid using fittings, couplings etc. that restrict the airflow, unless maximum flow is not needed.
6. Regulator may be installed so that adjusting handle is in any position. Attach gauge to one 1/4" gauge port and plug the other 1/4" gauge port.
7. Turning the adjusting screw clockwise raises the regulated pressure, and turning it counterclockwise lowers the regulated pressure.

MAINTENANCE

1. At least every six months remove bottom plug and clean plug, body and valve.
2. TO DISASSEMBLE: Shut off air supply and vent air lines on both sides of regulator. Turn adjusting screw counterclockwise to relieve compression or spring. Remove cover, retaining ring, bonnet, spring disc, and piston. By removing bottom plug and spring, the valve can be removed from the bottom of the regulator.
3. TO ASSEMBLE: Relubricate all seals and sealing surfaces with lubricant. Replace valve, bottom spring, and bottom plug. Insert piston into body, place spring, spring disc, and bonnet in position, and install retaining ring and cover. RETAINING RING MUST BE FULLY SEATED IN GROOVE.
4. IF UNIT WILL NOT REGULATE TO PRESSURE NEEDED, OR IF PRESSURE DROP BECOMES EXCESSIVE: Remove bottom plug, spring and valve. Clean and check o-rings, valve and valve seat for wear or damage. Relubricate o-rings with lubricant. Replace worn or damaged parts.

REPAIR KITS AND REPLACEMENT PARTS

Repair kit — self-relieving	RRP-95-159
High-pressure spring (0-180 psi)	RRP-95-220
Standard-pressure spring (0-125 psi)	RRP-95-226
Standard-pressure gauge (0-160 psi)	K4520N14160
High-pressure gauge (0-300 psig)	K4520N14300
Piston kit — nonrelieving	RRP-95-451
Pipe-mounting bracket	GRP-95-734



WILKERSON®

Richland, MI 49083

Tel: (269) 629-5000

Instructions d'installation et Service

84-007-000 (French)

Régulateur modèle R30 avec
Variations et Accessoires

DISTRIBUE: April, 2006

Supplantent: Juillet, 2004

Doc.# 84007000, ECN# 060299, Rev. 5

⚠ AVERTISSEMENT

Afin d'éviter un fonctionnement imprévu du système pouvant occasionner des blessures aux personnes et des dommages matériels :

- Débrancher l'alimentation électrique (si nécessaire) avant toute installation, entretien ou conversion.
- Débrancher l'alimentation en air et dépressuriser toutes les canalisations d'air connectées à cet appareil avant installation, entretien ou conversion.
- Utiliser l'appareil conformément aux normes de pression, température, et autres conditions spécifiées par le fabricant dans ces instructions.
- Le médium doit être exempt d'humidité si la température descend en dessous de 0°C.
- L'entretien doit se faire conformément aux procédures décrites ici.
- L'installation, l'entretien, et la conversion de ces appareils doivent être effectués par des personnels qualifiés, au fait des techniques pneumatiques.
- Après installation, entretien, ou conversion, les alimentations en air et en électricité (si nécessaire) seront connectées et l'appareil testé pour vérifier son fonctionnement correct et l'absence de fuites. Si l'appareil présente une fuite audible ou ne fonctionne pas correctement, ne pas l'utiliser.
- Les inscriptions concernant les avertissements et spécifications sur l'appareil ne devront pas être recouvertes de peinture, etc. Si le masquage est impossible, contactez votre représentant local pour des étiquettes de remplacement.

⚠ AVERTISSEMENT

Une rupture de l'appareil peut occasionner des blessures graves.

Ne pas utiliser ce régulateur pour du gaz en bouteille.

Ne pas dépasser la norme de pression primaire maximum.

⚠ AVERTISSEMENT

LA DEFAILLANCE, LE CHOIX ERREUR OU L'USAGE NON CONFORME DES PRODUITS ET/OU SYSTEMES ICI DECIRTS, OU PRODUITS Y AFFERANT, PEUVENT ENTRAINER LA MORT, DES BLESSURES AUX PERSONNES ET DES DOMMAGES MATERIELS.

Ce document et autres informations de « The Company », ses filiales et distributeurs autorisés offre des options complémentaires d'utilisation du produit et/ou système pour des utilisateurs ayant l'expertise technique requise. Il est important que vous analysez tous les aspects de l'usage prévu, y compris les conséquences de toute défaillance, et que vous passiez en revue les informations concernant les produits et systèmes dans le catalogue actuel des produits. En raison de la diversité des conditions de fonctionnement et d'utilisation de ces produits ou systèmes, l'utilisateur, et lui seul, selon ses propres analyses et tests, porte la responsabilité du choix final des produits et systèmes. Il est aussi de sa responsabilité pleine et entière de s'assurer que les produits soient utilisés conformément aux normes de sécurité et avertissements d'usage.

Les produits décrits ici, y compris, mais non exclusivement, les caractéristiques des produits, spécifications, aspects, disponibilité et prix, sont susceptibles de modification à tout moment et sans préavis par « The Company » et ses filiales.

DES EXEMPLAIRES SUPPLEMENTAIRES DE CES INSTRUCTIONS SONT DISPONIBLES POUR ACCOMPAGNER LES APPAREILS/MANUELS D'ENTRETIEN CORRESPONDANT A CES PRODUITS. CONTACTEZ VOTRE REPRESENTANT LOCAL.

INSTALLATION

1. Lire l'avertissement ci-haut avant l'installation.
2. La pression maximale d'utilisation est de 21 bar (300 psig). La température d'utilisation se situe entre 0°C et 65.6 °C (de 32°F à 150 °F).
3. Installer le dispositif avant et aussi près que possible du point d'utilisation de l'air régulé.
4. Positionner le régulateur de manière à ce que le débit soit orienté dans la direction de la flèche.
5. La tuyauterie du système et celle de l'orifice du régulateur doivent être du même diamètre. Éviter d'utiliser des raccords, bagues, etc. qui diminuent le débit d'air.
6. On peut installer le dispositif avec le bouton de réglage dans n'importe quelle position. Raccorder un manomètre à l'un des orifices de 0,635 cm (1/8") et boucher l'orifice non utilisé.
7. On augmente la pression régulée en tournant la vis de réglage dans le sens horaire; on la diminue en tournant la vis de réglage dans le sens antihoraire.

ENTRETIEN

1. Au moins tous les six mois, démonter et nettoyer le corps et le siège de soupape de temps à autre.
2. POUR DÉMONTER LE RÉGULATEUR : Fermer l'arrivée d'air ou d'eau au régulateur et mettre la conduite à la pression atmosphérique de chaque côté du régulateur. Tourner la vis de réglage dans le sens antihoraire jusqu'à ce qu'il n'y ait plus de pression sur le ressort. Ôter le bouton, la bague de retenue, le chapeau, le disque-ressort et le piston. En retirant le bouchon inférieur, on peut démonter l'ensemble de soupape et le ressort de soupape.
3. POUR REMONTER : Lubrifier tous les joints et les surfaces de contact avec un lubrifiant de type. Remonter la soupape, le ressort de soupape et le bouchon inférieur. Introduire le piston dans le corps, mettre le ressort, le ressort-disque et le chapeau en place, et installer la bague de retenue et le bouton. LA BAGUE DE RETENUE DOIT ÊTRE BIEN EN PLACE DANS LA RAINURE.
4. SI LE DISPOSITIF N'ASSURE PAS LA RÉGULATION À LA PRESSION VOULUE OU SI LA DIFFÉRENCE DE PRESSION DEVIENT EXCESSIVE : Ôter le bouchon inférieur, le ressort et la soupape. Nettoyer et examiner la soupape, le siège de soupape et les joints toriques. Lubrifier les joints toriques avec un lubrifiant de type. Les remplacer s'ils sont usés ou endommagés.

TROUSSES DE RÉPARATION ET PIÈCES DE RECHANGE

Trousse de réparation — dispositif autorégulateur	RRP-95-159
Ressort à haute pression (0-180 psig)	RRP-95-220
Ressort à pression standard (0-125 psig)	RRP-95-226
Manomètre à pression standard (0-160 psig)	K4520N14160
Manomètre à haute pression (0-300 psig)	K4520N14300
Trousse de piston (non autorégulateur)	RRP-95-451
Support de montage sur tuyau	GRP-95-734



WILKERSON®

Richland, MI 49083

Tel: (269) 629-5000

Las Instrucciones de la instalación**y el Servicio****84-007-000 (Spanish)****Regulador Modelo R30****con Variaciones y Accesorios****PUBLICADO: April, 2006****Desbanca: Julio, 2004**

Doc.# 84007000, ECN# 060299, Rev. 5

**ADVERTENCIA**

Para evitar un comportamiento impredecible del sistema que pueda ocasionar lesiones personales y daños a la propiedad:

- Antes de instalar, reparar o convertir, desconecte el suministro eléctrico (cuando sea necesario).
- Antes de instalar, reparar o convertir, desconecte el suministro de aire y despresurice todas las líneas de aire que están conectadas a este producto.
- Haga funcionar dentro de la presión, temperatura y demás condiciones especificadas por el fabricante y que se incluyen en estas instrucciones.
- El medio debe estar libre de humedad si la temperatura ambiente se encuentra por debajo del punto de congelación.
- Repare de acuerdo con los procedimientos que se incluyen en estas instrucciones.
- La instalación, reparación y conversión de estos productos debe ser realizada por personal competente que entienda la manera en que se deben aplicar los productos neumáticos.
- Despues de la instalación, reparación y conversión, se debe conectar los suministros eléctricos y de aire (cuando sea necesario), y el producto se debe poner a prueba para determinar que funciona correctamente y no tiene pérdidas. Si se detecta una pérdida audible, o si el producto no funciona correctamente, no lo ponga en funcionamiento.
- Las advertencias y especificaciones que aparecen en el producto no deben estar cubiertas por pintura, etc. Si no resulta posible colocarlo con cinta adhesiva, póngase en contacto con su representante local para obtener etiquetas de repuesto.

**ADVERTENCIA**

La ruptura del producto puede ocasionar lesiones graves.

No conecte el regulador al gas embotellado.

No exceda la clasificación de presión primaria máxima.

**ADVERTENCIA**

EL FALLO O LA SELECCIÓN INCORRECTA O EL USO INCORRECTO DE LOS PRODUCTOS Y/O SISTEMAS AQUÍ DESCRITOS U OTROS ARTÍCULOS RELACIONADOS PUEDE RESULTAR EN MUERTE, LESIONES PERSONALES Y DAÑO A LA PROPIEDAD.

Este documento y demás información de la compañía, sus subsidiarias y distribuidores autorizados ofrecen opciones de productos y sistemas para mayor investigación por parte de los usuarios que cuentan con conocimientos técnicos. Es importante que analice todos los aspectos de su aplicación, incluyendo las consecuencias de cualquier fallo y que revise la información concerniente al producto o los sistemas que se encuentran en el catálogo actual de productos. Debido a la variedad de condiciones de funcionamiento y aplicaciones para estos productos o sistemas, el usuario, mediante su propio análisis y pruebas, es únicamente responsable por la selección final de los productos y sistemas, y por garantizar que se cumpla con todos los requisitos de funcionamiento, seguridad y advertencia de la aplicación.

Los productos aquí descritos, incluyendo pero sin limitarse, a las características del producto, las especificaciones, los diseños, la disponibilidad y los precios, están sujetos a cambios por parte de la compañía y de sus subsidiarias en cualquier momento sin aviso.

SE PUEDE OBTENER COPIAS ADICIONALES DE ESTAS INSTRUCCIONES PARA INCLUIR CON EL EQUIPO / LOS MANUALES DE MANTENIMIENTO QUE UTILIZAN ESTOS PRODUCTOS. COMUNIQUESE CON SU REPRESENTANTE LOCAL.

INSTALACION

1. Remítase a la ADVERTENCIA antes de proceder a la instalación.
2. La clasificación de presión máxima es de 21 bar (300 PSIG). El rango de temperatura es de 0°C a 65.6°C (32°F a 150°F).
3. Instale la unidad delante de y lo más cerca posible de donde se requiere el aire regulado.
4. Instale la unidad de modo que el aire circule a través del cuerpo en la dirección indicada por la flecha.
5. Instale una unidad con el mismo tamaño de tubo que el del tubo en uso. Evite utilizar accesorios, acopladores, etc. que restringen el flujo de aire, salvo que no se requiera un flujo máximo.
6. El regulador puede instalarse de modo que el mango de ajuste esté en cualquier posición. Acople el manómetro a una abertura de manómetro de 1/4" y tapone la otra abertura de manómetro de 1/4".
7. Al girar el tornillo de ajuste en el sentido de las manecillas del reloj se aumenta la presión regulada, y al girarlo en el sentido contrario se la reduce.

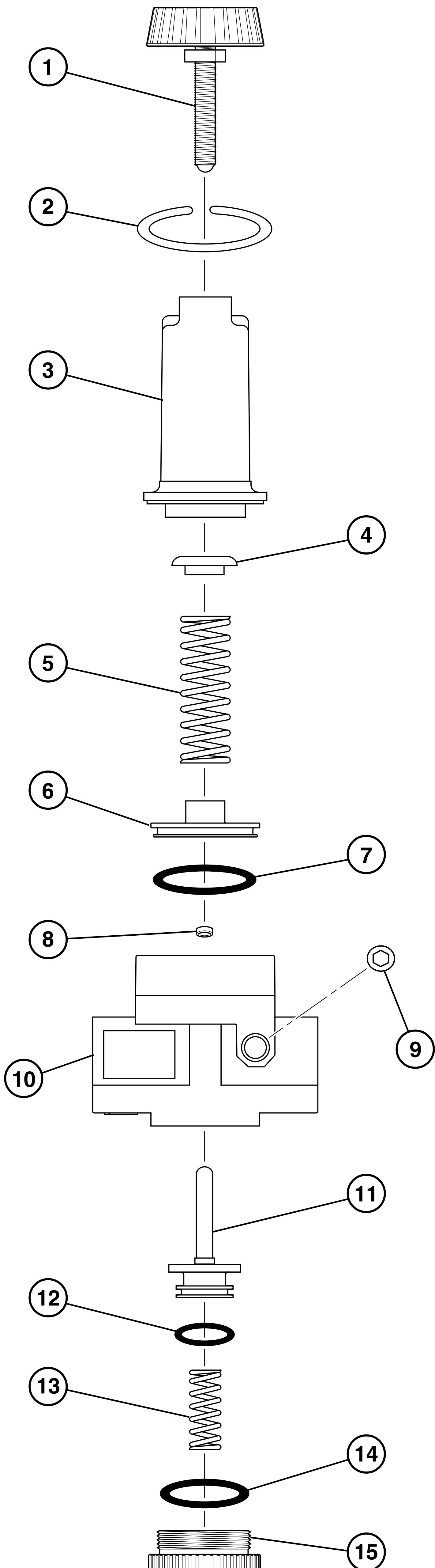
MANTENIMIENTO

1. Por lo menos cada seis meses, retire el tapón inferior y limpie el tapón, el cuerpo y la válvula.
2. **PARA DESARMAR:** Cierre el suministro de aire al regulador y purgue los conductos de aire a ambos lados del regulador. Gire el tornillo de ajuste en sentido contrario al de las manecillas del reloj para aliviar la compresión sobre el resorte. Retire la cubierta, el anillo de fijación, el sombrerete, el disco de resorte y el pistón. Al retirar el tapón inferior y el resorte, se puede retirar la válvula de la parte inferior del regulador.
3. **PARA ARMAR:** Vuelva a lubricar todas las juntas y superficies de sellado con el lubricante. Cambie la válvula, el resorte inferior y el tapón inferior. Inserte el pistón en el cuerpo, coloque el resorte, el disco del resorte y el sombrerete en posición e instale el anillo de fijación y la cubierta. **EL ANILLO DE FIJACION DEBE ESTAR ASENTADO TOTALMENTE EN LA RANURA.**
4. **SI LA UNIDAD NO REGULA A LA PRESION REQUERIDA O SI LA CAIDA DE PRESION SE VUELVE EXCESIVA:** Retire el tapón inferior, el resorte y la válvula. Limpie y revise las juntas tóricas, la válvula y el asiento de la válvula por si hubiera desgaste o daños. Vuelva a lubricar las juntas tóricas con lubricante. Cambie las partes desgastadas o dañadas.

JUEGOS DE REPARACION Y REPUESTOS

Juego de reparación - autodescargador	RRP-95-159
Resorte de alta presión (0-180 psi)	RRP-95-220
Resorte de presión estándar (0-125 psi)	RRP-95-226
Manómetro de presión estándar (0-160 psi)	K4520N14160
Manómetro de alta presión (0-300 psig)	K4520N14300
Juego de pistón - no descargador	RRP-95-451
Ménsula de montaje en tubo	GRP-95-734





- 1** ADJUSTING KNOB (NNR)
BOUCHON DE RÉGLAGE (NNR)
PERILLA DE AJUSTE (NNR)
- 2** RETAINING RING
BAGUE DE RETENUE
ANILLO DE FIJACION
- 3** BONNET (NNR)
CHAPEAU (NNR)
SOMBRERETE (NNR)
- 4** SPRING DISC (NNR)
DISQUE-RESSORT (NNR)
DISCO DEL RESORTE (NNR)
- 5** REGULATING SPRING
RESSORT RÉGULATEUR
RESORTE DE REGULACION
- 6** PISTON (NNR)
PISTON (NNR)
PISTON (NNR)
- 7** O-RING
JOINT TORIQUE
JUNTA TORICA
- 8** DISC SEAL
JOINT DE DISQUE
SELLO DEL DISCO
- 9** PIPE PLUG (1 required)
BOUCHON DE TUYAU (1 nécessaire)
TAPON DEL TUBO (se requiere 1)
- 10** BODY (NNR)
CORPS (NNR)
CUERPO (NNR)
- 11** VALVE ASSEMBLY
ENSEMBLE DE SOUPAPE
ENSAMBLE DE LA VALVULA
- 12** O-RING
JOINT TORIQUE
JUNTA TORICA
- 13** VALVE SPRING
RESSORT DE SOUPAPE
RESORTE DE LA VÁLVULA
- 14** O-RING
JOINT TORIQUE
JUNTA TORICA
- 15** BOTTOM PLUG (NNR)
BOUCHON INFÉRIEUR (NNR)
TAPON INFERIOR (NNR)

NNR = NOT NORMALLY REPLACED
NORMALEMENT NON REMPLACÉ
NORMALMENTE NO SE REEMPLAZA

First incorporated in August of 1948, Wilkerson manufactures a complete line of compressed air treatment and control products to meet a wide variety of industrial, process, consumer and health care applications. Today, Wilkerson serves over 500 different industries throughout the world.

Over the years, Wilkerson facilities, manufacturing and engineering technology have kept pace with increased sales volume, the growing need to satisfy customers' specific requirements and the demands placed on production.

Wilkerson's growing leadership in the industry is due to our determined

commitment to quality; quality of products, services and people. Our dedication to the total quality management process assures our customers that we can consistently provide the highest levels of product quality and customer service required to meet their needs.

From the very beginning, Wilkerson has sold its products through a world-wide, independent distributor network. We currently have 200 distributors throughout North America, plus an expanding network of international distributors in over 40 countries. Our distributors, who have many years of experience in compressed air treatment and

control, offer excellent product knowledge, technical assistance and local inventory. As a result of representing other complimentary products, they are able to satisfy their customers' total requirements.

Today's broad line of Wilkerson products is the result of continuing product innovations and technology advancements which frequently become industry standards. Wilkerson is dedicated to designing and manufacturing innovative products with features and operating characteristics that meet customer requirements for quality, performance, reliability, serviceability, safety and value.

WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from The Company, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application including consequences of any failure, and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by The Company and its subsidiaries at any time without notice.

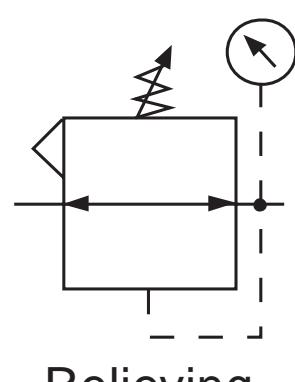
Offer of Sale

The items described in this document are hereby offered for sale by The Company, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated on the separate page of this document "Offer of Sale".

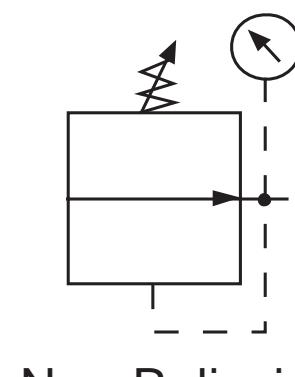


Regulator

R30



Relieving



Non-Relieving



R30-06-000

Filters, Regulators, Lubricators

B

Features

- Balanced Valve Design
- Standard Self-Relieving
- Two 1/4 NPT / BSPT-Rc Gauge Ports Standard – Can Be Used for Additional Outlet Ports
- Piston Operated
- High Flow Capacity

Specifications

Flow Capacity*	3/4	481 SCFM (227 dm ³ /s)
	1	500 SCFM (236 dm ³ /s)
	1-1/4	800 SCFM (377 dm ³ /s)
Adjusting Range Pressure		0 to 125 PSIG (0 to 8.6 bar)
		0 to 180 PSIG (0 to 12.4 bar)
Gauge Port (2 ea.)	NPT / BSPT-Rc	1/4
Maximum Supply Pressure		300 PSIG (20.7 bar)
Operating Temperature		32° to 150°F (0° to 65.5°C)
Port Size	NPT / BSPP-G	3/4, 1, 1-1/4
Weight	lb. (kg)	6 (2.7)

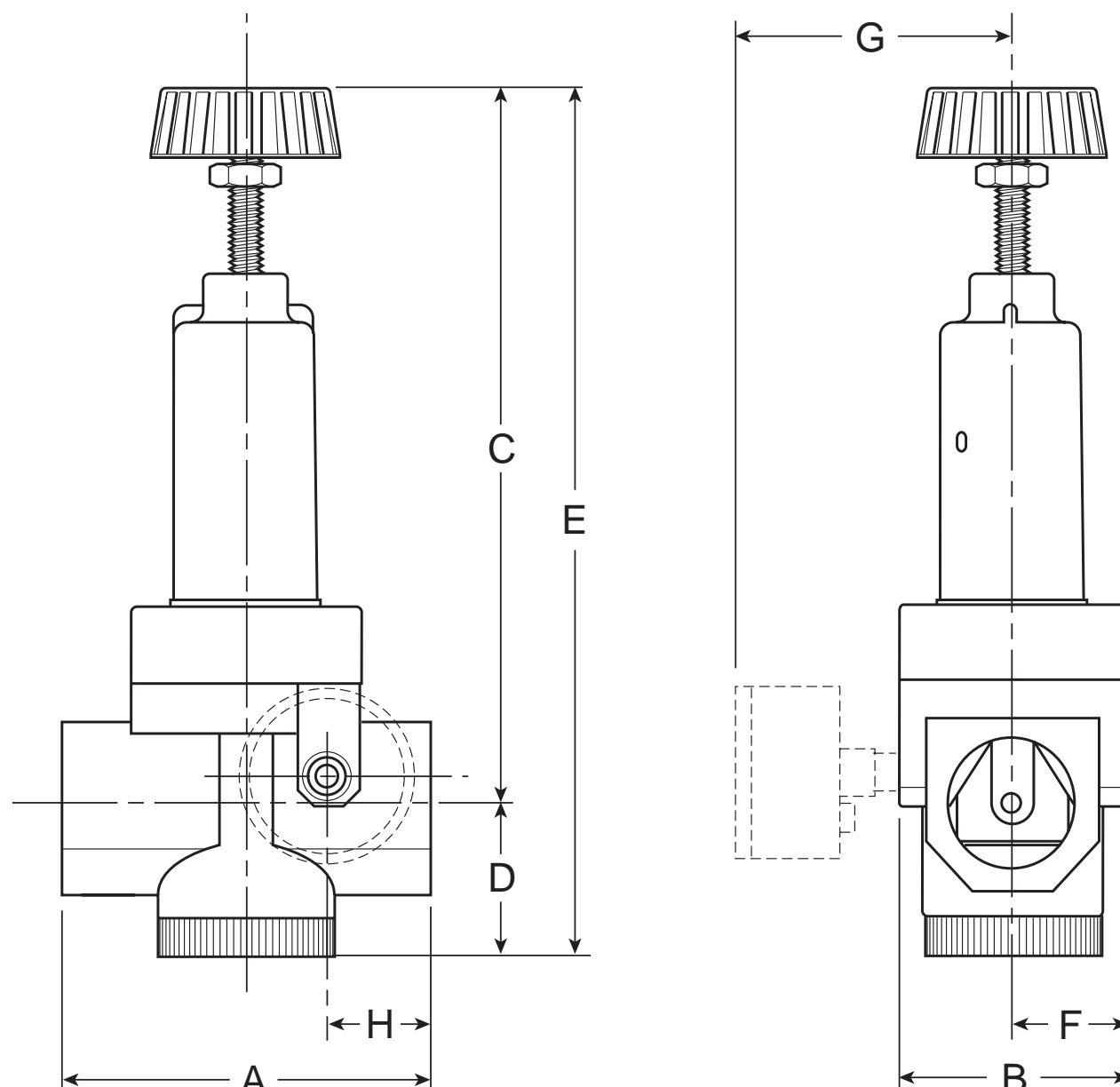
* Inlet pressure 100 PSIG (6.9 bar). Secondary pressure 80 PSIG (5.5 bar).

Materials of Construction

Body	Zinc
Bonnet	Zinc
Piston	Zinc
Seals	Nitrile
Springs	Steel
Valve Assembly	Brass / Nitrile / Steel

WARNING

Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed maximum primary pressure rating.

**Dimensions**

Models	Inches (mm)	A	B	C	D	E	F	G	H
Standard Unit R30-XX-000	4.33 (110)	2.65 (67)	8.62 (218.9)	1.75 (44)	10.37 (263)	1.33 (34)	—	—	1.23 (31.2)
With Gauge R30-XX-G00	4.33 (110)	2.65 (67)	8.62 (218.9)	1.75 (44)	10.37 (263)	1.33 (34)	2.99 (76)	—	1.23 (31.2)

WILKERSON®

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Pneumatic Division
Richland, Michigan
www.wilkerсонcorp.com

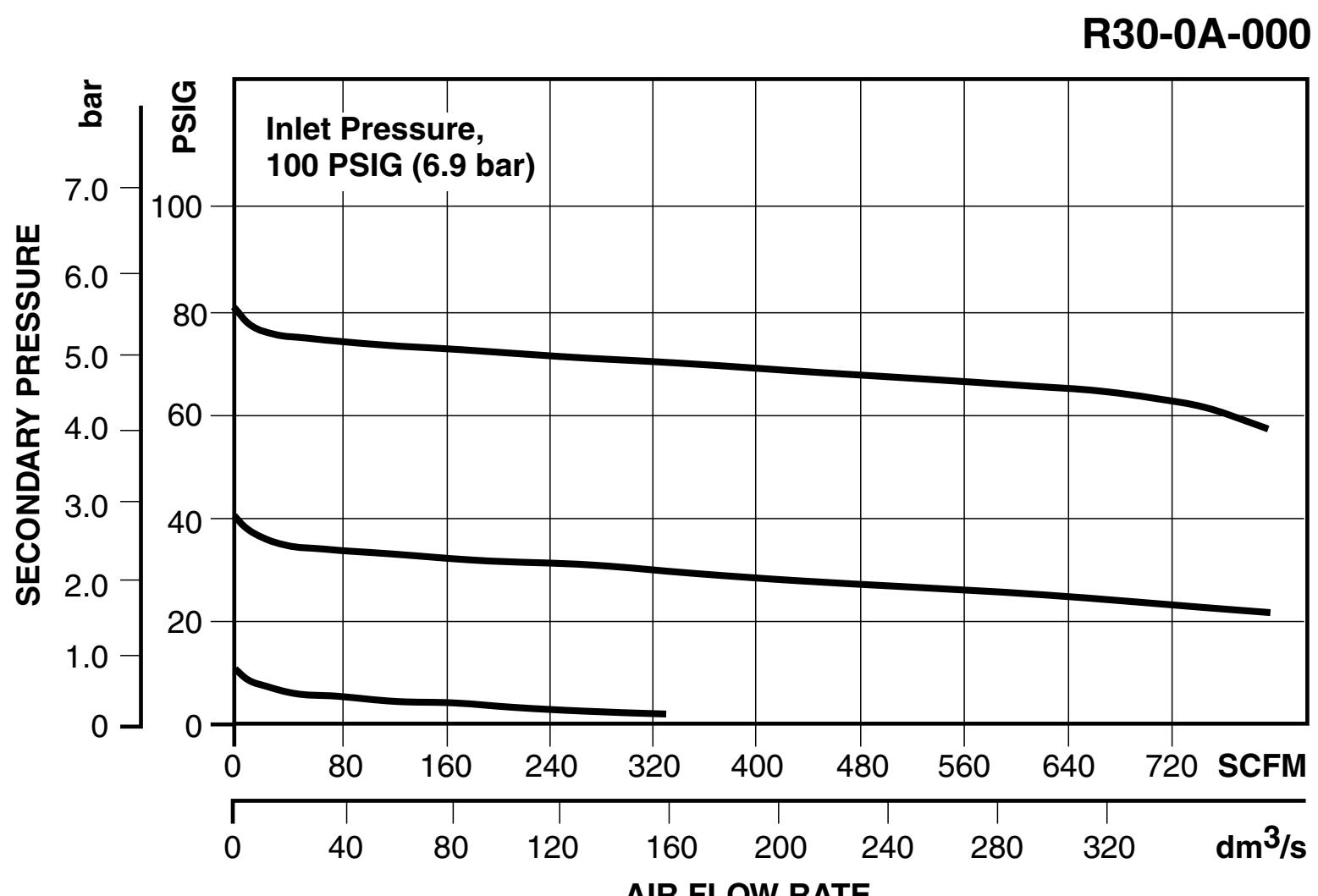
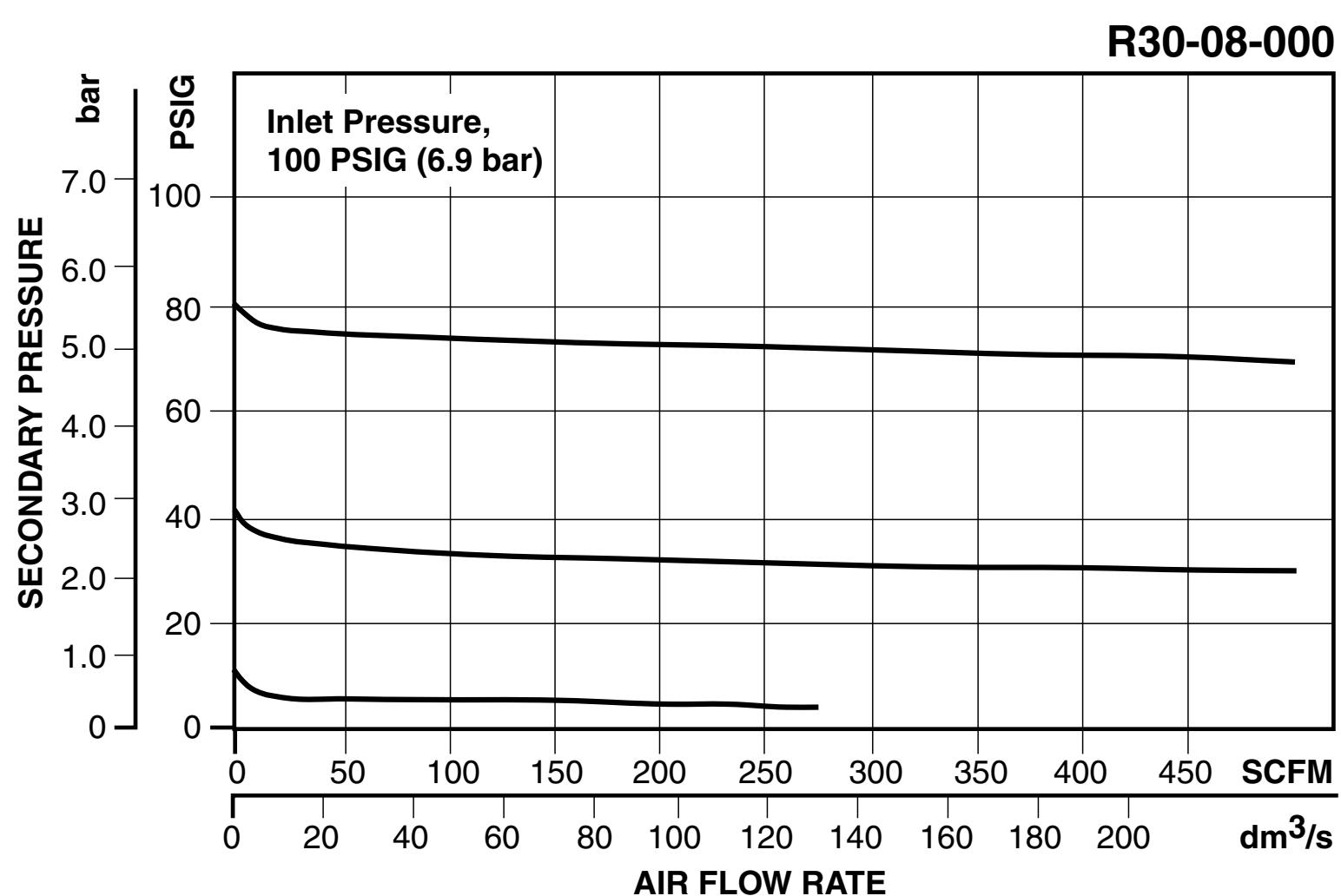
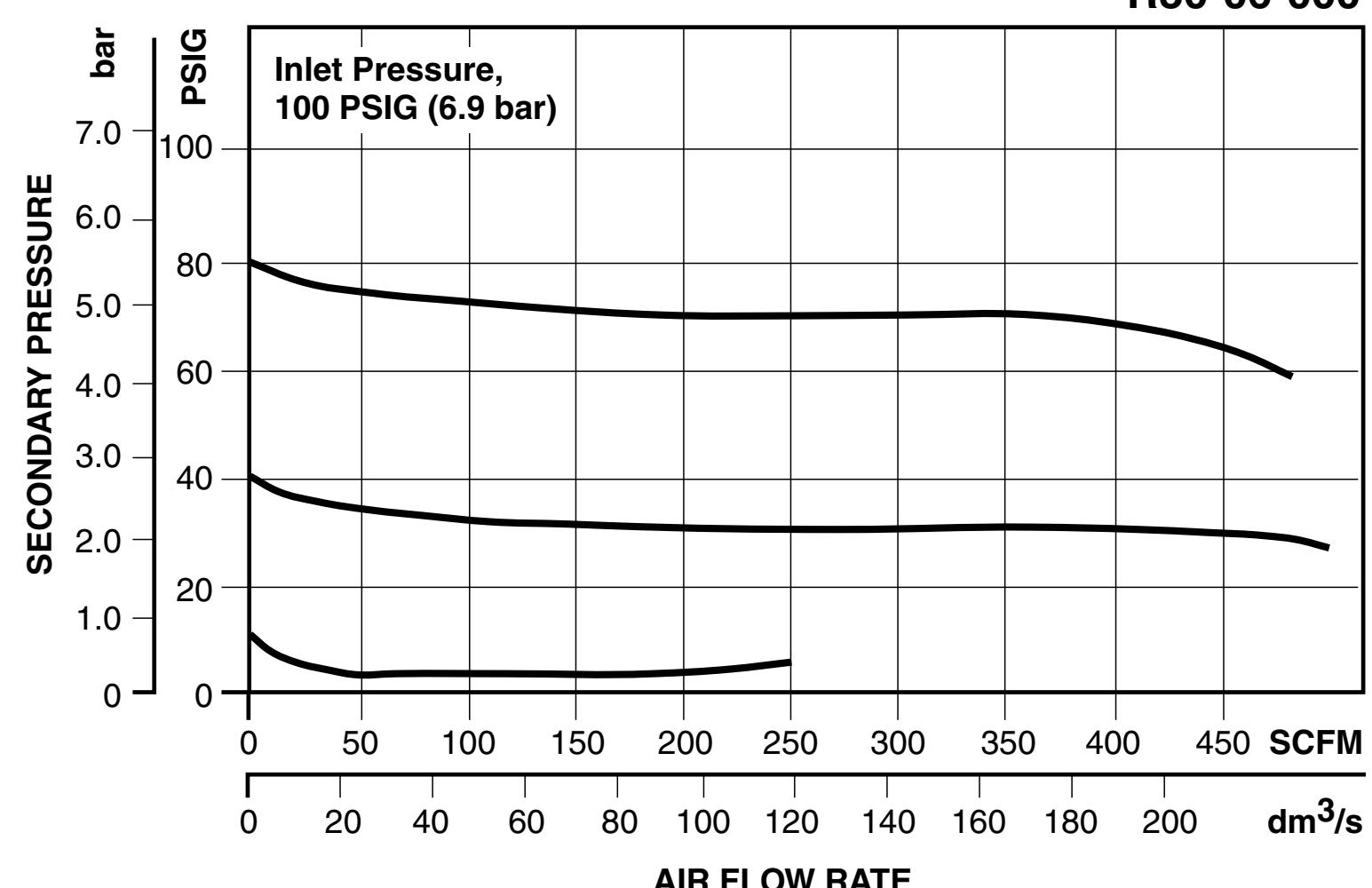
= "Most Popular"

Replacement Kits

Piston Assembly –	
Non-relieving	RRP-95-451
Relieving.....	RRP-95-964
Spring, Regulating –	
0 to 125 PSIG (0 to 8.6 bar).....	RRP-95-226
0 to 180 PSIG (0 to 12.4 bar)	RRP-95-220
Valve Assembly –	
Valve, Valve Spring, Bottom Plug O-ring	RRP-95-159

Accessories

Gauge, Pressure –	
0 to 160 PSIG (0 to 11 bar), 2" Dial Face, 1/4" NPT, CBM	K4520N14160
0 to 300 PSIG (0 to 20 bar), 2" Dial Face, 1/4" NPT, CBM	K4520N14300
0 to 160 PSIG, 1-3/4" Digital Round, 1/4" NPT	K4517N14160
Wall Mounting Bracket –	
Gauge Port Adapter, 1/4" NPT	RRP-95-590
U-bolt Pipe Clamp	GRP-95-734



Ordering Information

Model Type	Port Size	Standard Pressure 10 to 125 PSIG (0.7 to 8.6 bar)	High Pressure 10 to 180 PSIG (0.7 to 12.4 bar)
Relieving	3/4	R30-06-000	R30-06-H00
	1	R30-08-000	R30-08-H00
	1-1/4	R30-0A-000	R30-0A-H00
Non-relieving	3/4	R30-06-N00	R30-06-HN0
	1	R30-08-N00	R30-08-HN0
	1-1/4	R30-0A-N00	R30-0A-HN0

Options - To order an option supplied with the unit model, add the appropriate coded suffix letter in the designated position of the model number.

Safety Guide For Selecting And Using Pneumatic Division Products And Related Accessories

WARNING:

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF PNEUMATIC DIVISION PRODUCTS, ASSEMBLIES OR RELATED ITEMS ("PRODUCTS") CAN CAUSE DEATH, PERSONAL INJURY, AND PROPERTY DAMAGE. POSSIBLE CONSEQUENCES OF FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THESE PRODUCTS INCLUDE BUT ARE NOT LIMITED TO:

- Unintended or mistimed cycling or motion of machine members or failure to cycle
- Work pieces or component parts being thrown off at high speeds.
- Failure of a device to function properly for example, failure to clamp or unclamp an associated item or device.
- Explosion
- Suddenly moving or falling objects.
- Release of toxic or otherwise injurious liquids or gasses.

Before selecting or using any of these Products, it is important that you read and follow the instructions below.

1. GENERAL INSTRUCTIONS

- 1.1. **Scope:** This safety guide is designed to cover general guidelines on the installation, use, and maintenance of Pneumatic Division Valves, FRLs (Filters pressure Regulators and Lubricators), Vacuum products and related accessory components.
- 1.2. **Fail-Safe:** Valves, FRLs, Vacuum products and their related components can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of associated valves, FRLs or Vacuum products will not endanger persons or property.
- 1.3 **Relevant International Standards:** For a good guide to the application of a broad spectrum of pneumatic fluid power devices see: ISO 4414:1998, Pneumatic Fluid Power – General Rules Relating to Systems. See www.iso.org for ordering information.
- 1.4. **Distribution:** Provide a copy of this safety guide to each person that is responsible for selection, installation, or use of Valves, FRLs or Vacuum products. Do not select, or use Wilkerson valves, FRLs or vacuum products without thoroughly reading and understanding this safety guide as well as the specific Wilkerson publications for the products considered or selected.
- 1.5. **User Responsibility:** Due to the wide variety of operating conditions and applications for valves, FRLs, and vacuum products Wilkerson and its distributors do not represent or warrant that any particular valve, FRL or vacuum product is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:
 - Making the final selection of the appropriate valve, FRL, Vacuum component, or accessory.
 - Assuring that all user's performance, endurance, maintenance, safety, and warning requirements are met and that the application presents no health or safety hazards.
 - Complying with all existing warning labels and / or providing all appropriate health and safety warnings on the equipment on which the valves, FRLs or Vacuum products are used; and,
 - Assuring compliance with all applicable government and industry standards.
- 1.6. **Safety Devices:** Safety devices should not be removed, or defeated.
- 1.7. **Warning Labels:** Warning labels should not be removed, painted over or otherwise obscured.
- 1.8. **Additional Questions:** Call the appropriate Wilkerson technical service department if you have any questions or require any additional information. See the Wilkerson publication for the product being considered or used, or call 269-629-2550, or go to www.wilkersoncorp.com, for telephone numbers of the appropriate technical service department.

2. PRODUCT SELECTION INSTRUCTIONS

- 2.1. **Flow Rate:** The flow rate requirements of a system are frequently the primary consideration when designing any pneumatic system. System components need to be able to provide adequate flow and pressure for the desired application.
- 2.2. **Pressure Rating:** Never exceed the rated pressure of a product. Consult product labeling, Pneumatic Division catalogs or the instruction sheets supplied for maximum pressure ratings.
- 2.3. **Temperature Rating:** Never exceed the temperature rating of a product. Excessive heat can shorten the life expectancy of a product and result in complete product failure.
- 2.4. **Environment:** Many environmental conditions can affect the integrity and suitability of a product for a given application. Pneumatic Division products are designed for use in general purpose industrial applications. If these products are to be used in unusual circumstances such as direct sunlight and/or corrosive or caustic environments, such use can shorten the useful life and lead to premature failure of a product.
- 2.5. **Lubrication and Compressor Carryover:** Some modern synthetic oils can and will attack nitrile seals. If there is any possibility of synthetic oils or greases migrating into the pneumatic components check for compatibility with the seal materials used. Consult the factory or product literature for materials of construction.
- 2.6. **Polycarbonate Bowls and Sight Glasses:** To avoid potential polycarbonate bowl failures:
 - Do not locate polycarbonate bowls or sight glasses in areas where they could be subject to direct sunlight, impact blow, or temperatures outside of the rated range.
 - Do not expose or clean polycarbonate bowls with detergents, chlorinated hydro-carbons, ketones, esters or certain alcohols.
 - Do not use polycarbonate bowls or sight glasses in air systems where compressors are lubricated with fire resistant fluids such as phosphate ester and di-ester lubricants.

H

Safety Guidelines



2.7. Chemical Compatibility: For more information on plastic component chemical compatibility see Pneumatic Division technical bulletins Tec-3, Tec-4, and Tec-5

2.8. Product Rupture: Product rupture can cause death, serious personal injury, and property damage.

- Do not connect pressure regulators or other Pneumatic Division products to bottled gas cylinders.
- Do not exceed the maximum primary pressure rating of any pressure regulator or any system component.
- Consult product labeling or product literature for pressure rating limitations.

3. PRODUCT ASSEMBLY AND INSTALLATION INSTRUCTIONS

3.1. Component Inspection: Prior to assembly or installation a careful examination of the valves, FRLs or vacuum products must be performed. All components must be checked for correct style, size, and catalog number. DO NOT use any component that displays any signs of nonconformance.

3.2. Installation Instructions: Wilkerson published Installation Instructions must be followed for installation of Wilkerson valves, FRLs and vacuum components. These instructions are provided with every Wilkerson valve or FRL sold, or by calling 269-629-2550, or at www.wilkersoncorp.com.

3.3. Air Supply: The air supply or control medium supplied to Valves, FRLs and Vacuum components must be moisture-free if ambient temperature can drop below freezing

4. VALVE AND FRL MAINTENANCE AND REPLACEMENT INSTRUCTIONS

4.1. Maintenance: Even with proper selection and installation, valve, FRL and vacuum products service life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a component failure, and experience with any known failures in the application or in similar applications should determine the frequency of inspections and the servicing or replacement of Pneumatic Division products so that products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at minimum, must include instructions 4.2 through 4.10.

4.2. Installation and Service Instructions: Before attempting to service or replace any worn or damaged parts consult the appropriate Service Bulletin for the valve or FRL in question for the appropriate practices to service the unit in question. These Service and Installation Instructions are provided with every Wilkerson valve and FRL sold, or are available by calling 269-629-2550, or by accessing the Wilkerson web site at www.wilkersoncorp.com.

4.3. Lockout / Tagout Procedures: Be sure to follow all required lockout and tagout procedures when servicing equipment. For more information see: OSHA Standard – 29 CFR, Part 1910.147, Appendix A, The Control of Hazardous Energy – (Lockout / Tagout)

4.4. Visual Inspection: Any of the following conditions requires immediate system shut down and replacement of worn or damaged components:

- Air leakage: Look and listen to see if there are any signs of visual damage to any of the components in the system. Leakage is an indication of worn or damaged components.
- Damaged or degraded components: Look to see if there are any visible signs of wear or component degradation.
- Kinked, crushed, or damaged hoses. Kinked hoses can result in restricted air flow and lead to unpredictable system behavior.
- Any observed improper system or component function: Immediately shut down the system and correct malfunction.
- Excessive dirt build-up: Dirt and clutter can mask potentially hazardous situations.

Caution: Leak detection solutions should be rinsed off after use.

4.5. Routine Maintenance Issues:

- Remove excessive dirt, grime and clutter from work areas.
- Make sure all required guards and shields are in place.

4.6. Functional Test: Before initiating automatic operation, operate the system manually to make sure all required functions operate properly and safely.

4.7. Service or Replacement Intervals: It is the user's responsibility to establish appropriate service intervals. Valves, FRLs and vacuum products contain components that age, harden, wear, and otherwise deteriorate over time. Environmental conditions can significantly accelerate this process. Valves, FRLs and vacuum components need to be serviced or replaced on routine intervals. Service intervals need to be established based on:

- Previous performance experiences.
- Government and / or industrial standards.
- When failures could result in unacceptable down time, equipment damage or personal injury risk.

4.8. Servicing or Replacing of any Worn or Damaged Parts: To avoid unpredictable system behavior that can cause death, personal injury and property damage:

- Follow all government, state and local safety and servicing practices prior to service including but not limited to all OSHA Lockout Tagout procedures (OSHA Standard – 29 CFR, Part 1910.147, Appendix A, The Control of Hazardous Energy – Lockout / Tagout).
- Disconnect electrical supply (when necessary) before installation, servicing, or conversion.
- Disconnect air supply and depressurize all air lines connected to system and Pneumatic Division products before installation, service, or conversion.
- Installation, servicing, and / or conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversions air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or if the product does not operate properly, do not put product or system into use.
- Warnings and specifications on the product should not be covered or painted over. If masking is not possible, contact your local representative for replacement labels.

4.9. Putting Serviced System Back into Operation: Follow the guidelines above and all relevant Installation and Maintenance Instructions supplied with the valve FRL or vacuum component to insure proper function of the system.



Warning: Use Limitations

Wilkerson's warranties are void, and Wilkerson assumes no responsibility for any resulting cost, loss, injury or any other damages whatsoever, with respect to any plastic bowl unit for which a bowl guard is standard equipment if the unit is placed in service without the bowl guard and, except as otherwise specified in writing by Wilkerson, with respect to any Wilkerson products which are used in other than compressed air service. Specific warnings with respect to these and other use limitations appear elsewhere in this catalog.

Wilkerson maintains a policy of ongoing product development and improvement. We therefore reserve the right to change dimensions specification and design without notice.

Do not place plastic bowl unit in service without bowl guard installed.

Plastic bowl units are sold only with bowl guards with the exception to miniature units (C04, F00, L00, & M00). To minimize the danger of flying fragments in the event of plastic bowl failure, the bowl guards should not be removed. If the unit is in service without the bowl guard installed, manufacturer's warranties are void, and the manufacturer assumes no responsibility for any resulting loss.

If the unit has been in service and does not have a bowl guard, order one and install before placing back in service.

Caution

Certain compressor oils, chemicals, household cleaners, solvents, paints and fumes will attack plastic bowls and can cause bowl failure. Do not use near these materials. When bowl becomes dirty replace bowl or wipe only with a clean, dry cloth. Reinstall bowl guard or buy and install a bowl guard. Immediately replace any crazed, cracked, damaged or deteriorated plastic bowl with a bowl or a new plastic bowl and bowl guard.

Caution

Except as otherwise specified by the manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Before using with fluids other than air, or for non-industrial applications, or for life support systems, consult Wilkerson Operations for written approval.

Some of the Materials that will Attack Polycarbonate Plastic Bowls

Acetaldehyde	Chloroform	Milk of Lime (CaOH)
Acetic acid (conc.)	Cresol	Nitric Acid (conc.)
Acetone	Cyclohexanol	Nitrobenzene
Acrylonitrile	Cyclohexanone	Nitrocellulose Lacquer
Ammonia	Cyclohexene	Phenol
Ammonium Fluoride	Dimethyl Formamide	Phosphorous Hydroxy
Ammonium Hydroxide	Diozane	Chloride
Ammonium Sulfide	Ethgane tetrachloride	Perchlorethylene
Anaerobic adhesives	Ethyl Acetate	Phosphorous
Trichloride and Sealants	Ethyl Ether	Propionic Acid
Antifreeze	Ethylamine	Pyridine
Benzene	Ethylene Chlorohydrin	Sodium Hydroxide
Benzoic Acid	Ethylene Dichloride	Sodium Sulfide
Benzyl Alcohol	Ethylene Glycol	Styrene
Brake Fluids	Formic Acid (conc.)	Sufuric Acid (conc.)
Bromobenzene	Freon (Refrig. & Propell.)	Sulphural Chloride
Butyric Acid	Gasoline (High Aromatic)	Tetrahydronaphthalene
Carbolic Acid	Hydrazine	Tiophene
Carbon Disulfide	Hydrochloric Acid (conc.)	Toluene
Carbon Tetrachloride	Lacquer Thinner	Turpentine
Caustic Potash Solution	Methyl Alcohol	Xylene & Others
Caustic Soda Solution	Methylene Chloride	
Chlorobenzene	Methylene Salicylate	

Trade Names of some Compressor Oils, Rubber Compounds and other Materials that will Attack Polycarbonate Plastic Bowls.

Atlas "Perma-Guard"	National Compound #N11
Buna N	"Nylock" VC-3
Cellulube #150 and #220	Parco #1306 Neoprene
Crylex #5 cement	*Permabond 910
*Eastman 910	Petron PD287
Garlock #98403 (polyurethane)	Prestone
Haskel #568-023	Pydraul AC
Hilgard Co.'s hil phene	Sears Regular Motor Oil
Houghton & Co. oil #1120, #1130 & #1055	Sinclair oil "Lily White"
Houtosafe 1000	Stauffer Chemical FYRQUEL #150
Kano Kroil	Stillman #SR 269-75 (polyurethane)
Keystone penetrating oil #2	Stillman #SR 513-70 (neoprene)
*Loctite 271	Tannergas
*Locite 290	Telar
*Locite 601	Tenneco anderol #495 & #500 oils
*Loctite Teflon-Sealant	Titon
Marvel Mystery Oil	*Vibra-tite
Minn. Rubber 366Y	Zerex

*When in raw liquid form.

We cannot possibly list all harmful substances, so check with Mobay or the General Electric office for further information on polycarbonate plastic.

The trade names "EconOmist" and "Flow-Guide" are registered at the United States Patent Office.

"Auto-Fill", "Dial-Air", "Flex-Drain", "Mainliner" and "Whirl-Flo" are trademarks of Wilkerson.

Claims and Shortages: Risk of loss passes to buyer when goods are delivered to the carrier. Inspect all shipments for damage at time of receipt. Claims should be filed by the consignee against the carrier.

Changes: Wilkerson maintains a policy of ongoing product development and improvement.

We therefore reserve the right to change dimensions, specifications and design without notice.



Offer of Sale

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods or work described will be referred to as "Products".

1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve months from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRIMES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other

claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) the dissolves or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which the Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

02/12

