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# HeatWork®

BRUKSANVISNING

**HeatWork®**

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# 1. Introduktion

## 1.1. HW-maskinerna

**För specifik information, föreskrifter och säkerhetsanvisningar som gäller endast HydroHeater, se separat kapitel för "HydroHeater".**



Typiska användningsområden för maskinerna är upptining av marken, upptining av diken, frostskydd och uppvärmning av byggen där frost, fukt och temperaturer är en utmaning.

**FrostHeater HW 1800** är en maskin för frost och tjältining, härdning av betong och allmänna värmearbeten.

**FrostHeater HW 3600 / HW 3600 Container** har pumpkapacitet och panna för extra stora och krävande upptiningsarbeten. Kan kopplas till externa trummor för att fördubbla upptiningsytan.

**FrostHeater HW 3600** är maskinen som tinar upp snabbast, även på små områden.

**PetroHeater har utvecklats speciellt för oljeindustrin.**

**HW-maskinerna** använder dieselförbränning för att värma upp den cirkulerande värmevätskan, och elektricitet för drift av pumpen och styrsystemet.

Maskinen har utrustats med två eller tre parallellkopplade upptinings slangar på 315/210 meter. Slangarna spolats in med hjälp av en motor på en hel eller en tredelad slangtrumma. Maskinen och upptinings slangarna har fyllts och förberetts med en värmetransporterande cirkulationsvätska.

Slangarna läggs ut på marken med ett cc-avstånd på 0–60 centimeter beroende på upptiningsytan och det önskade upptiningsresultatet. Slangarna täcks med reflekterande HW-isoleringsmattor och HW-presenningar för ett maximalt upptiningsresultat.

En steglös justering av väsketemperaturen resulterar i en ekonomisk och flexibel användning vare sig man vill tina upp eller frostskydda jorden.

Släpvagnsmodellerna kan lätt transporteras av fordon med en tillåten släpvagnsvikt på 2000 kg för HW 1800 / HW 3600, och 2600 kg för HW 6000. Se specifikationerna i kap. 14.1 för närmare upplysningar gällande högsta tillåtna vikt. Container-modellerna är utrustade med lyftöglor och gaffelfickor för att underlätta flyttning eller transport av maskinerna.

### Användningsområden

- ✓ Upptining av marken
- ✓ Upptining av rör
- ✓ Härdning av betong
- ✓ Torkning av byggen
- ✓ Uppvärmning med fläktar
- ✓ Upptining av snö och is på tak
- ✓ Frostskydd
- ✓ Upptining av diken
- ✓ Drift av golvvärmesystem

## 1.2. Identifiering av maskinen

På stommens vänstra stöd på släpvagnens framsida och på stommen under brännaren hittar du maskinens ID-nummer som anger serienumret. Serienumret består av 3 siffror och ska alltid uppges i samband med kontakt med leverantören för smidigare hjälp.

Manufactured by:	<b>HeatWork AS</b> Teknologiveien 5, 8517 Narvik, Norway				
Year of manufacture:	<input type="text"/>				
Serial number:	<input type="text"/>				
Model:	<b>CE</b>				
Total weight:	<b>HW 3600</b> 2000 Kg	<b>HW 1800</b> 1950 Kg	<b>HW 6000</b> 2200 Kg	<b>HW 3600 C</b> 2300 Kg	<b>HW 6000 C</b> 2300 Kg

## 1.3. Säkerhetsaspekt

Maskinens komponenter och upptiningsslangarna uppnår yttemperaturer som motsvarar den justerade vätsketemperaturen. Brännskador kan uppstå om användningsinstruktionerna i denna bruksanvisning inte följs.

I och med att maskinen förbränner dieselolja både i pannan och ett eventuellt aggregat avges det varm avgas. Själva maskinenheten ska på grund av kvävningsrisk och fara för pipbrand aldrig placeras inomhus eller under tak. Det bör iakttas försiktighet vid det utvändiga avgasröret på grund av risk för brännskador.

Dieseln fylls upp med samma varsamhet som man annars tillämpar vid hantering av bränsle.

Det är extremt viktigt att upptningsområdet och maskinen skärmas av med avspärrningsband för att hindra skador på personer och utrustning.

### OBSERVERA

FÖR ALLA PERSONER SOM ÄR DELAKTIGA I ANVÄNDNINGEN AV DENNA MASKIN ÄR DET VIKTIGT ATT LÄSA OCH FÖLJA INSTRUKTIONERNA I DENNA BRUKSANVISNING.

**I denna bruksanvisning kommer följande varningstecken att dyka upp:**



## 1.4. CE-märkning

HW-maskinen är CE-märkt. CE-symbolen finns på maskinens ID-bricka och bifogas med ett tillkännagivande gällande samsvar från producenten HeatWork AS.

### **OBSERVERA**

För Norge:

HW-maskinen har definierats som en anläggningsmaskin och behöver inte registreras hos det norska Biltilsynet. Maskinens utrustning kan inte avlägsnas för att använda släpvagnen till transporter av tillfälliga föremål. Sådan användning KRÄVER registrering av släpvagnen.

Andra land:

Ta reda på särskilda nationella regler för registrering och hastighetsbegränsningar innan maskinen fraktas. HW-maskinen är en anläggningsmaskin och det kan finnas nationella hastighetsbegränsningar gällande frakt av släpvagnen i oregistrerat tillstånd. Vid sådana begränsningar rekommenderas registrering av maskinen.

## 2. Överblick

### 2.1. Beskrivning av HW-maskinerna

Maskinens driftskomponenter har monterats på en galvaniserad maskinstomme som kopplats till en galvaniserad boggisläpvagn eller i en specialanpassad container.

Höljet tillverkas i helstöpt glasfiber.

HW-maskinen levereras med en eller flera reglerbara cirkulationspumpar beroende på modell.

HW 1800 levereras med en hel trumma och två slangkretsar på 315 m som kan parallellkopplas till uttagen vid sidan av trumman.

HW 3600 och HW 6000 -maskinerna levereras med en standard tredelad slangtrumma. Trumman har tre slangkretsar på 210 m som parallellkopplas via kontrollpanelen.

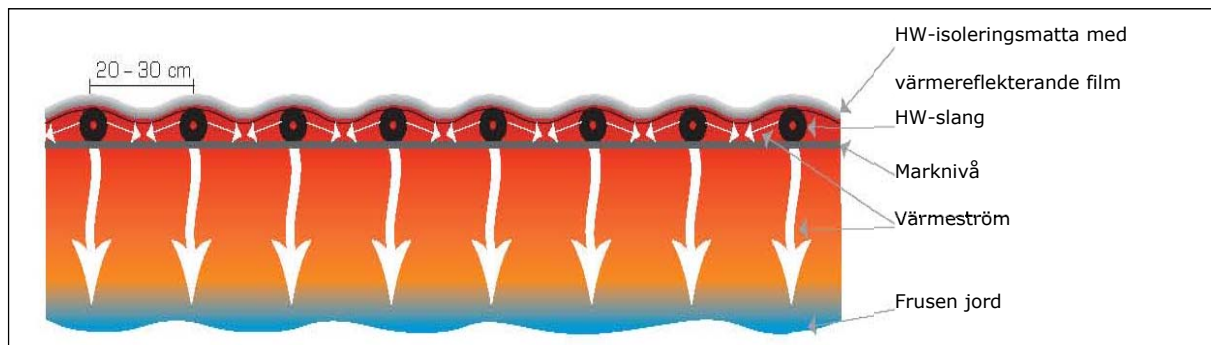
De tre värmeslangarna täcker sammanlagt en upptiningsyta på ca 130 m<sup>2</sup> med ett slangavstånd på 20 cm, och 200 m<sup>2</sup> med ett c/c på 30 cm. De enskilda slangarna täcker en upptiningsyta på ca 43 m<sup>2</sup> med motsvarande slangavstånd.

Det går enkelt och snabbt att breda ut värmeslangar, HW-isoleringsmattor och HW-presenningar.

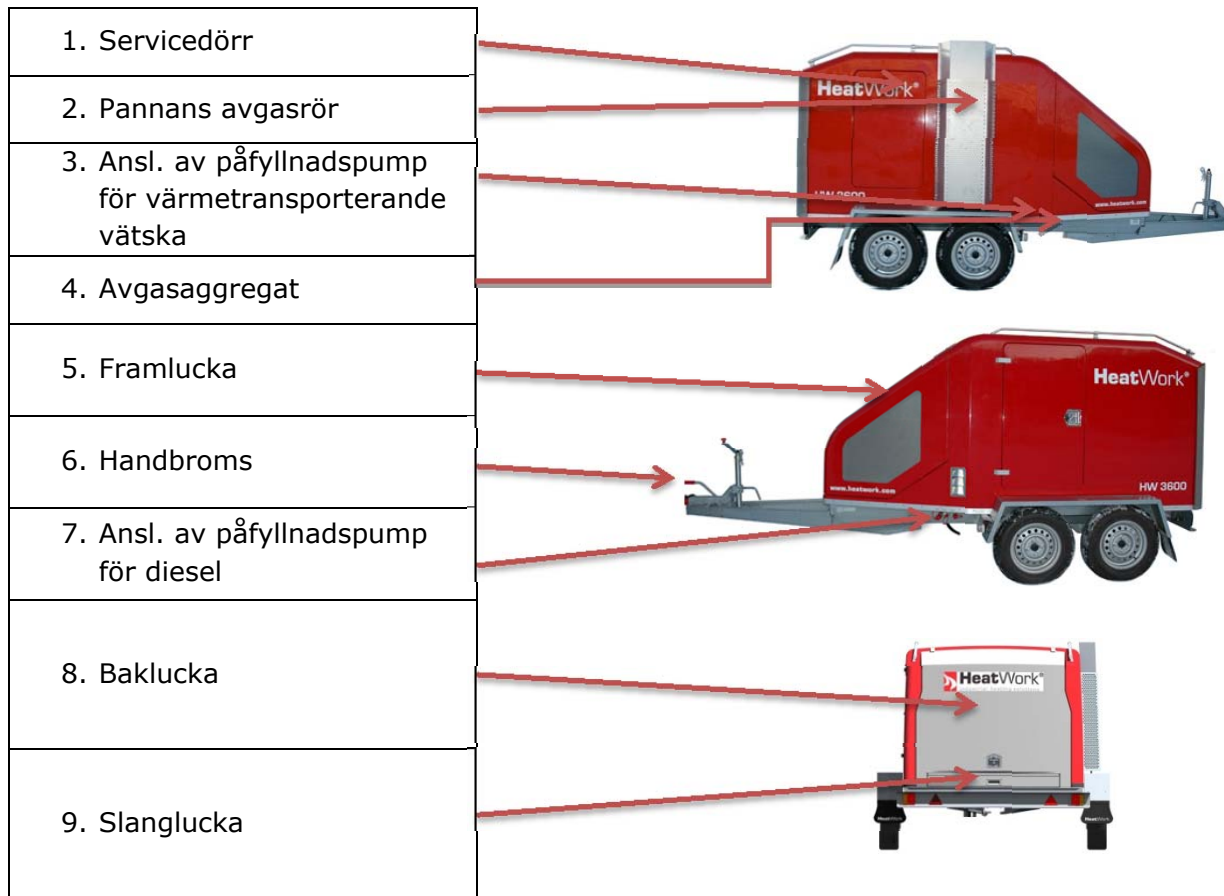
De ursprungliga värmereflekterande HW-isoleringsmattorna ger systemet en minimal värmeförlust.

Maskinen har utvecklats speciellt för stora uppvärmnings- och upptiningsarbeten där extern tilläggsutrustning kan tillkopplas för att dra ännu större nytta av maskinen. Bland annat kan man koppla till en eller flera externa trummor som utvidgar upptiningsområdet.

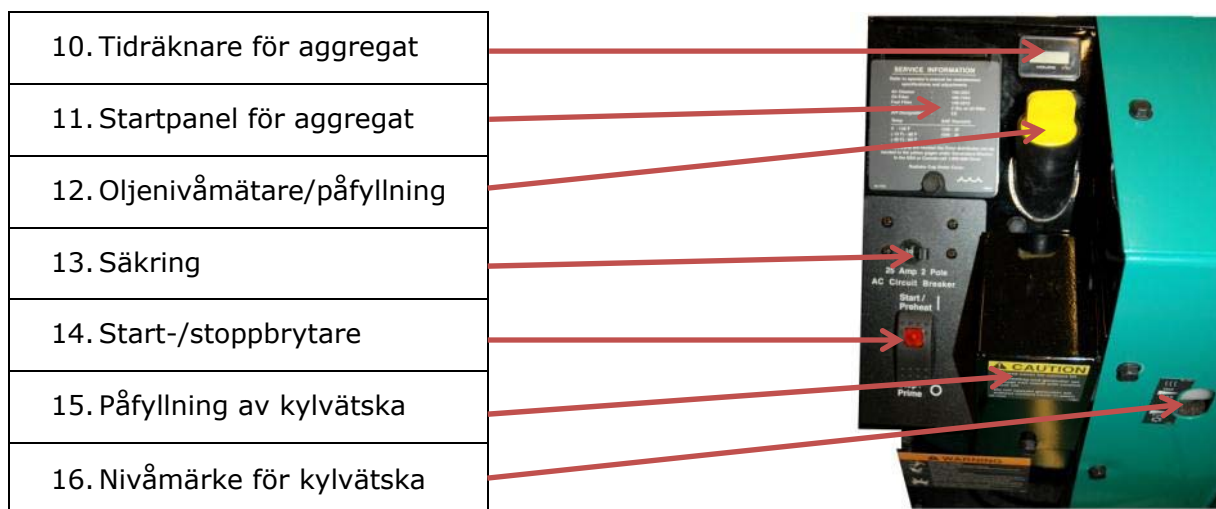
#### HW-maskinernas upptiningsprincip



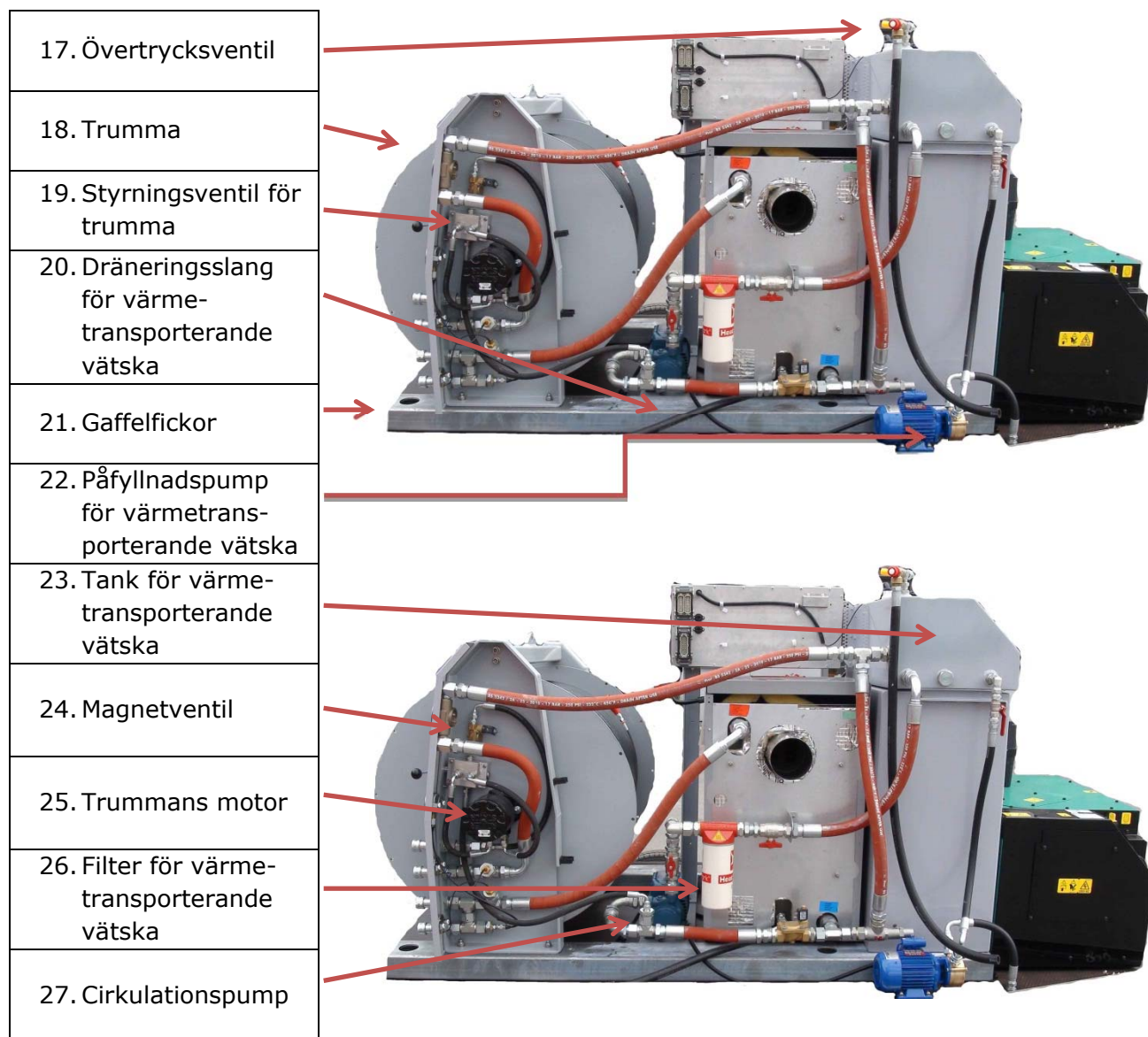
## 2.2. Överblick av HW-maskinerna



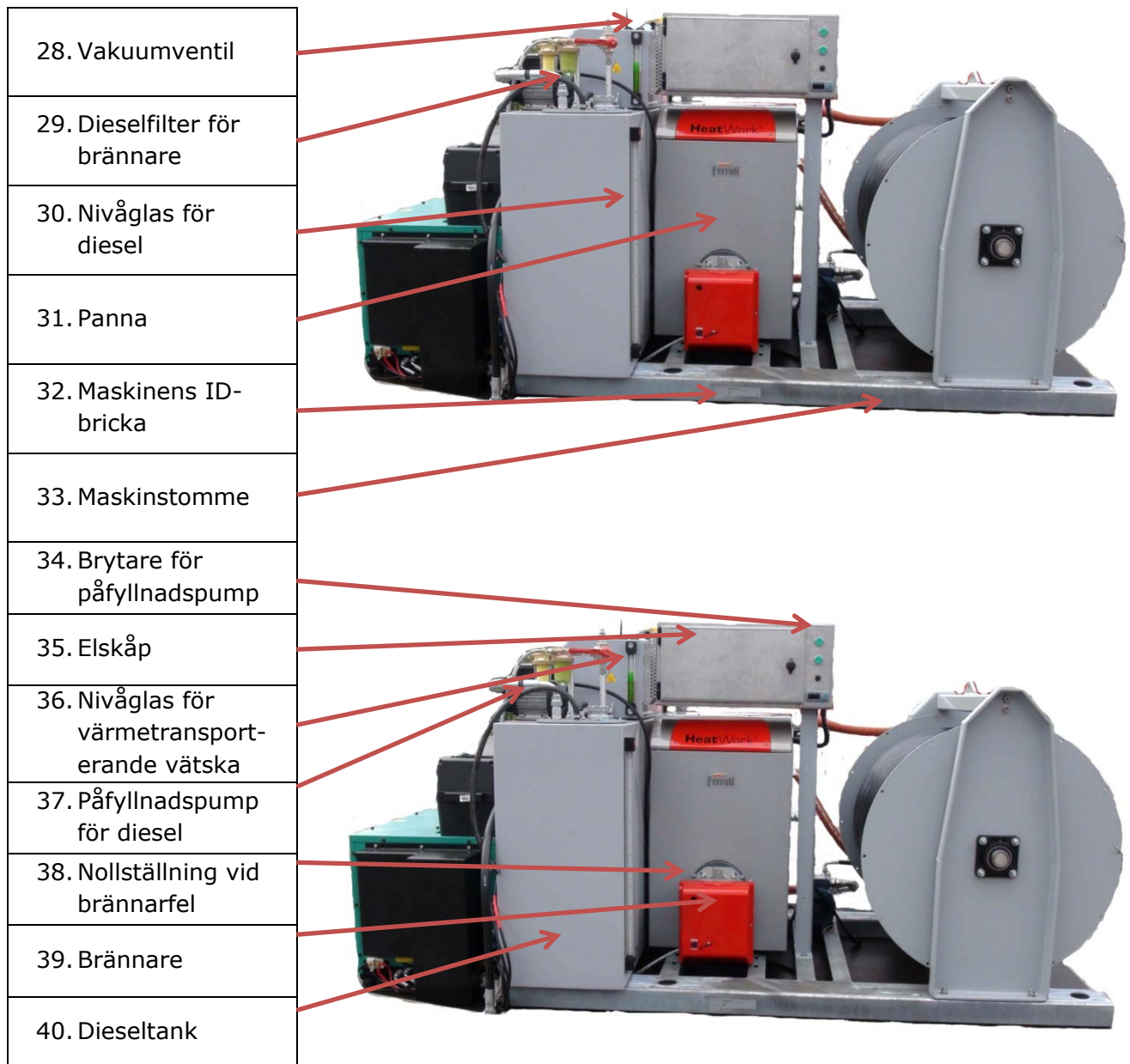
## 2.3. Överblick av Cummins Onan



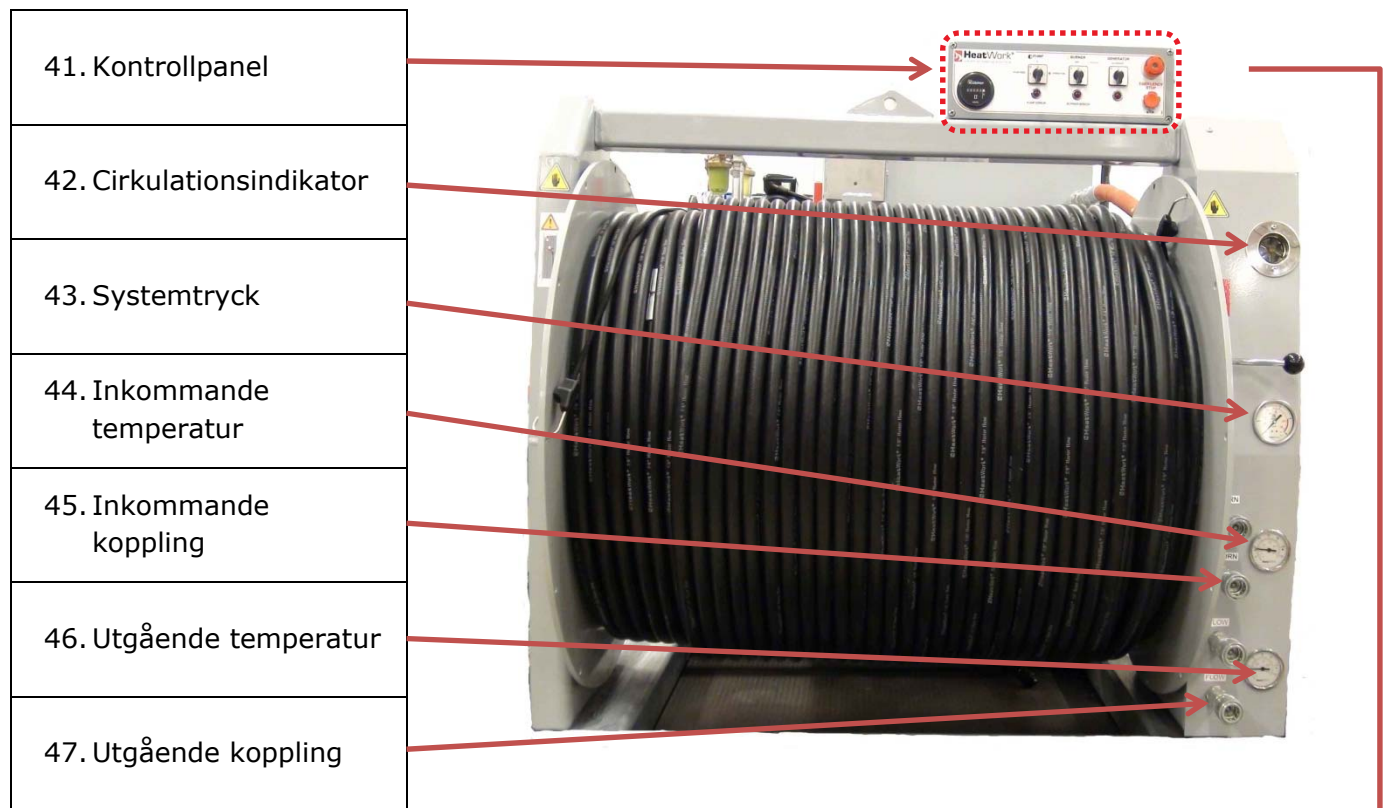
## 2.4. Överblick av HW 1800







## 2.5. Överblick av kontrollpanelen på HW 1800



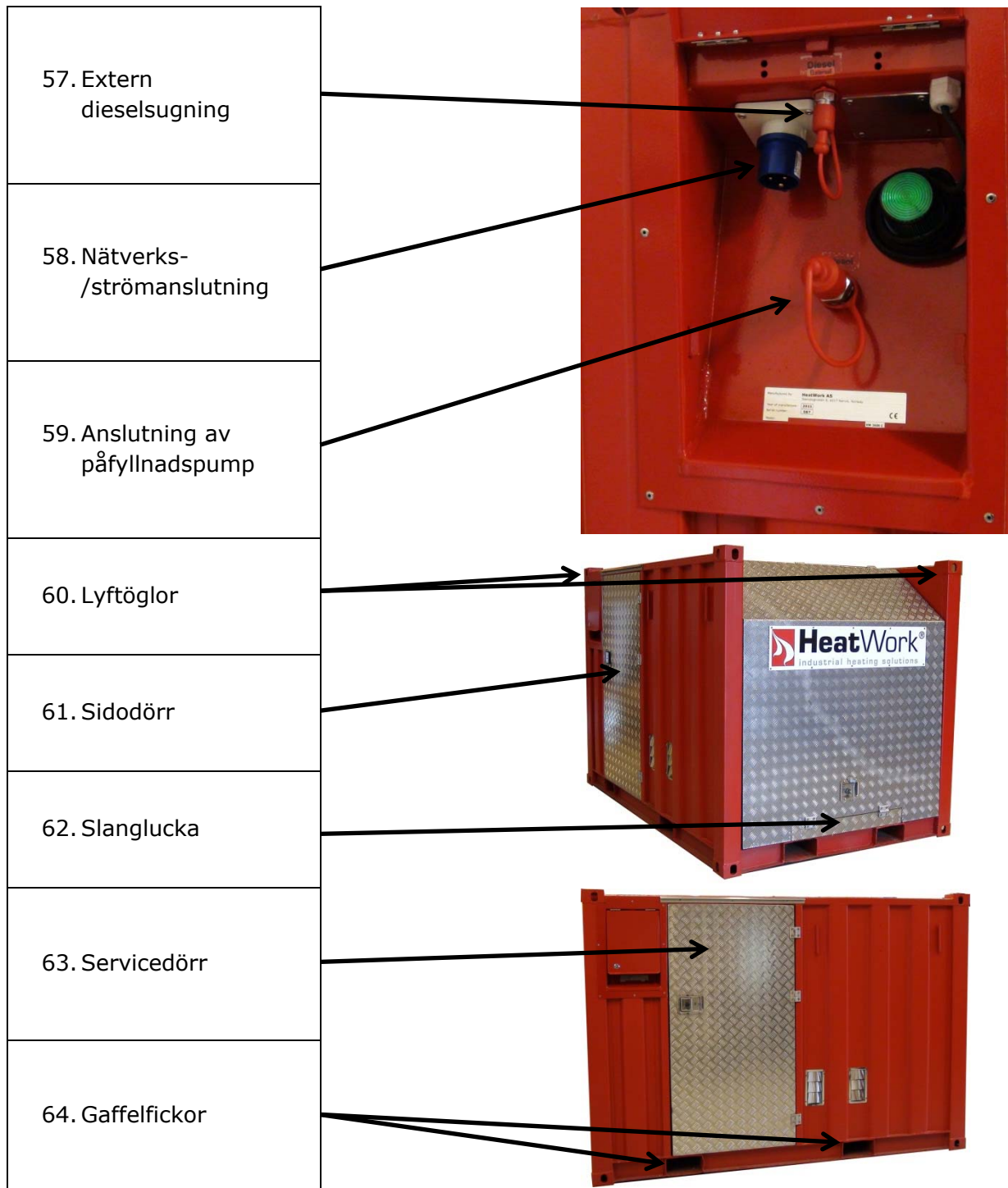
48. Tidrännare för cirkulationspump	49. Pumpbrytare	50. Brännarens brytare	51. Starta aggregat / autostart	52. Nödstopp
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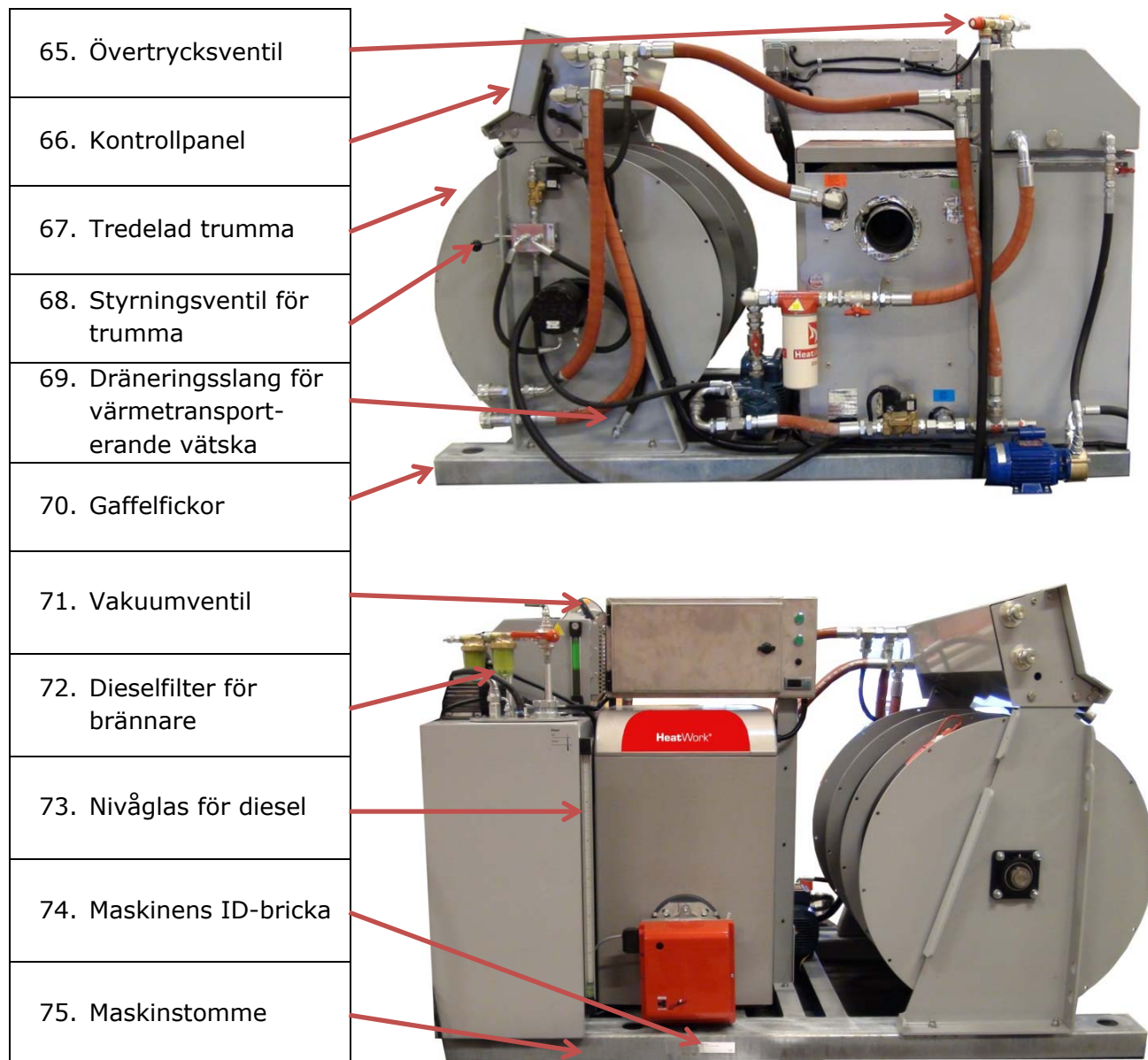
53. Pumpens felindikator	54. Brännarens felindikator	55. Indikatorlampa för aggregat	56. Stanna aggregatet
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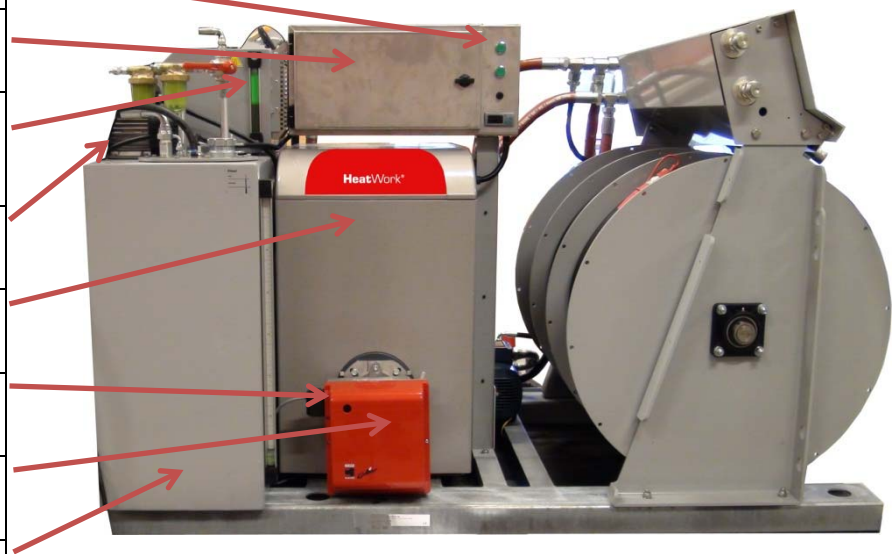
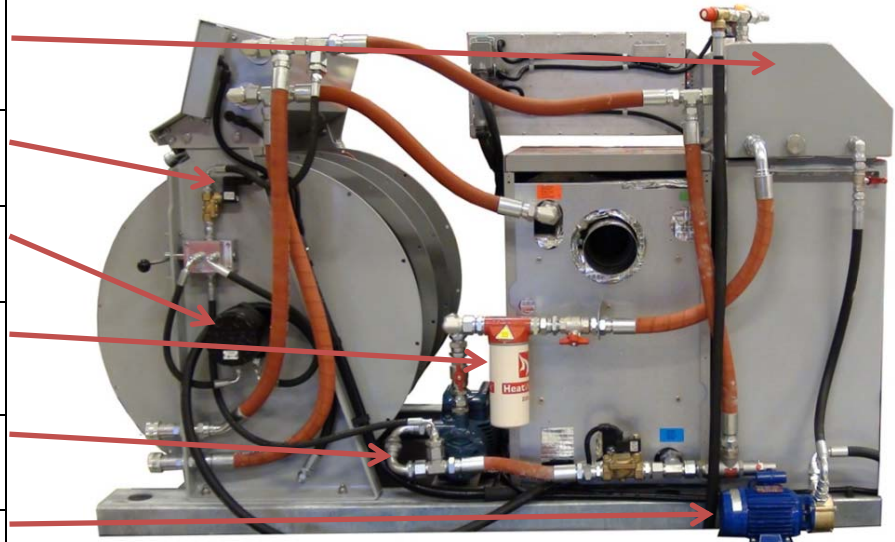
## 2.6. Överblick av HW 3600 Container



## 2.7. Överblick av HW 3600



76. Tank för värmetransporterande vätska
77. Magnetventil
78. Trummans motor
79. Filter för värmetransporterande vätska
80. Cirkulationspump
81. Påfyllnadspump för värmetransporterande vätska
82. Brytare för påfyllnadspump
83. Elskåp
84. Nivåglas för värmetransporterande vätska
85. Påfyllnadspump för diesel
86. Panna
87. Nollställning vid brännarfel
88. Brännare
89. Dieseltank





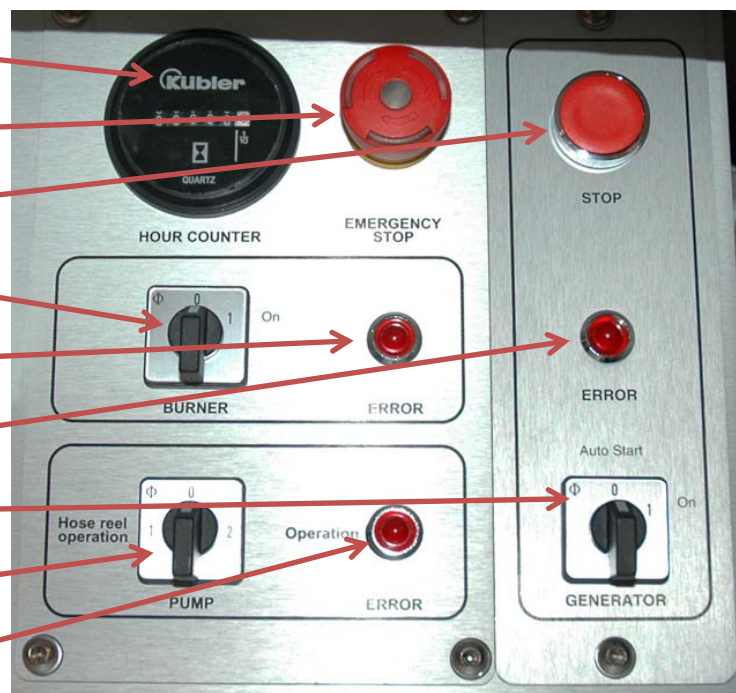
## 2.8. Överblick av kontrollpanelen på HW 3600

90. Inkommande extern temperatur	91. Systemtryck	92. Inkommande temperatur för upptiningskretsar
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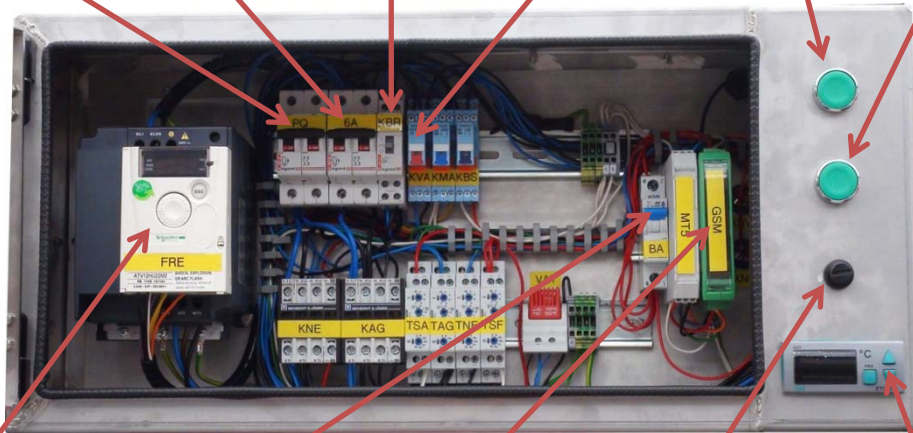
93. Utgående koppling	94. Systemtemperatur	95. Cirkulationsindikator	96. Inkommande koppling
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97. Tidräknare för cirkulationspump
98. Nödstopp
99. Stanna aggregatet
100. Brännarens brytare
101. Brännarens felindikator
102. Indikatorlampa för aggregat
103. Starta aggregatet / autostart
104. Pumpens brytare
105. Pumpens felindikator



## 2.9. Elskåpet

106. Säkring för pump (16 A)	107. Säkring för förbrukare (6 A)	108. Kontaktor för brännare	109. Varningslampa	110. Påfyllningspump för värmetransporterande vätska	111. Påfyllningspump för diesel
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112. Frekvensomformare för pump	113. Batteri (4 A) DC	114. GSM-sändare	115. Överhettningsskydd	116. Temperaturreglering
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## 2.10. Dieselolja

HW använder dieselolja för uppvärmning av den värmetransporterande vätskan. Det rekommenderas användning av vinterdiesel, arktisk klass 2 vid temperaturer under 0 °C. Vid driftstemperaturer under -20 °C bör det blandas parafin i dieselvätskan enligt följande förhållande (3:1 vinterdiesel/parafin). HeatWork tar inte ansvar för problem som eventuellt uppstår som en följd av att man använt andra slags bränslen.

(Användning av avgiftsfri diesel ger den mest ekonomiska driften av HW-maskinen.)

## 2.11. Värmetransporterande vätska

Den värmetransporterande HW-vätskan har anpassats och testats för användning i kombination med HW-maskinen. HeatWork AS rekommenderar därför HW:s värmetransporterande vätska. HeatWork tar inte ansvar för problem som eventuellt uppstår som en följd av att man använt andra slags värmetransporterande vätskor i cirkulationssystemet. Ytterligare utblandning av den värmetransporterande vätskan kan åstadkomma driftsstörningar eller problem.

HW:s värmetransporterande vätska har märkts enligt bifogad illustration.

### OBSERVERA!

ANVÄND ALLTID HeatWorks värmetransporterande vätska. Användning av andra värmetransporterande vätskor förorsakar maskinfel.



## 2.12. HW-slangar

HW 3600 / HW 6000 levereras med totalt 630 meter värmeslangar. Trumman är tredelad och varje enskild slangs längd är 210 meter vilket gör systemet flexibelt att använda.

HW 1800 levereras med totalt 350 eller 630 meter slangar. Trumman är en hel trumma och varje enskild slangs längd är 1 x 350 meter eller 2 x 315 meter.

HeatWork tar inte ansvar för problem som eventuellt uppstår som en följd av att man använt andra slags slangar.



**FARA**

ANVÄND ALLTID HW-värmeslangar.

HW-slangarna har trycktestats och tillverkats i förmålsenliga materialer. OLYCKSHÄNDELSER vid användning av andra än ursprungliga slangar kan förorsaka allvarliga brännskador.

## 2.13. HW Winter-Insulation

### Unik konstruktion

De unika isolationsmattorna minimerar värmeförlusten till omgivningen när de används tillsammans med HW-maskinen. Den aluminiumbelagda sidan reflekterar strålningsvärmen från marken vilket gör att denna slags isolering lämpar sig väl för otaliga ändamål.

Material		Slutet cellskum i polymer med tre eller sju skikt
		Ett reflekterande skikt
Bredd/längd		1,2 x 3 m (7 skikt)
		1,2 x 6 m (7 skikt)
		2 x 6 m (3 skikt)
		2 x 12 m (3 skikt)
Yta per matta		3,6–24 m <sup>2</sup>
Totalvikt per matta		2,1–9,6 kg
<b>Produktens egenskaper</b>		
Fukt		Suger inte åt sig fukt. Inga kapillärsugande egenskaper: vädertålig.
Hållbarhet		Ändrar sig inte under användning. Lång livstid.
Temperatur		Flexibel även i extremt höga och låga temperaturer.

### Användningsområden

- ✓ Isolering vid upptining
- ✓ Frostskydd över nystöpta betongdäck
- ✓ Täckning över förskalning
- ✓ Isolering av byggnadsmaterial
- ✓ Isolering av utgrävda tomter
- ✓ Diken m.m.



## 3. Användningsområden

### 3.1. Frostskydd och tjältning

HW-konceptet är det mest effektiva sättet att frostskydda och tina upp tjälen i marken. Slangarna bredds ut i mönster på det önskade området som täcks över med HW-isoleringsmattor. Nedan hittar du några exempel på var HW-maskinerna kan användas.

#### Upptining av marken på stora och små områden

- ✓ Vatten- och avloppsanläggningar
- ✓ Kabeldiken
- ✓ Schakt, socklar och golvytor
- ✓ Tak och beläggningar
- ✓ Røjning av is och snö
- ✓ Öppnande av frusna vattenvägar
- ✓ Öppnande av frusna vägtrummor

### 3.2. Underhåll och uppvärmning

När en upptiningsprocess har genomförts kan man om man så vill justera ner vätsketemperaturen till underhållsvärme för att hindra inträngandet av ny frost. Det sänker värmekostnaderna till ett minimum. Den inställda underhållstemperaturen beror på temperaturen utomhus samt värmeytan.

#### Frostfria

- ✓ Beläggningsytor
- ✓ Sandmassor, fogsand
- ✓ Utfyllnadsmassor
- ✓ Rörgator
- ✓ Spårväxlare
- ✓ Flytbryggor
- ✓ Byggnadsunderlag

#### Uppvärmning av

- ✓ Arbetstält
- ✓ Baracker
- ✓ Lager och brukshallar
- ✓ Byggen

#### Förvärmning av

- ✓ Markområden innan stöpning
- ✓ Förskalningar och betongarbeten
- ✓ Torkning av betong och håldäckselement

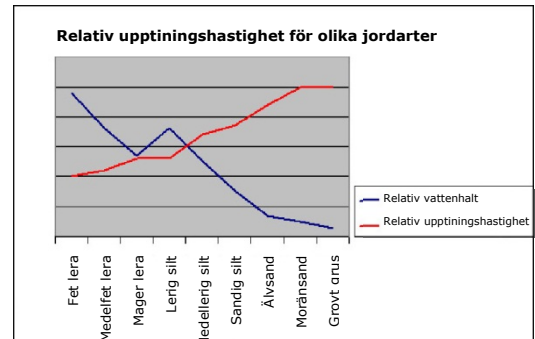
Ta kontakt med HeatWork AS vid eventuella frågor.



## 4. Upptining av olika jordmassor

### 4.1. Allmänt om upptining

HW-maskinerna har en upptiningskapacitet på 10–60 cm per dygn. För normala jordmassor är upptiningshastigheten vanligtvis 20–50 cm, men den varierar kraftigt beroende på jordart, jordens vattenhalt, slangarnas avstånd och temperaturen utomhus. Upptiningshastigheten minskar framför allt när mängden vatten/is ökar i marken. Den relativa upptiningshastigheten visas för 9 olika slags jordmån i diagrammet till höger.



De viktigaste egenskaperna som påverkar maskinens upptiningshastighet är vätskans temperatur och avståndet mellan slangarna.

Ur användarens synpunkt är sättet slangarna läggs ut på och isoleringen avgörande för att säkra en god upptining.

### 4.2. Slangavstånd

Ett mindre avstånd mellan värmeslangarna ger en kraftigare upptiningseffekt ( $W/m^2$ ). Även om ett slangavstånd på 10–30 cm oftast är tillräckligt, bör slangarna alltid placeras så tätt ihop som möjligt om man vill uppnå en rask upptining och har tillräckligt med tillgängliga slangar på en liten upptiningsyta.

För områden på mer än 300 m<sup>2</sup> som ska tinas upp samtidigt bör slangavståndet vara ca 50 cm. I så fall kan det fortfarande efter upptiningen förekomma frosttäckta områden på ytan mellan slangarna. Djupare under ytan kommer jordmassan emellertid att vara fullständigt upptinad. De frosttäckta områdena på ytan kan lätt brytas med en grävskopa vid grävning. Beräkna god tid till upptiningsarbetet när avståndet mellan slangarna är så pass stort.

### 4.3. Speciella jordmassor vid upptining

#### Lera och jord

Lera och jord är massor med en typisk vattenhalt på 27–50 %. Jordmassor i våtmark kan innehålla en ännu högre vattenhalt. I och med att upptining av is kräver mycket energi sker upptining av sådana jordmassor speciellt långsamt. Bryt bort all is och snö från ytan och placera slangarna så tätt ihop som möjligt vid upptining av sådana jordmassor. Upptiningshastigheten för de här jordmassorna är vanligtvis 10–30 cm per dygn.

#### Grovt grus och makadam

Extremt dränerande jordarter som grovt grus och makadam är svåra att tina upp i och med att kontaktytan mellan partiklarna är liten. Därför rekommenderas avlägsnande av isoleringen och påfyllning av vatten efter en dags upptining på hela upptiningsområdet. Täck sedan slangarna på nytt och fortsätt upptiningen. Metoden erbjuder en betydligt snabbare upptiningshastighet. Snö och is som ligger på området innan man börjat upptiningen ska därför inte röjas undan. Det upptinade vattnet från isen kommer att sörja för en snabb upptining tack vare ökad värmeledning i massorna.

#### Is och snö på marken

Upptining av ren is kräver otroligt mycket energi. Det behövs till exempel lika mycket energi för att tina upp 10 cm ren is som att tina upp 30–40 cm sandig silt med 15 % vattenhalt. Beräkna därför en extra dags upptining ifall upptiningsområdet har en 10 cm tjock isyta som inte kan röjas undan före upptining.

### 4.4. Utplacering av slangar och isolering

Slarvig placering av slangar och isolering är ett typiskt användarfel som resulterar i en väsentligen reducerad upptiningseffekt.

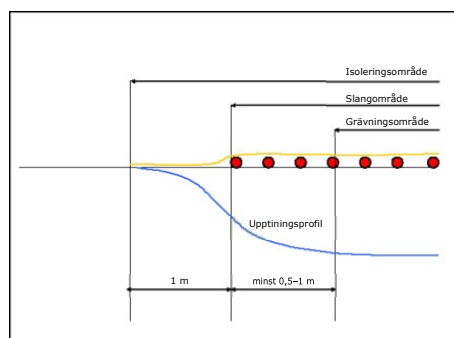
I och med att värmen kanaliseras direkt från slangarna ner i marken är det oerhört viktigt att slangarna placeras så att de har god kontakt med marken. Den uppvärmda luften under isoleringsmattorna ger en avsevärt ökad värmeförlust till luften.

HW-isoleringsmattorna placeras 30 cm överlappande så att värmeförlusten till luften minimeras. Fäst mattorna med plankor eller liknande tyngder som förhindrar mattorna från att blåsa bort med vinden.

Värmeslangarna måste alltid placeras 0,5–1 m utanför det önskade grävningområdet på alla kanter. Isolera gärna upp till en meter extra utanför slangområdet. Se bifogade illustration.

Vid smala upptiningsfält transporteras en väsentlig mängd värmeenergi ut mot sidorna och ger därför ett mindre upptiningsdjup. Placera därför värmeslangarna extra långt utanför själva grävningområdet.

Användande av andra än ursprungliga isoleringsmattor ger ökad värmeförlust till luften och reducerad upptiningseffekt.



## 4.5. Upptiningshastighet och yta

Upptiningshastighet och -yta med en slang på 630 m		
Slangavstånd (cm)	Yttäckning (m <sup>2</sup> )	Upptiningshastighet
5	32	Snabb upptining
10	64	
15	97	Normal upptining
20	129	
25	162	
30	194	
35	226	Långsam upptining / frostskydd
40	259	
45	291	

### Beräkning av slangavstånd, upptiningsyta och slangarnas längd

1 slang	=	210 m
2 slangar	=	420 m
3 slangar	=	630 m

### Upptiningsyta – kapacitet

Maximal upptiningsyta beräknas med given slanglängd och önskat slangavstånd:

$$\text{Upptiningsyta} = \text{total slanglängd} \times \text{slangavstånd}$$

### Krävd slangmängd

Krävd total slanglängd för att tina upp ett givet område med ett givet slangavstånd:

$$\text{Total slanglängd} = \text{upptiningsyta} / \text{slangavstånd}$$

### Krävt slangavstånd

Slangavståndet räknas ut ifrån den givna ytan och den totala slanglängden:

$$\text{Slangavstånd} = \text{upptiningsyta} / \text{total slanglängd}$$

### Exempel

Målet är att täcka ca 150 m<sup>2</sup> med en total slanglängd på 630 m. Vilket slangavstånd ska användas för att täcka den önskade ytan:

$$\text{Total slanglängd} = 150 / 630 = 0,238 \text{ m}$$

*Slangavståndet ska vara högst 24 cm.*

**OBS! Den täckta ytan bör alltid vara lite större än grävningens område.**

*Ifall man önskar en snabbare upptining bör man betrakta möjligheten att tina upp fältet i två omgångar så att det sista området tinas upp medan det första grävs ut.*

## 4.6. Kontroll av upptiningsdjupet

Det enklaste sättet att kontrollera marken för att observera hur djupt det upptinade området sträcker sig är med hjälp av en grävsropa eller genom att slå ner med ett spett eller ett spjut.

Visa försiktighet ifall det ska grävas i närheten av värmeslangarna så att slangarna inte skadas.



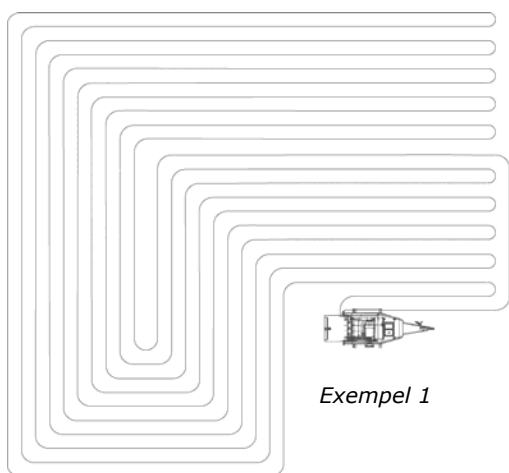
Vid kontrollering av upptiningsdjupet måste området vara tillräckligt väl upplyst för att undvika att slangar blir avskurna i misstag. Skållande het värmetransporterande vätska kommer att strömma ut ifall slangarna blir avskurna under användning vilket kan förorsaka personskador.

## 4.7. Utbredningsmönster och täckning av ytor

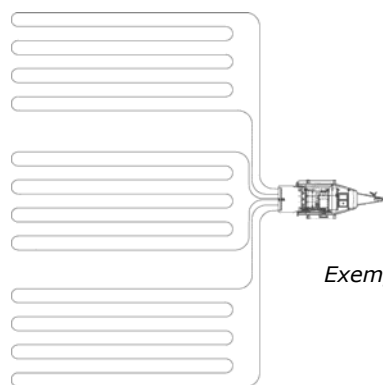
Exemplen i fortsättningen visar hur slangarna kan placeras i slingor. Mönstren varierar från uppdrag till uppdrag. Det är viktigt att planera varje jobb och att placera släpvagnen lämpligt så att utbredningen av slangarna blir så lätt som möjligt och så att man når ända fram till den yta slangarna ska täcka.

Vid små upptiningsfält är det fördelaktigt att använda sig av ett cirkulärt mönster där slangarna läggs tätt intill varandra som visat i illustration 3 under.

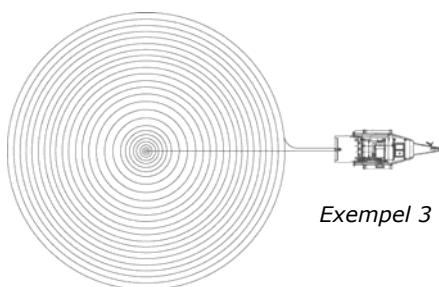
Ju djupare tjäle, desto längre utanför själva grävningområdet bör slangarna läggas.



Exempel 1



Exempel 2



Exempel 3

## 5. Säkerhet

HW-maskinen använder diesel som uppvärmningskälla till upptinings slangarna och elektricitet för drift av pumpen och styrsystemet. Diesel är antändligt och bör därför behandlas med varsamhet.



För att undvika oönskad kontakt med het värmetransporterande vätska är det **VIKTIGT** att alla komponenter i cirkulationssystemet underhålls och kontrolleras ofta.

Under normal användning kommer en del ytor att ha en hög temperatur. När HW-maskinen startas upp ska användaren befinna sig på plats vid maskinen ända tills systemet har nått sin driftstemperatur. Användaren ska under systemets inkörning kontrollera kopplingar, ventiler, etc. och försäkra sig om att systemet är tätt och läckagefritt och att maskinen inte uppvisar andra avvikande tecken.

### 5.1. Personlig skyddsutrustning

Under drift kan den värmetransporterande vätskans temperatur stiga upp till 115 °C. När det arbetas med apparater som når en så pass hög temperatur är det viktigt att användaren vidtar lämpliga åtgärder med tanke på personlig skyddsutrustning. Användaren tillråds alltid använda arbetskläder som har godkänts för arbete i stark värme, vattentäta arbetsshandskar, skyddssko och arbetshjälm under arbetsuppdrag med HW-maskiner i tillägg till de obligatoriska skyddsglasögonen.



Användande av skyddsskor, arbetskläder, handskar och hjälm rekommenderas vid hantering av HW-maskiner, i tillägg till obligatoriska **SKYDDSGLASÖGON**.



**Obligatoriska skyddsglasögon**



**Het vätska under tryck**

Användaren uppmanas medha en förbandslåda och ögonbad i dragfordonet/arbetsbilen eller på något annat varmt ställe i närheten av maskinen. De bör av naturliga orsaker förvaras på ett frostfritt och lätt tillgängligt ställe. Utrustningen är speciellt viktig i omgivningar där vatten inte finns lätt tillgängligt. Se bilagan för HMS datablad för HW:s värmetransporterande vätska.

## 5.2. Säkerhetsanordningar

HW-maskinerna förses med en automatisk avstängningsfunktion på cirkulationspumpen som stannar vid ett eventuellt slangbrott eller läckage av värmetransporterande vätska på grund av andra orsaker. Avstängningsfunktionen aktiveras när den värmetransporterande vätskans tank har nått en viss miniminivå. Högsta mängden värmetransporterande vätska som kan gå till spillo är ca. 30 liter. Värmevätskan skadar inte miljön. Vid pumpens toppkapacitet sprutar mindre än 1 liter värmetransporterande vätska ut per sekund.

Pannans brännare innehåller ett överhettningsskydd som slår av brännaren när temperaturen har överskridit en säkerhetsnivå. Den måste i så fall nollställas.

PVC-duken på kontrollpanelen måste alltid hänga över slangarna när maskinen är i användning.

Vid konstant användning av brännare måste brännaren stängas av 5 min / 24 timmar.

## 5.3. Nödstoppbrytare

Maskinerna förses med en nödstoppbrytare för användning i eventuellt farliga situationer som kan uppstå i samband med slangläckage och inspolning.



## 6. Förberedning och transport

### 6.1. Förberedning

Före start bör det genomföras en kontroll så att utrustningen är klar innan den transporteras till arbetsområdet. Det är viktigt i och med att man ofta står inför kalla förhållanden varvid man helst bör undvika arbetsuppgifter som kunde ha skötts på förhand. Nedanför har vi samlat upp ett antal väsentliga punkter som bör kontrolleras före transporter till arbetsstället.

#### Lufttryck, ljus, broms

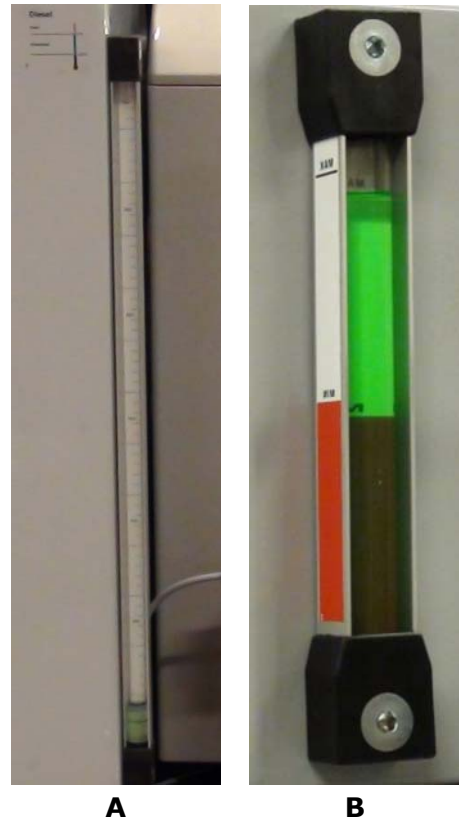
Kontrollera lufttrycket i släpvagnens däck innan transport. Se till att transport- och arbetsbelysningen fungerar som de ska. Kontrollera släpvagnens transportbelysning när strömkontakten från dragfordonet har tillkopplats. Besiktiga den invändiga arbetsbelysningen. Se till att handbromsen är tillräckligt spänd och att den fungerar som den ska. Avvikelser bör korrigeras före HW-maskinen transporteras.

#### Påfyllning av diesel och värmetransporterande vätska

Dieseln och den värmetransporterande vätskan kan fyllas/påfyllas på HW-maskinens användningsplats.

Fyllningen/påfyllningen bör emellertid helst företas innan HW-maskinen transporteras till arbetsområdet. I vissa tillfällen kan transporter med en tom dieseltank vara ändamålsenligt vid längre sträckningar.

Kontrollera alltid nivåglaset för diesel **(A)** och värmetransporterande vätska **(B)** innan maskinen startas.





## MANUELL FyllNING AV DIESEL

Vid manuell fyllning observeras dieseltankens nivåglas. Avsluta den manuella fyllningen innan tanken blir överfull.

Vid driftstemperaturer under -20 °C ska parafin blandas i dieseln enligt förhållandet (3:1 vinterdiesel/parafin).

### Fyllning av diesel med påfyllnadspump

Påfyllnadspumpens slang kopplas till den vänstra snabbkopplingen **(A)**.

För containermodellen se bild **(B)**.

Placera slangen ordentligt ner i dieseltanken.

Håll påfyllnadspumpens knapp nedtryckt på elskåpet **(C)**.

Släpp knappen när du nått maxnivån. Pumpen stannar.



**A**



**B**



**C**

## UPPKOPPLING TILL EXTERN DIESELTANK

Alla HW-maskiner kan suga direkt från en extern tank för att öka den obemannade drifttiden. Vrid inspektionslokets kran till ett vertikalt läge **(D)**. Koppla upp medföljande sugslang (5 meter) till den mittersta snabbkopplingen på maskinen **(E)** och den andra änden till en extern tank. Var noga med att torka av smuts från slangnippeln före anslutning.

För containermodellen se **(F)**



**D**



**E**



**F**



## Fyllning av värmetransporterande vätska

Fyll på värmetransporterande vätska endast när den befinner sig under 45 °C. Använd endast vätska av typen HW:s värmetransporterande vätska. Användning av andra slags vätskor eller blandningsförhållanden kan leda till driftsstörningar och problem. Garantin gäller inte i sådana fall. Maskinen har försetts med en slang till påfyllnadspumpen som befinner sig i frambdelen av aggregatutrymmet.

Påfyllnadspumpens slang kopplas till snabbkopplingen på högra sidan av maskinen. **(G)** Placera slangens ordentligt ner i den värmetransporterande vätskans behållare. Öppna kranen, **(H)**.

Håll påfyllnadspumpens knapp nedtryckt på elskåpet **(I)**.

Släpp knappen när du nått maxnivån så stannar pumpen.

Stäng kranen **(H)** efter fyllning.

Den värmetransporterande vätskan töms genom sin egen dräneringsslang.



**G**



**H**



**I**

## 6.2. Transportering av HW-maskinen

Maskinens transport ska ske med fordon vilkas tillåtna släpvagnsvikt inte överstiger den angivna maximivikten i kap 14.1. Dragfordonet bör väljas med tanke på vägförhållandena där transporten ska genomföras. HW-maskinerna kommer färdigt utrustade med helårsdäck.

Kontrollera att allt överensstämmer med nationella särregler för transport.



Transport av HW 3600 FrostHeater

## 7. Förfarande

Det här avsnittet tar sig an en korrekt drift av HW-maskinerna steg för steg. I det följande beskriver vi hanteringen av maskinen från dess parkering tills upptyningsuppdraget har utförts och maskinen riggats ner.

### 7.1. Upprigging och start

Innan värmeslangar och mattor läggs ut bör gällande område spärras av med band för att hindra anläggningsmaskiner eller andra fordon från att skada utrustningen som lagts ut på marken.



**FARA**

Själva maskinenheten ska aldrig placeras inomhus eller under tak pga. fara för kvävning och pipbrand.

### Nätverks/ström-uppkoppling – Autostart av strömaggregat

Om man väljer nätström, kopplas den bifogade skarvsladden till nätkontakten och därefter till apparatens intag vid sidan av kontrollpanelen. Genom att ställa autostartbrytaren i (ON)-läge kommer strömaggregatet att starta automatiskt om nätströmmen uteblir. När nätströmmen återkommer registrerar maskinen situationen och stannar aggregatet inom några minuter. Maskinen fortsätter därefter att gå på nätström. När maskinen stannas måste autostartbrytaren ställas i (0)-läget för att strömaggregatet inte ska starta automatiskt.



**J**



**K**



**L**



Det är speciellt viktigt att ett jordspett har slagits ner i marken för att jorda maskinen.

### Uppkoppling till en extern dieseltank

Maskinerna kan kopplas till en extern dieseltank för en ökad obemannad driftstid.

## Innställning för utspolning

### Manuell utdragning

Ifall maskinen hanteras av endast en person, rekommenderas utdragning av värmeslangarna från trumman för hand för att undvika slack och därmed "hopning". Sätt därför regleringskranen i ett neutralt läge (vågrätt).

### Motoriserad utdragning

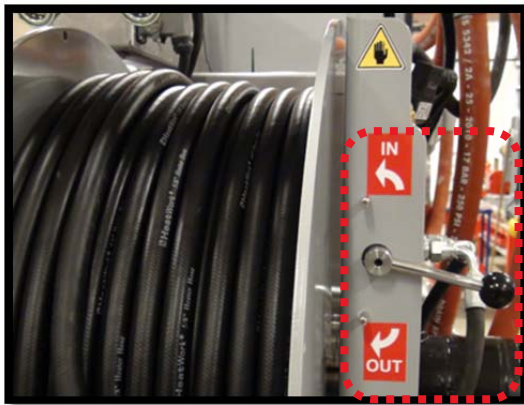
Ifall maskinen hanteras av två personer kan cirkulationspumpen användas till att styra trumman.

Hastigheten justeras då av en person, medan en annan breder ut värmeslangarna på upptiningsytan. Följ påföljande anvisningar:

- Ställ cirkulationsbrytaren i trummans driftsläge.
- Trummans hastighet justeras med hjälp av regleringsspaken.



**Klämrisk**



HW 3600



HW 1800

## Utdragning av slangar

Värmeslangarna ska dras/köras ut en i taget. Slangarna kopplas till maskinen när önskat antal kretsar har dragits ut. Se till att inte blanda ändarna på kretsarna vid uppkoppling till maskinen.

## Utbredning av slangarna på marken

Försök uppnå bästa möjliga markkontakt med värmeslangarna och undvik att lägga slangarna på vassa föremål. Slangavståndet beräknas utgående från önskad upptiningshastighet och upptiningsyta. Se föregående kapitel för detaljer om upptiningshastighet, täckning av ytor och slangavstånd.

## Kopplingar av slangar

Torka av smuts från slangkopplingarna innan uppkoppling till grenrörsuttagen. Se till att fästa kopplingarna ordentligt så att de inte lossnar när pumpen startar. Cirkulationspumpen ska vara avslagen när slangarnas snabbkopplingar monteras/avmonteras.

**Slangarnas ändar har färgkodats. En ände kopplas till utgående och den andra till inkommande uttag.**

## Start av cirkulationspump

Cirkulationspumpen startas alltid före brännaren startas. Cirkulationsbrytaren ställs i läget: "Operation".

### OBSERVERA!

UNDVIK så gott det går att låta slangkopplingarnas invändiga delar komma i kontakt med jord och sand så att smuts inte kommer åt det värmetransporterande vätskesystemet.

### OBSERVERA!

Cirkulationspumpen måste startas före BRÄNNAREN startas. Annars startar inte BRÄNNAREN.

## Innställning av vätsketemperatur och start av brännare

HW-maskinerna levereras med en digital termostat för justering av vätsketemperaturen.

Innan brännaren startas justeras vätsketemperaturen på pannans panel till önskad temperatur. Den högsta tillåtna vätsketemperaturen på HW 1800 är 90 °C och på HW 3600/6000 100 °C.

## Start av brännaren

Brännaren startas genom att sätta brännarbrytaren på kontrollpanelen i läge 1. Brännaren startar då om några sekunder. OBS: cirkulationspumpen måste startas före brännaren startas.

## Kontroll av cirkulation og tryck

Varje cirkulationskrets i systemet har en separat strömningsindikator. Kontrollera att de roterar i den eller de respektive cirkulationskretsar som är i användning. Se dessutom till att det inte förekommer läckage i kopplingar, slangar eller i maskinens kopplingar. Kontrollen genomförs innan isoleringsmattorna bredds ut så att man har full översikt över utlagda slangar.

Kontrollera alltid systemtrycket vid uppstart och med jämna mellanrum under upptiningen. Det brukar vara högt i början och sjunka sedan med en ökande vätsketemperatur och antalet tillkopplade slangkretsar.

Kontrollera strömningsindikatorernas hastighet för att se till att alla tillkopplade slangkretsar cirkulerar.

Om strömningsindikatorn stannar, finns det veck på den aktuella slangkretsen.

*Det normala driftstrycket är 2–6 bar.*



STRÖMNINGS-  
HASTIGHET

### **Utbredning av isoleringsmattor**

När cirkulationen kommit igång placeras HW-isoleringsmattor ut över de utbredda slangarna. Mattorna bör överlappa varandra med minst 30 cm. Mattorna tillråds läggas en halv meter utanför slangarna runt upptiningsytan.

Den värmereflekterande aluminiumsidan ska alltid ligga nedåtvänd mot slangarna. Undvik att dra isoleringsmattorna längs marken med aluminiumsidan nedåt, i och med att det försämrar isoleringsförmågan med tiden.

Isoleringsmattorna kan skyddas mot vinden med hjälp av HW-presenningar. Undvik vassa föremål så att mattorna inte skadas.

#### **OBSERVERA!**

UNDVIK att släpa isoleringsmattorna med aluminiumsidan ned mot marken. Det förorsakar onödvändig slitage.

## **7.2. Nedriggning**

### **Nedkylning före inspolning**

När ett upptiningsuppdrag är klart bör den värmetransporterande vätskan kylas ned före inspolning. Det gör man genom att slå av brännaren och låta cirkulationspumpen gå tills man når 30 °C temperatur på den utgående vätskan.

En kallare vätska ger ett kraftigare inspolningsmoment på trummans motor.

### **Driftslampa för lokal övervakning**

Maskinerna levereras med en driftslampa på taket för lokal övervakning och information om att maskinen är i användning. Ljuset blinkar grönt under normal drift. En släckt lampa är ett tecken på avbruten drift eller på att maskinen är avslagen.



## Inspolning

OBS: Var försiktig vid inspolning. Det är klämrisk mellan trumman och sidostöden. Försök aldrig stanna trumman för hand. Behåll ett tryggt avstånd till trumman under inspolning så att inte händer eller handskar fastnar mellan slangarna eller i trummans snoddar.

När vätsketemperaturen sjunkit till under 30 °C, kan slangarna spolas in. Slå av cirkulationspumpen och koppla ändarna från grenrörsuttagen. Trä omedelbart skyddshättorna över slangarnas ändar. Koppla den ena änden av slangen till en av trummans krokarna med änden uppåtvänd. Spola endast in en slang i taget.

Pumpbrytaren sätts i trummans driftsläge. Trummans inspolningshastighet justeras sedan med hjälp av regleringsventilen. Användaren bör hålla i slangen under inspolningen och leda slangen in för hand så att slangen packas så tätt som möjligt på trumman och att det förekommer så lite slack som möjligt. Handskar eller en fuktig trasa bör användas för att dra av smutsen från slangarna under inspolningen. Användaren tar kontroll på styrspaken när slangens ände närmar sig trumman så att inspolningens sista fas genomförs lugnt och kontrollerat.

Montera till sist de ursprungliga gummisnoddarna för att fästa slangarnas ändar till öppningarna i trummans gavlar. Fäst kroken så att dens ände inte sticker ut mot en sektion utan slangar. På så sätt elimineras risken för att något fastnar i kroken under inspolning av följande sektion.



**Klämrisk**



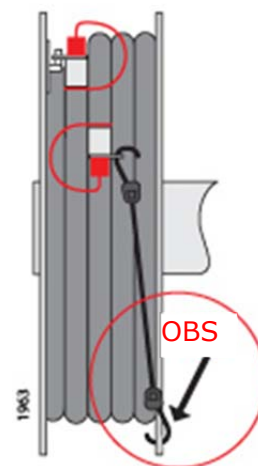
**FARA**

Risk för att händerna fastnar i trummans krok eller mellan slangarna under inspolning

## OBSERVERA!

Slangänden ska vara uppåtvänd när slangen fästs till slangkroken.

Det är viktigt att hålla slangarna STRAMA under inspolningen SAMT att det mesta av jord och sand dras av slangen vid inspolningen.



## Avstängning

När slangarna fästs på trumman slås cirkulationspumpen (104) av. Vridbrytaren slås av innan strömkabeln kopplas ur. Följ avstängningsanvisningarna för aggregatet vid aggregatdrift. Stäng och lås dörrar och luckor. HW-maskinen är nu klar för att transporteras.

## 8. Övervakning under drift

Det här avsnittet tar sig an övervakningen av HW-maskiner under drift. Anvisningarna i fortsättningen förutsätter att systemet har nått sin driftstemperatur.



### FARA

Användning av ANNAN utrustning än den som maskinen levererats med kan förorsaka oförutsedda driftsproblem och PERSONSKADOR.

### OBSERVERA!

Det måste alltid ses till att slangarna INTE har hamnat i kläm ELLER att slangerna inte är VRIDEN så att cirkulationen förhindras.

### 8.1. Lokal övervakning

När HW-maskinen befinner sig i drift kan man övervaka processen via kontrollpanelen innanför bakluckan. HW 3600 och 6000 har tre cirkulationskretsar med separata strömningsindikatorer.

HW 1800 har en gemensam strömningsindikator och temperaturmätare för utgående och inkommande temperatur.



HW 3600:s kontrollpanel

Den utgående temperaturen varierar i cykler med in- och utkoppling av brännaren kring pannans förinställda vätsketemperatur.

Den inkommande temperaturen visar alltid en lägre temperatur än den utgående temperaturen. En normal inkommande temperatur ligger på 50–100 °C beroende på antalet tillkopplade slangar, upptiningstiden, temperaturen utomhus, förhållandena på marken och isolering. Den inkommande temperaturen är som lägst i början när temperaturskillnaden mellan marken och slangerna är som störst.

Maskinens systemtryck ligger kring 2–6 bar under normal drift. Systemets tryck varierar beroende på kretsarnas antal, vätsketemperaturen och utbredningsmönstret. HW-maskinernas användare skaffar sig så småningom mer erfarenhet med tanke på de olika egenskaperna.

## 8.2. Justering av drift

I vissa fall kan de tre cirkulationskretsarna ha olika inkommande temperaturer och strömningshastighet. Om man förutsätter att slingornas strömningshastighet är den samma, tyder en låg temperatur på en av slingorna på en särskilt stor värmeförlust i kretsen. Kontrollera att slangarna har täckts tillräckligt omsorgsfullt med isoleringsmattorna.

Ifall man siktar på en mindre upptiningseffekt på en av slingorna kan den strypas med volymströmregleraren (tilläggsutrustning). En mindre strömningshastighet avger mindre värme. Strömningens volymen bedöms visuellt av användaren på strömningssindikatorerna.

Om man ska tina upp ett större område för grävning, kan man genom justering av strömningshastigheten reglera områdets upptiningshastighet enligt grävningssupdragets ordningsföljd.

## 8.3. GSM-användarhandledning

Användning av GSM-systemet kräver insättning av ett SIM-kort. Ett kontantkort fungerar utmärkt.

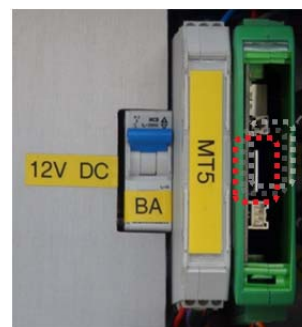
När SIM-kortet programmeras bör maskinen vara kopplad till strömnätet eller strömaggregatet måste vara igång.

OBS! SIM-kortets PIN-kod måste kopplas ur med hjälp av en vanlig telefon innan det placeras i maskinen.

## 8.4. Insättning av SIM-kort

Anvisningar för att sätta in eller byta SIM-kort:

1. Öppna elskåpet.
2. Öppna det genomskinliga plastlocket i det gröna facket.
3. Sätt in ett nytt SIM-kort och tryck försiktigt kortet på plats. Kontaktytan till vänster och kortets hack ned/ut.



GSM-del i elskåpet

## 8.5. Indikatorlampor

När maskinen är i användning blinkar en lysdiod på GSM-enheten med olika färgkoder:

- Rött ljus: blinkar när enheten inte har kontakt med mobilnätet.
- Grönt ljus: blinkar när enheten har kontakt med mobilnätet.
- Orange ljus: blinkar när det skickas SMS från enheten.



## 8.6. Varningsmeddelanden

Maskinens GSM-kontrollstyrning ger användaren följande varningar och förslag till åtgärder:

### **VARNING 1 – DIESELLARM**

"Låg dieselnivå på HW-maskinen, 25 liter kvar i tanken."

### **VARNING 2 – BRÄNNARLARM:**

"HW-maskinens brännare har stannat. Nollställ brännarens relä. Dieselpumpen måste luftas efter torrkorning."

### **VARNING 3 – NÄTSPÄNNING:**

"HW-maskinens nätspänning har fallit bort. Kontrollera inkommande ledning och spänning. Inspektera säkringar och aggregat."

### **VARNING 4 – GLYKOLNIVÅ:**

"HW-maskinen har stannat på grund av för låg nivå av värmetransporterande vätska. Undersök eventuella läckage. Reparera och fyll på vätska."

### **VARNING 5 – BRÄNNARE:**

"HW-maskinens brännare har stannat. Nollställ överhettningsskyddet på pannans kontrollpanel."

## 8.7. Servicemeddelanden

### **Avläsning av utgående temperatur på den värmetransporterande vätskan:**

Skicka checktemp till GSM:s SIM-kort.

### **Stanna brännaren:**

Skicka out2 on till GSM:s SIM-kort.

### **Starta brännaren:**

Skicka out2 off till GSM:s SIM-kort.

## 8.8. Lägga till nya nummer

GSM-varningarna erbjuder möjligheten att informera tre olika nummer i samband med varje varning. När det läggs in nya nummer försvinner inte de gamla numren i och med att upp till tre nummer kan larmas samtidigt. Inläggning av ett nytt telefonnummer kan göras till alla varningar x eller bara på önskade varningar. Skriv följande meddelande till maskinen för att lägga till nummer:

INxTEL\_telefonnummer

Där x står för meddelandetyp 1, 2 eller 3, och \_ står för ett mellanrum. Små och stora bokstäver är valfria. Det måste skickas ett meddelande för varje varning.

Exempel: för att lägga in samma nummer till alla varningar skickar man fem meddelanden:

IN1TEL 0707654321

IN2TEL 0707654321

IN3TEL 0707654321

IN4TEL 0707654321

IN5TEL 0707654321

Om man önskar varna fler nummer samtidigt för en slags varning använder man ett mellanrum mellan siffrorna. Varje varning kan innehålla högst tre nummer.

Exempel:

IN1TEL 0707654321 0765432100

## 8.9. Avlägsna telefonnummer

För att avlägsna alla telefonnummer på en varning skriver man:

INxTEL\_OFF

Exempel:

IN1TEL OFF

## 9. Indikatorer och felmeddelanden

### 9.1. Indikatorer på kontrollpanelen

#### Nät

Visar att maskinen är kopplad till strömnätet.

#### Pumpfel

Om indikatorn för pumpfel lyser kan det hända, att brännaren har startat men inte pumpen, eller att det finns för lite värmetransporterande vätska i tanken. Pumpen måste alltid startas före brännaren. Om inte detta stämmer ska man ta kontakt med servicepersonalen för att kontrollera den elektriska pumpmotorn.

#### Brännarfel

Om indikatorn för pumpfel lyser kan det vara fel på bränsletillförseln. Fyll på med eventuell diesel om tom, lufta dieseltillförseln, rengör dieselfiltret och kontrollera brännaren.

Indikatorn lyser också om brännaren har slagit sig av på grund av fotomotståndsrelät (87). Det händer ifall brännaren släcks på grund av konvektion i avgasröret. Nollställ brännarens fotomotståndsrelä genom att trycka in den röda brytaren.

### 9.2. Nivåglas för värmetransporterande vätska

Innan nivån når sitt minimiläge bör den påfyllas med värmetransporterande vätska. Cirkulationspumpen stannar om vätskenivån sjunker för lågt.

Miniminivån finns indikerad på nivåglaset på den värmetransporterande vätskans tank. Mängden värmetransporterande vätska mellan minimi- och maximinivån är 35 liter.

**Lägg märke till att mininivån ligger mitt på den värmetransporterande vätskans tank!**

### 9.3. Felsökning i HW-maskinerna

Fel	Möjliga orsaker	Korrigering
<b>Pumpfel-indikatorn lyser</b>	<ul style="list-style-type: none"> <li>▪ Frekvensomformaren i elskåpet.</li> <li>▪ Fel på pumpmotorn/el-motorn.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Kontrollera felkoden på omformaren och läs bruksanvisningen.</li> <li>▪ Kontakta servicepersonalen.</li> </ul>
<b>Pump och brännare stannar/ startar inte, varningslampan är inte tänd</b>	Låg vätskenivå i den värmetransporterande vätskans tank.	Fyll på värmetransporterande vätska.
<b>Brännaren startar inte</b>	<ul style="list-style-type: none"> <li>▪ Cirkulationspumpen har inte startats först.</li> <li>▪ Överhettningsskyddet har slagits ut.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Starta pumpen först.</li> <li>▪ Nollställ överhettningsskyddet.</li> </ul>
<b>Brännarfel-indikatorn lyser</b>	<ul style="list-style-type: none"> <li>▪ Brännaren har slocknat på grund av konvektion i avgasröret.</li> <li>▪ Fel på bränsletillförseln.</li> <li>▪ Fel på brännaren.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Nollställ fotomotståndrelät på brännaren (se bruksanvisning).</li> <li>▪ Fyll på diesel, rengör dieselfiltret. Kontrollera brännaren.</li> <li>▪ Kontakta servicepersonalen.</li> </ul>
<b>Brännaren stannar, varningslampan är inte tänd</b>	Överhettningsskyddet kan ha slagits ut på grund av hög vätsketemperatur och låg cirkulation.	Minska vätsketemperaturen, öka cirkulationen och nollställ pannans säkring efter 3 min.
<b>Svart avgas från pannan</b>	Fel inställning av brännarparametrar (luft, bränsle, munstycke och tryck) på grund av höjd över havet eller slitage.	Kontakta servicepersonalen.
<b>Högt utgående tryck</b>	Ihopklämd värmeslang.	Slå av pumpen, kontrollera slangarna.

### 9.4. Felsökning i aggregatet

Fel	Möjliga orsaker	Korrigering
<b>Startmotorn fungerar, men motorn startar inte</b>	<ul style="list-style-type: none"> <li>▪ Tom på bränsle.</li> <li>▪ Tätt dieselfilter.</li> <li>▪ Utomhustemperaturen lägre än -18 °C.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fyll på bränsle och följ anvisningarna för luftning.</li> <li>▪ Rengör dieselfiltret.</li> <li>▪ Se till att höja starttemperaturen.</li> </ul>
<b>Låga varv</b>	<ul style="list-style-type: none"> <li>▪ För stor strömbelastning.</li> <li>▪ Smutsigt luftfilter.</li> <li>▪ Tätt dieselfilter.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Avlägsna externa förbrukare.</li> <li>▪ Rengör luftfiltret.</li> <li>▪ Rengör dieselfiltret.</li> </ul>
<b>Svart avgas</b>	Smutsigt luftfilter.	Rengör luftfiltret.
<b>Startmotorn fungerar inte/ går långsamt</b>	<ul style="list-style-type: none"> <li>▪ Batteriet är urladdat.</li> <li>▪ Oljenivån under minimum.</li> <li>▪ Elektriskt fel eller fel på startmotorn.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ladda batteriet.</li> <li>▪ Fyll på olja.</li> <li>▪ Kontakta servicepersonalen.</li> </ul>

## 9.5. Felsökning i frekvensomformaren

### Drive does not start, no error code displayed

- If the display does not light up, check the power supply to the drive (ground and input phases connection, see page 19).
- The assignment of the "Fast stop" or "Freewheel" functions will prevent the drive starting if the corresponding logic inputs are not powered up. The ATV12 then displays **n5t** in freewheel stop and **F5t** in fast stop, it will display **rdy** in freewheel stop. This is normal since these functions are active at zero so that the drive will be stopped safely if there is a wire break. Assignment of LI to be checked in **C0nF/FULL/FULFUn-5t** - menu.
- Make sure that the run command input(s) is activated in accordance with the selected control mode (parameters **Type of control tCC** page 47 and **2 wire type control tCt** page 50, in **C0nF/FULL/ID** - menu).
- If the reference channel or command channel is assigned to Modbus, when the power supply is connected, the drive displays "**n5t**" freewheel and remain in stop mode until the communication bus sends a command.
- In factory setting "RUN" button is inactive. Adjust parameters **Reference channel 1 Fr I** page 60 and **Command channel 1 Cd I** page 61 to control the drive locally (**C0nF/FULL/CtL** - menu). See How to control the drive locally page 45.

### Fault detection codes that cannot be reset automatically

The cause of the fault must be removed before resetting by turning off and then on.

**S0F** and **t nF** faults can also be reset remotely by means of a logic input (parameter **Detected fault reset assignment r5F** page 77 in **C0nF/FULL/FLt** - menu).

**InFb**, **S0F** and **t nF** faults can be inhibited and cleared remotely by means of a logic input (parameter **Detected fault inhibition assignment InH** page 81).

Code	Name	Possible causes	Remedy
<b>CrFI</b>	Precharge	<ul style="list-style-type: none"> <li>• Charging relay control fault or charging resistor damaged</li> </ul>	<ul style="list-style-type: none"> <li>• Turn the drive off and then back on again</li> <li>• Check the connections</li> <li>• Check the stability of the main supply</li> <li>• Contact your local Schneider Electric representative</li> </ul>
<b>InFI</b>	Unknown drive rating	<ul style="list-style-type: none"> <li>• The power card is different from the card stored</li> </ul>	<ul style="list-style-type: none"> <li>• Contact your local Schneider Electric representative</li> </ul>
<b>InF2</b>	Unknown or incompatible power board	<ul style="list-style-type: none"> <li>• The power card is incompatible with the control card</li> </ul>	<ul style="list-style-type: none"> <li>• Contact your local Schneider Electric representative</li> </ul>
<b>InF3</b>	Internal serial link	<ul style="list-style-type: none"> <li>• Communication fault between the internal cards</li> </ul>	<ul style="list-style-type: none"> <li>• Contact your local Schneider Electric representative</li> </ul>
<b>InF4</b>	Invalid industrialization zone	<ul style="list-style-type: none"> <li>• Inconsistent internal data</li> </ul>	<ul style="list-style-type: none"> <li>• Contact your local Schneider Electric representative</li> </ul>
<b>InF9</b>	Current measurement circuit failure	<ul style="list-style-type: none"> <li>• Current measurement is not correct due to hardware circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Contact your local Schneider Electric representative</li> </ul>
<b>- - - -</b>	Problem of application Firmware	<ul style="list-style-type: none"> <li>• Bad application firmware update using the Multi-Loader tool</li> </ul>	<ul style="list-style-type: none"> <li>• Flash again the application firmware of the product</li> </ul>
<b>InFb</b>	Internal thermal sensor failure	<ul style="list-style-type: none"> <li>• The drive temperature sensor is not operating correctly</li> <li>• The drive is in short circuit or open</li> </ul>	<ul style="list-style-type: none"> <li>• Contact your local Schneider Electric representative</li> </ul>
<b>InFE</b>	Internal CPU	<ul style="list-style-type: none"> <li>• Internal microprocessor fault</li> </ul>	<ul style="list-style-type: none"> <li>• Turn the drive off and then back on again</li> <li>• Contact local Schneider Electric representative</li> </ul>

## Diagnostics and Troubleshooting

### Fault detection codes that cannot be reset automatically (continued)

Code	Name	Possible causes	Remedy
<b>OCF</b>	Overcurrent	<ul style="list-style-type: none"> <li>Parameters in the <a href="#">Motor control menu d r C</a> - page <a href="#">55</a> are not correct</li> <li>Inertia or load too high</li> <li>Mechanical locking</li> </ul>	<ul style="list-style-type: none"> <li>Check the parameters</li> <li>Check the size of the motor/drive/load</li> <li>Check the state of the mechanism</li> <li>Connect line motor chokes</li> <li>Reduce the <a href="#">Switching frequency 5 F r</a> page <a href="#">57</a></li> <li>Check the ground connection of drive, motor cable and motor insulation.</li> </ul>
<b>SCF1</b>	Motor short circuit	<ul style="list-style-type: none"> <li>Short-circuit or grounding at the drive output</li> <li>Ground fault during running status</li> <li>Commutation of motors during running status</li> <li>Significant current leakage to ground if several motors are connected in parallel</li> </ul>	<ul style="list-style-type: none"> <li>Check the cables connecting the drive to the motor, and the motor insulation</li> <li>Connect motor chokes</li> </ul>
<b>SCF3</b>	Ground short circuit		
<b>SCF4</b>	IGBT short circuit	<ul style="list-style-type: none"> <li>Internal power component short circuit detected at power on</li> </ul>	<ul style="list-style-type: none"> <li>Contact your local Schneider Electric representative</li> </ul>
<b>SOF</b>	Overspeed	<ul style="list-style-type: none"> <li>Instability</li> <li>Overspeed associated with the inertia of the application</li> </ul>	<ul style="list-style-type: none"> <li>Check the motor</li> <li>Overspeed is 10% more than <a href="#">Maximum frequency t F r</a> page <a href="#">55</a> so adjust this parameter if necessary</li> <li>Add a braking resistor</li> <li>Check the size of the motor/drive/load</li> <li>Check parameters of the speed loop (gain and stability)</li> </ul>
<b>ENF</b>	Auto-tuning	<ul style="list-style-type: none"> <li>Motor not connected to the drive</li> <li>One motor phase loss</li> <li>Special motor</li> <li>Motor is rotating (being driven by the load, for example)</li> </ul>	<ul style="list-style-type: none"> <li>Check that the motor/drive are compatible</li> <li>Check that the motor is present during auto-tuning</li> <li>If an output contactor is being used, close it during auto-tuning</li> <li>Check that the motor is completely stopped</li> </ul>



## Diagnostics and Troubleshooting

### Fault detection codes that can be reset with the automatic restart function, after the cause has disappeared

These faults can also be reset by turning on and off or by means of a logic input (parameter [Detected fault reset assignment r 5 F](#) page 77). OHF, OLF, OPF1, OPF2, OSF, SLF1, SLF2, SLF3 and tJF faults can be inhibited and cleared remotely by means of a logic input (parameter [Detected fault inhibition assignment InH](#) page 81).

Code	Name	Possible causes	Remedy
<b>LFF1</b>	AI current lost fault	Detection if: <ul style="list-style-type: none"> <li>Analog input AI1 is configured as current</li> <li>AI1 current scaling parameter of 0% <a href="#">CrL1</a> page 51 is greater than 3 mA</li> <li>Analog input current is lower than 2 mA</li> </ul>	<ul style="list-style-type: none"> <li>Check the terminal connection</li> </ul>
<b>ObF</b>	Overbraking	<ul style="list-style-type: none"> <li>Braking too sudden or driving load too high</li> </ul>	<ul style="list-style-type: none"> <li>Increase the deceleration time</li> <li>Install a module unit with a braking resistor if necessary</li> <li>Check the line supply voltage, to be sure that it is under the maximum acceptable (20% over maximum line supply during run status)</li> </ul>
<b>OHF</b>	Drive overheating	<ul style="list-style-type: none"> <li>Drive temperature too high</li> </ul>	<ul style="list-style-type: none"> <li>Check the motor load, the drive ventilation and the ambient temperature. Wait for the drive to cool down before restarting. See Mounting and temperature conditions page 12.</li> </ul>
<b>DLC</b>	Process overload	<ul style="list-style-type: none"> <li>Process overload</li> </ul>	<ul style="list-style-type: none"> <li>Check the process and the parameters of the drive to be in phase</li> </ul>
<b>DLF</b>	Motor overload	<ul style="list-style-type: none"> <li>Triggered by excessive motor current</li> </ul>	<ul style="list-style-type: none"> <li>Check the setting of the motor thermal protection, check the motor load.</li> </ul>
<b>OPF1</b>	1 output phase loss	<ul style="list-style-type: none"> <li>Loss of one phase at drive output</li> </ul>	<ul style="list-style-type: none"> <li>Check the connections from the drive to the motor</li> <li>In case of using downstream contactor, check the right connection, cable and contactor</li> </ul>
<b>OPF2</b>	3 output phase loss	<ul style="list-style-type: none"> <li>Motor not connected</li> <li>Motor power too low, below 6% of the drive nominal current</li> <li>Output contactor open</li> <li>Instantaneous instability in the motor current</li> </ul>	<ul style="list-style-type: none"> <li>Check the connections from the drive to the motor</li> <li>Test on a low power motor or without a motor: In factory settings mode, motor phase loss detection is active <a href="#">Output Phase loss detection OPPL</a> page 80 = <b>YES</b>. To check the drive in a test or maintenance environment, without having to use a motor with the same rating as the drive, deactivate motor phase loss detection <a href="#">Output Phase loss detection OPPL</a> = <b>NO</b></li> <li>Check and optimize the following parameters: <a href="#">IR compensation (law U/F) UFr</a> page 56, <a href="#">Rated motor voltage Un5</a> page 55 and <a href="#">Rated motor current nCr</a> page 55 and perform an <a href="#">Auto-tuning tUn</a> page 58.</li> </ul>
<b>OSF</b>	Main overvoltage	<ul style="list-style-type: none"> <li>Line voltage too high:               <ul style="list-style-type: none"> <li>At drive power on only, the supply is 10% over the maximum acceptable voltage level</li> <li>Power with no run order, 20% over the maximum line supply</li> </ul> </li> <li>Disturbed line supply</li> </ul>	<ul style="list-style-type: none"> <li>Check the line voltage</li> </ul>

## Diagnostics and Troubleshooting

Fault detection codes that can be reset with the automatic restart function, after the cause has disappeared (continued)

Code	Name	Possible causes	Remedy
<b>PHF</b>	Input phase loss	<ul style="list-style-type: none"> <li>• Drive incorrectly supplied or a fuse blown</li> <li>• Failure of one phase</li> <li>• 3-phase ATV12 used on a single-phase line supply</li> <li>• Unbalanced load</li> <li>• This protection only operates with the drive on load</li> </ul>	<ul style="list-style-type: none"> <li>• Check the power connection and the fuses.</li> <li>• Use a 3-phase line supply.</li> <li>• Disable the fault by setting <a href="#">Input Phase loss detection IPL</a> page <a href="#">80</a> = <a href="#">r0</a>.</li> </ul>
<b>SCF5</b>	Load short circuit	<ul style="list-style-type: none"> <li>• Short-circuit at drive output</li> <li>• Short circuit detection at the run order or DC injection order if parameter <a href="#">IGBT test S t r t</a> page <a href="#">81</a> is set to <a href="#">y e s</a></li> </ul>	<ul style="list-style-type: none"> <li>• Check the cables connecting the drive to the motor, and the motor's insulation</li> </ul>
<b>SLF1</b>	Modbus communication	<ul style="list-style-type: none"> <li>• Interruption in communication on the Modbus network</li> </ul>	<ul style="list-style-type: none"> <li>• Check the connections of communication bus.</li> <li>• Check the time-out (<a href="#">Modbus time out t t o</a> parameter page <a href="#">83</a>)</li> <li>• Refer to the Modbus user manual</li> </ul>
<b>SLF2</b>	SoMove communication	<ul style="list-style-type: none"> <li>• Fault communicating with SoMove</li> </ul>	<ul style="list-style-type: none"> <li>• Check the SoMove connecting cable.</li> <li>• Check the time-out</li> </ul>
<b>SLF3</b>	HMI communication	<ul style="list-style-type: none"> <li>• Fault communicating with the external display terminal</li> </ul>	<ul style="list-style-type: none"> <li>• Check the terminal connection</li> </ul>
<b>ULF</b>	Process underload fault	<ul style="list-style-type: none"> <li>• Process underload</li> <li>• Motor current below the <a href="#">Application Underload threshold L U L</a> parameter page <a href="#">53</a> during a period set by <a href="#">Application underload time delay U L t</a> parameter page <a href="#">53</a> to protect the application.</li> </ul>	<ul style="list-style-type: none"> <li>• Check the process and the parameters of the drive to be in phase</li> </ul>
<b>t JF</b>	IGBT overheat	<ul style="list-style-type: none"> <li>• Drive overheated</li> <li>• IGBT internal temperature is too high according to ambient temperature and load</li> </ul>	<ul style="list-style-type: none"> <li>• Check the size of the load/motor/drive.</li> <li>• Reduce the <a href="#">Switching frequency S F r</a> page <a href="#">57</a>.</li> <li>• Wait for the drive to cool before restarting</li> </ul>

## Diagnostics and Troubleshooting

### Faults codes that will be reset as soon as their causes disappear

The USF fault can be inhibited and cleared remotely by means of a logic input ([Detected fault inhibition assignment InH](#) parameter page [81](#)).

Code	Name	Possible causes	Remedy
<b>CF F</b>	Incorrect configuration	<ul style="list-style-type: none"> <li>HMI block replaced by an HMI block configured on a drive with a different rating</li> <li>The current configuration of customer parameters is inconsistent</li> </ul>	<ul style="list-style-type: none"> <li>Return to factory settings or retrieve the backup configuration, if it is valid.</li> <li>If the fault remains after reverting to the factory settings, contact your local Schneider Electric representative</li> </ul>
<b>CF I</b> (1)	Invalid configuration	<ul style="list-style-type: none"> <li>Invalid configuration</li> </ul> The configuration loaded in the drive via the bus or communication network is inconsistent. The configuration upload has been interrupted or is not fully finished.	<ul style="list-style-type: none"> <li>Check the configuration loaded previously.</li> <li>Load a compatible configuration</li> </ul>
<b>CF I2</b>	Download invalid configuration	<ul style="list-style-type: none"> <li>Interruption of download operation with Loader or SoMove</li> </ul>	<ul style="list-style-type: none"> <li>Check connection with Loader or SoMove.</li> <li>To reset the default re-start the download operation or restore the factory setting</li> </ul>
<b>US F</b>	Undervoltage	<ul style="list-style-type: none"> <li>Line supply too low</li> <li>Transient voltage dip</li> </ul>	<ul style="list-style-type: none"> <li>Check the voltage and the parameters of <a href="#">Undervoltage Phase Loss Menu U5b</a> - page <a href="#">81</a>.</li> </ul>

(1) When the CFI is present in the past fault menu, it means the configuration has been interrupted or is not fully finished.

#### HMI block changed

When an HMI block is replaced by an HMI block configured on a drive with a different rating, the drive locks in Incorrect configuration **CF F** fault mode on power-up. If the card has been deliberately changed, the fault can be cleared by pressing the ENT key twice, which **restores all the factory settings**.

## Diagnostics and Troubleshooting

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### Remote keypad error messages

Code	Name	Description
<i>In It:</i>	On initializing itself	<ul style="list-style-type: none"> <li>• Micro controller initializing</li> <li>• Communication configuration search</li> </ul>
<i>C O N . E</i> (1)	Communication error	<ul style="list-style-type: none"> <li>• It has 50ms time out error.</li> <li>• This message is shown after 220 retry attempts.</li> </ul>
<i>A - 1 1</i> (1)	Key alarm	<ul style="list-style-type: none"> <li>• Key has been pressed consecutively for more than 10 seconds.</li> <li>• Membrane switch disconnected.</li> <li>• Keypad woken up while a key is being pressed.</li> </ul>
<i>c L r</i> (1)	Confirm Fault reset	<ul style="list-style-type: none"> <li>• This message appears if the STOP key is pressed when there is a keypad fault.</li> </ul>
<i>d E U . E</i> (1)	Drive mismatch	<ul style="list-style-type: none"> <li>• Drive type (brand) did not match with keypad type (brand)</li> </ul>
<i>r O M . E</i> (1)	ROM abnormality	<ul style="list-style-type: none"> <li>• Keypad ROM abnormality detected by the checksum calculation.</li> </ul>
<i>r A M . E</i> (1)	RAM abnormality	<ul style="list-style-type: none"> <li>• Keypad RAM abnormality detected.</li> </ul>
<i>C P U . E</i> (1)	The other defect	<ul style="list-style-type: none"> <li>• The other defectt.</li> </ul>

(1) Flashing



# 10. Sommarförvaring

Under sommarsäsongen har HW-maskinen normalt mindre eller ingen användning och den ska därför lagras på ett tillfredsställande sätt, så att den är klar för följande säsong. Det är viktigt att maskinen har optimala förvaringsförhållanden.

HW-maskinen bör rengöras grundligt före sommarförvaringen. Det är speciellt viktigt att slangarna dras ut och rengörs innan de samlas i trumman för förvaring. Slangarna dras ut ur trumman och brister och skador kontrolleras noggrant. Samma förfarande vidtas såväl med slangar som med kopplingar.

Dessutom rekommenderas en allmän rengöring av hela maskinen.

Det värmetransporterande vätskesystemet ska vara fyllt med värmetransporterande vätska både i tanken och i slangarna. Eventuella nya slangar ska också fyllas med värmetransporterande vätska. Den värmetransporterande vätskan förhindrar korrosion i systemet.

Genomför service på pannan och brännaren enligt bilagorna i denna bruksanvisning. Servicen ska genomföras av certifierade personer/företag.

Dieseltanken fylls för förvaring.

Dieselfiltret byts ut med ett nytt filter.

Filtret för den värmetransporterande vätskan kontrolleras och skadade filter byts ut.

Avgasrör och andra öppningar på maskinen täcks så att inga främmande element kan komma åt dem.

Möjliga batterier kopplas ur och förvaras torrt.

Maskinen ska ALLTID hållas låst.

Det är viktigt med service efter att maskinen har använts under en vintersäsong för att garantera en effektiv användning av maskinen under det kommande året. Det är även betydelsefullt när det gäller garantin på nya maskiner.

Våra servicetekniker byter ut filter och munstycken, rengör brännare och panna samt mäter och reglerar brännarens avgaser vid behov. De kontrollerar slangar, kopplingar och säkerhetsventiler samt genomför en funktionskontroll av hela maskinen.



## **FARA**

Det är speciellt viktigt att slangar och kopplingar är i gott skick. Fel i den värmetransporterande vätskekretsen kan förorsaka allvarliga personskador vid driftstemperatur. Byt ut eller reparera komponenter som skadats eller slitits ut för att eliminera faran.

## **VIKTIGT!**

Töm aldrig cirkulationssystemet på värmetransporterande vätska. Det försämrar korrosionsskyddet. Utblandning eller användning av andra värmetransporterande vätskor kan skada cirkulationspumpen.

# 11. Garantier

## 11.1. Garantivillkor

HW-maskinerna levereras med garanti. I samband med köpet överlämnas maskinens garantivillkår i form av "Försäljningsvillkår för HeatWork".

Garantin gäller för de första 1500 timmarna eller 1 år, beroende på vad som inträffar först.

Maskinens driftstid som det hänvisas till i FÖRSÄLJNINGSVILLKÅREN är maskinens cirkulationstid som anges på instrumentpanelens tidsräknare.

För att garantin ska gälla förutsätts att maskinen används enligt bruksanvisningen. Garantin gäller inte om andra än ursprungliga komponenter eller delar används.

Garantin gäller inte heller vid användning av andra bränslen eller andra än den ursprungliga HW-värmetransporterande vätskan.

Heatwork AS kan kräva dokumentation på att maskinen har underhållits enligt serviceguiden för att garantin ska gälla. Dessutom ska det dokumenteras att certifierade företag eller personer genomfört servicen på pannan och brännaren. Serviceguiden ska därför följas och fyllas ut omsorgsfullt.

Garantin täcker inte heller någon slags användning av släpvagnen till andra ändamål än det den avsetts för.

### **OBSERVERA!**

Detaljerade garantivillkor finns beskrivna i  
FÖRSÄLJNINGSVILLKOR FÖR  
HEATWORK AS.



## 12. Kontroll och underhåll

Periodisk kontroll och underhåll är oerhört viktigt för att maskinen ska fungera felfritt och hålla länge. Nedanför beskrivs de olika serviceåtgärderna. Bifogad till bruksanvisningen finns en serviceguide för loggbokföring och beskrivningar av drifts- och tidsintervaller gällande maskinens service. Brister i serviceintervaller och dokumentation medför bortfall av garanti.

Om både driftstid och tidsintervall uppges, ska man följa den först inträffande intervallen.



Under ALLA underhållsåtgärder SKA systemet vare HELT NEDKYLT och STRÖMTILLFÖRSELN FRÅNKOPPLAD.



ALLA komponenter som uppvisar SKADOR eller BRISTER måste ALLTID bytas ut mot nya originaldelar.

### 12.1. Daglig kontroll

Kontrollera instrumentpanelens indikatorer.

Inspektera bränslenivån och fyll på vid behov. Torrkörning av systemet förorsakar driftsstopp och gör att bränslesystemet måste luftas.

Se till att den värmetransporterande vätskans nivå närmar sig toppen.

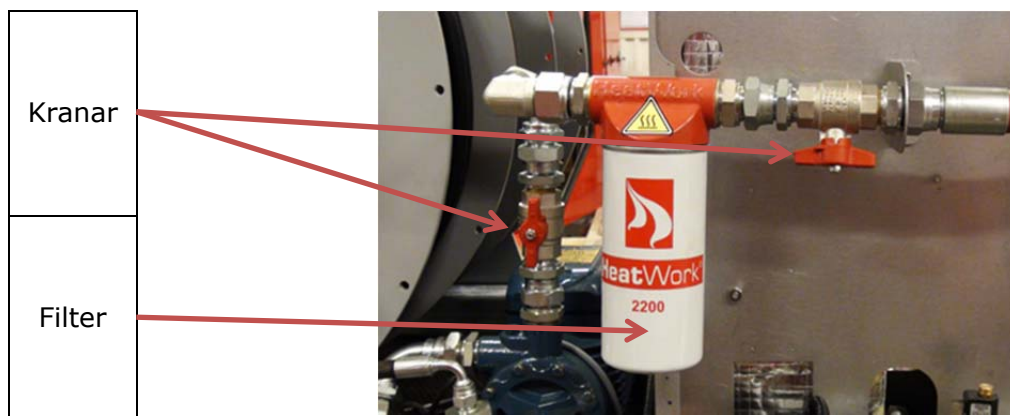
Om vätskans nivå befinner sig på den lägsta möjliga nivån har det antagligen uppstått läckage i värmeslangarna. Kontrollera slangarna och gjut vid behov provisoriskt ihop slangbrott med delar från reservdelsförpackningen. Pumpen stannar automatiskt när vätskenivån sjunker under minimum. Fyll på ny vätska enligt tidigare beskrivna anvisningar.

En del värmetransporterande vätska dunstar bort under maskinens användning. Fyll därför på med värmetransporterande vätska vid behov.

## 12.2. Utbyte av det värmetransporterande vätskesystemets filter

Det slutna vätskesystemet filtreras genom ett cirkulationsfilter på pumpens sug sida. Det skyddar pumpen mot skadliga partiklar. Det är synnerligen viktigt att följa intervallerna för filterutbyte för att säkra maskinens livslängd.

- Så här byter du ut det värmetransporterande vätskesystemets filter: Stäng bägge kranar på båda sidorna om filterhuset.
- Placera ett uppsamlingskärl under filtret i och med att det dräneras ut ca 1 liter vätska efter nedmontering.
- Byt ut filtret.
- Ställ kranarna tillbaka i sina ursprungliga lägen.



## 12.3. Utbyte av dieselfilter för brännare

Dieselfiltret finns ovanför dieseltankens inspektionslock. Filtret filtrerar bränsle till brännaren. Aggregatet har ett eget dieselfilter (se separat bruksanvisning för aggregatet).

För att byta ut filtret skruvar du av filterglaset, kontrollerar O-ringens och monterar ett nytt filterelement på plats. Dieselsystemet måste luftas ut manuellt efter utbyte av filter:

1. Avlägsna brännarens plastlock.
2. Öppna tappens eller skruvens.
3. Starta maskinen – pumpen och brännaren.
4. Tryck in och släpp motståndets nollställningsknapp.
5. Repetera punkt 3 tills brännaren tänds.
6. Skruva fast tappens eller skruvens i punkt 2.
7. Fäst brännarens plastlock, jämför punkt 1.



Brännarens dieselfilter

## 12.4. Aggregatets underhåll

Dieselfiltret finns ovanför dieseltankens inspektionslock. Filtret filtrerar bränsle till aggregatet. Filtret ska bytas ut varje gång man byter olja på aggregatet.

För att byta ut filtret skruvar du av filterglaset, kontrollerar O-ringen och monterar ett nytt filterelementet på plats.

Vätskekylt aggregat: byt ut oljan första gången efter 50 timmar, därefter var 250:e timme.

En serviceintervall på 250 timmar kräver specialolja.

För allt annat underhåll/service: se separat bruksanvisning för servicehandledning. Använd HeatWorks serviceguide för att dokumentera all service. Brister i service och dokumentation angående serviceguiden medför bortfall av garanti.



Aggregatets dieselfilter

## 12.5. Maskinens förvaring

Om maskinen inte ska användas under en längre period lönar det sig att fylla bränsletanken helt och hållet.

## 12.6. Tömning av dieseltank

Använd en lämplig pump för att tömma dieseltanken.

## 12.7. Utbyte av värmetransporterande vätska

Den värmetransporterande vätskan har fyra huvudsakliga uppgifter:

1. Förhindra systemets frysning
2. Höja kokpunkten
3. Smörja pumpen
4. Förhindra korrosion

I och med att den värmetransporterande vätskans kvalitet försämras under användning, måste vätskan kontrolleras med jämna mellanrum och vid behov bytas ut för att undvika maskinfel. Endast ursprunglig HW-värmetransporterande vätska tillråds. Användning av andra slags kylvätskor eller blandningsförhållanden kan förorsaka driftsstörningar eller problem. Garantin gäller inte i så fall.

Följ förfarandet enligt bifogade klistermärke när den värmetransporterande vätskan ska bytas ut.

Deponera den värmetransporterande vätskan som specialavfall på en godkänd avfallsanläggning. Vid påfyllning av ny vätska stäng dräneringskranen nere på pannan och följ påfyllningsanvisningarna.

## 12.8. Brännare

Brännaren behöver service varje 1500 driftstimme (tidsräknaren befinner sig på instrumentpanelen) eller varje år.

Svart avgas är ett tecken på brännarfel. Stanna maskinen och ta kontakt med servicepersonalen.

I slutet av varje säsong lönar det sig att genomföra brännarens service enligt brännarens bruksanvisning, se bilaga.

Brännarens service bör genomföras av certifierade experter.

### **OBSERVERA!**

BRÄNNAREN och PANNAN mister styrka vid bristande underhåll.

## 12.9. Panna

Pannan behöver underhåll samtidigt som brännaren. Pannans underhåll företas enligt pannans bruksanvisning, se bilaga.

**Pannans service bör genomföras av certifierade experter.**



### **VARNING**

ENDAST CERTIFIERADE specialister ska genomföra service på panna och brännare.

## 12.10. Slangar

HW-upptinings slangarna bör rengöras med en trasa i samband med slangarnas inspolning efter upptiningsuppdrag. Arbetshandskar är obligatoriska under inspolningen. HW-slangarna rekommenderas rengjorda på ytan med jämna mellanrum genom att spola dem med varmt vatten.

HeatWork rekommenderar å det varmaste utbyte av slangar vart tredje år av säkerhetsmässiga orsaker i och med att upptinings slangarna innehåller het vätska under tryck. Utslitna slangar utgör en risk för allvarliga brännskador vid slangbrott.

Vid läckage eller slangbrott stannar cirkulationspumpen ögonblickligen. Skär av slangen på båda sidorna av skadan/brottet och montera den provisoriska reparationskopplingen som finns i reservdelspåsen. Reparationskopplingen ligger i släpvagnens aggregatutrymme. Omedelbart efter avslutat upptiningsuppdrag bör slangen sammanfogas permanent med den medföljande presskopplingen från reparationsförpackningen. Maskinen ska inte användas innan den skadade slangen har reparerats enligt anvisningarna eller bytts ut. Fyll på värmetransporterande vätska enligt tidigare beskrivna anvisningar.

**Inspektera alltid slangarna för att upptäcka eventuella skador under inspolningen.**



### **FARA**

Skadade slangar måste ALLTID bytas ut eller repareras omedelbart.

# 13. Tekniska data

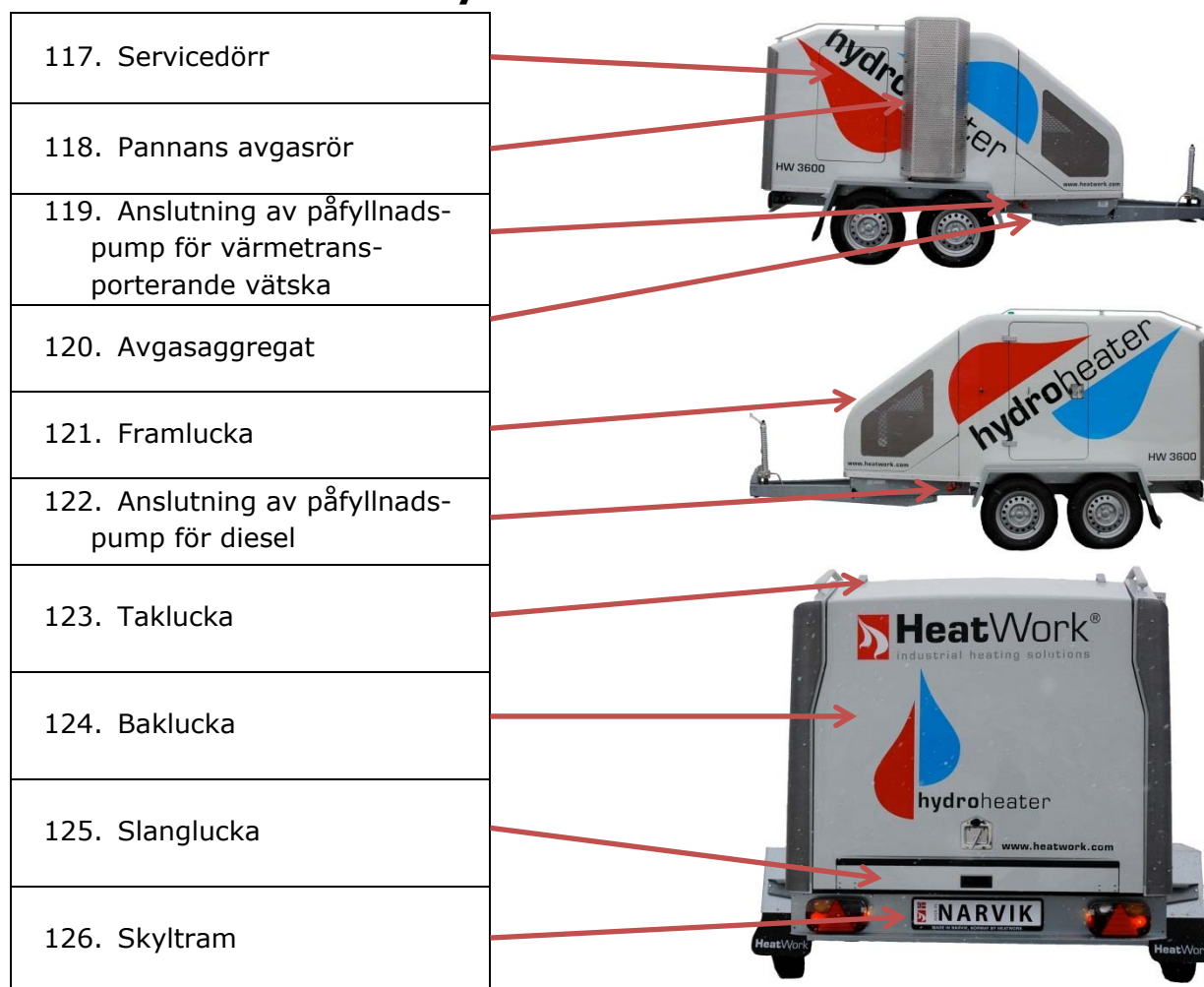
## 13.1. Tekniska specifikationer

Tekniska specifikationer	HW 1800-350	HW 1800	HW3600	HW 6000	Enhet
Overall size trailer	448 x 195 x 183	448 x 195 x 183	448 x 195 x 183	448 x 195 x 183	cm
Weight without fuel and generator / total weight trailer	1323/1693	1470/1840	1490/1860	1800/2200	kg
Overall size container			155 x 220 x 147	154 x 220 x 145	cm
Total weight container (No fuel)			1900	2200	kg
Hose	350 (1 x 350)	630 (2 x 315)	630 (3 x 210)	630 (3 x 210)	m
Heat transfer fluid (HTF) capacity	176,5	226	226	226	l
Generator weight	No generator	130/180	130/180	130/180	kg
Fuel requirements	Winter blend	Winter blend	Winter blend	Winter blend	
Fuel tank capacity	325	325	325	325	l
Fuel consumption at full load with / without generator	7,0	7,0 / 8,3	9,0 / 10,2	10,5 / 11,8	l/h
Pump capacity	2100	2100	1 x 3900	6000 (2 x 3000)	l/h
Run time with internal tank at average consumption 3,5l/h	91	91	91	91	h
Hose pressure	0-6	0-6	0-6	0-6	bar
Thaw capacity standard	100	200	200	200	m <sup>2</sup>
Thaw capacity with accessories	100	400	600	800	m <sup>2</sup>
Cure capacity standard	200	400	400	400	m <sup>2</sup>
Cure capacity with accessories	200	800	1200	1600	m <sup>2</sup>
Normal operating temperature	90	90	100	100	°C
Trailer axle rating	1000	1000	1300	1300	kg
Wheel code	4,5 JX 13 H2	4,5 JX 13 H2	4,5 JX 13 H2	4,5 JX 13 H2	
Trailer tongue weight maximum	100	100	100	100	kg
Tire code	155/80 R13 84N	155/80 R13 84N	155/80 R13 84N	155 R13 91/89N	
Tire rating	500	500	500	580 (D)	kg
Tire pressure	44/300	44/300	44/300	65/450	Psi/kPa
Heat boiler	70	70	103	105	kWh
Number of heatcourses	1	2	3	3	st
Individual flow and returntemp. indication	-	-	3	3	st
1" outlets for external heating equipment	-	1	1	1	st
5/8" outlets for external heating equipment	1	2	3	3	st
Semi-automatic internal refuel-pump	-	X	X	X	
GSM-process monitoring	-	X	X	X	

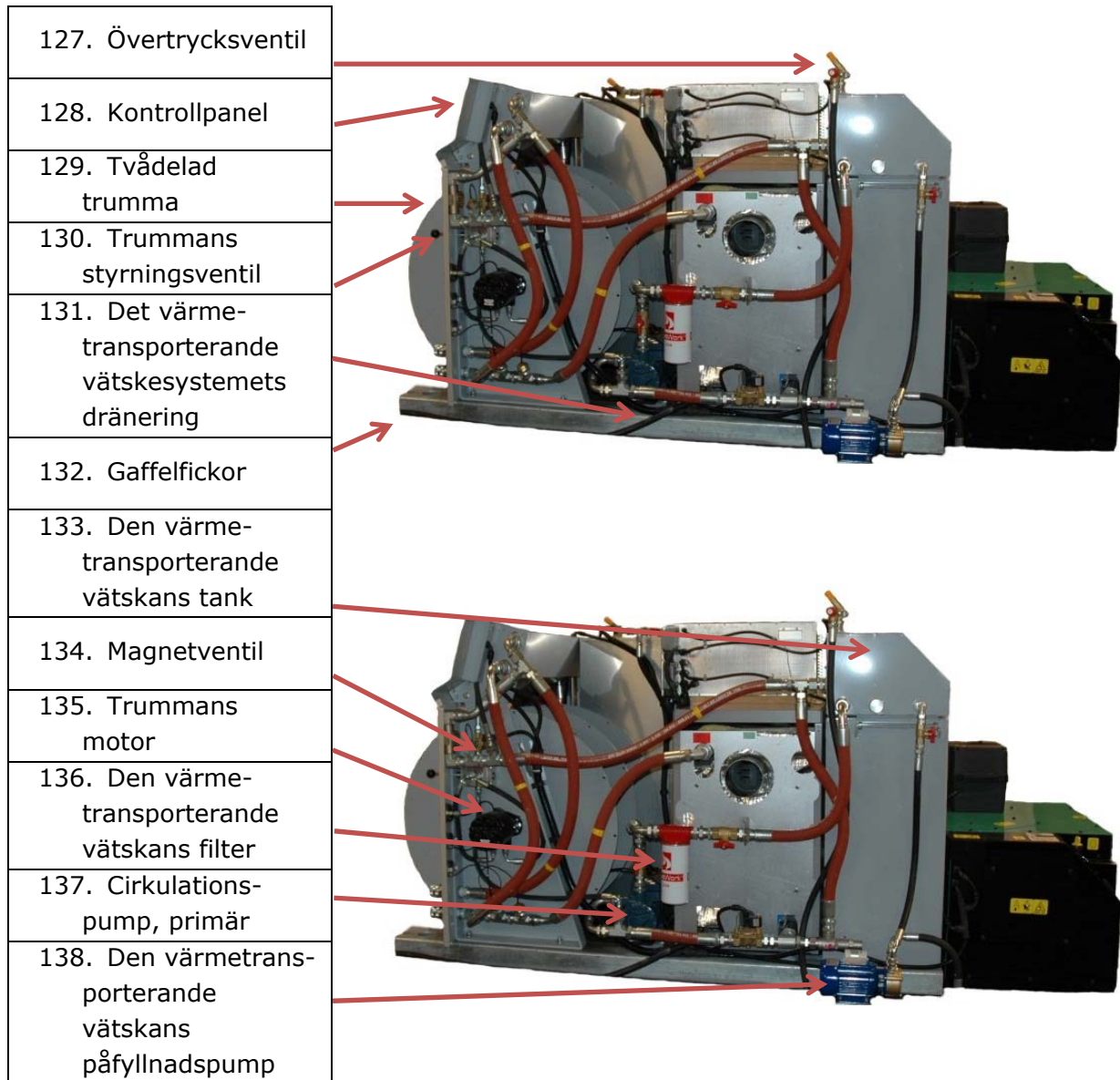
# 14. HydroHeater

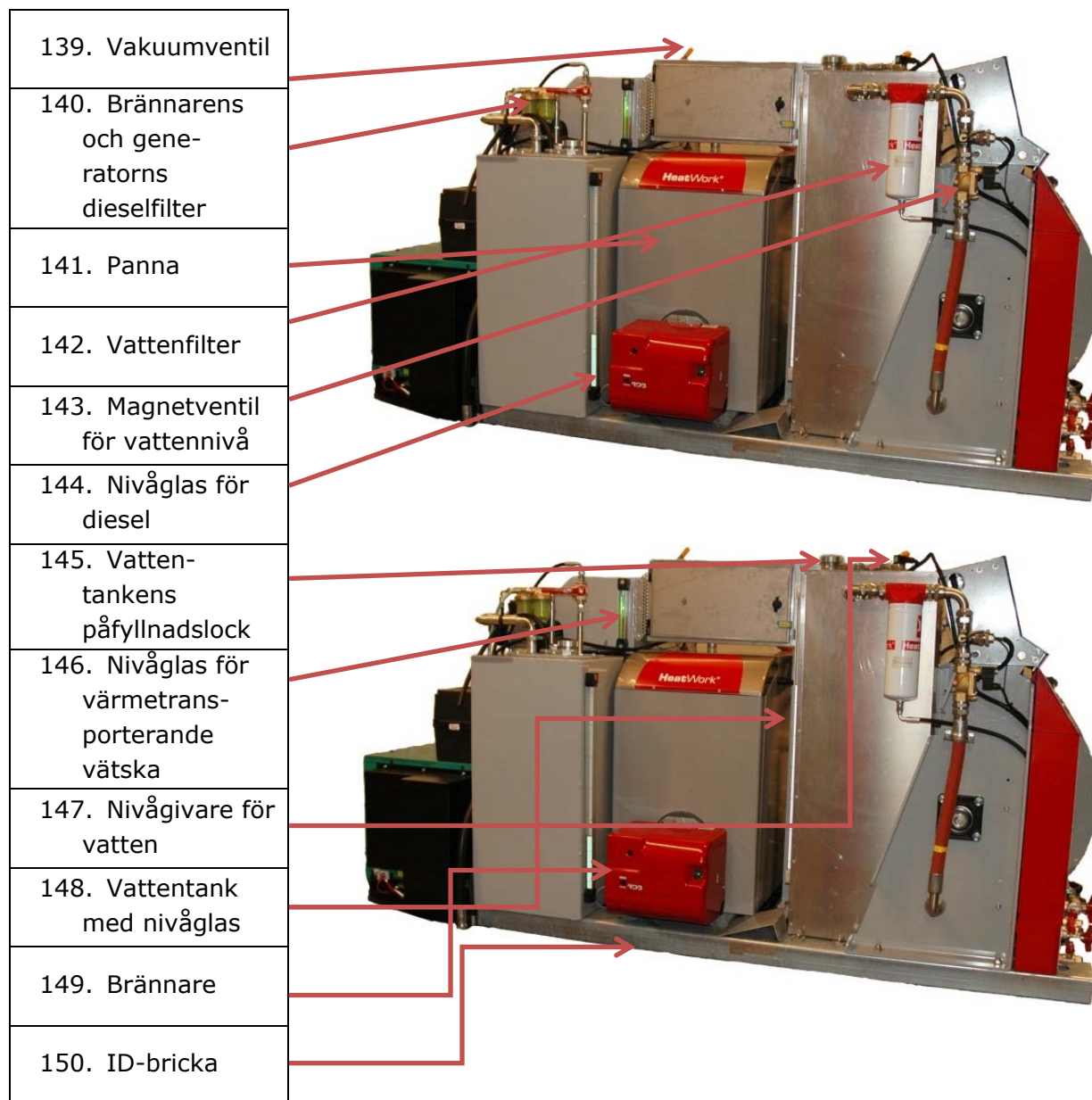
Det här kapitlet handlar om specifika funktioner som gäller endast HydroHeater. Kapitlen 1–13 omfattar de funktioner som är gemensamma för alla HeatWork-maskiner (primärsidan i HydroHeater).

## 14.1. Överblick av HydroHeater

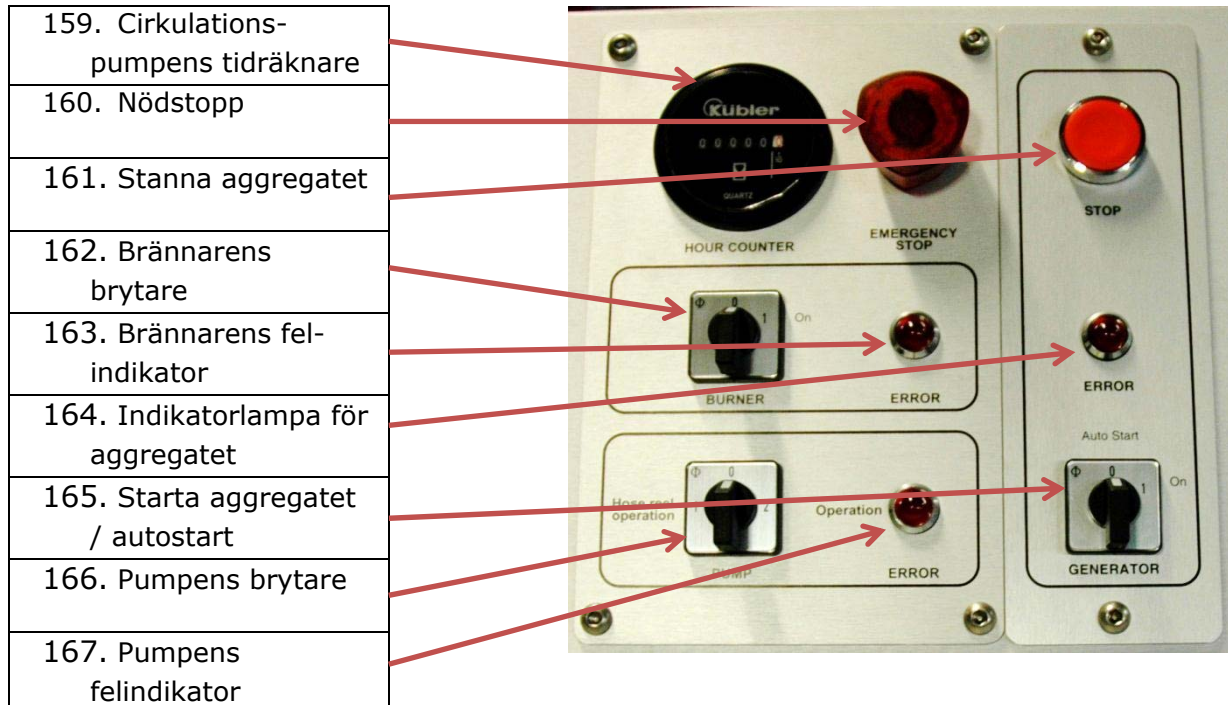
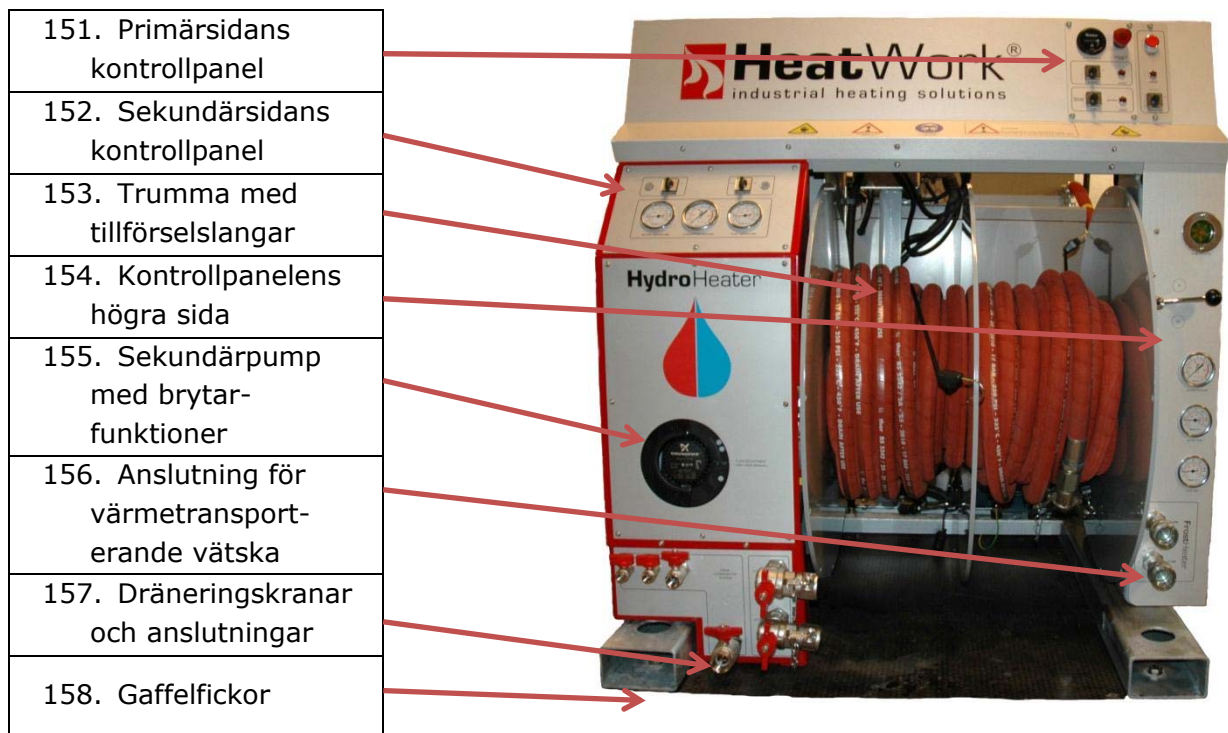




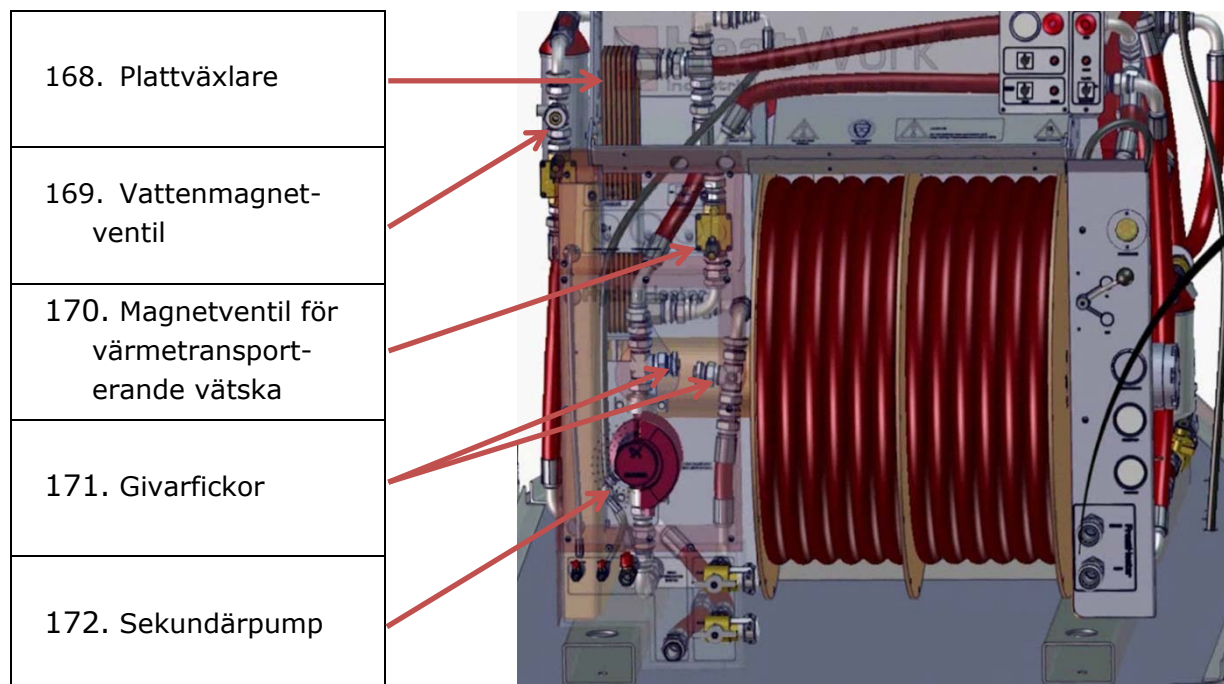




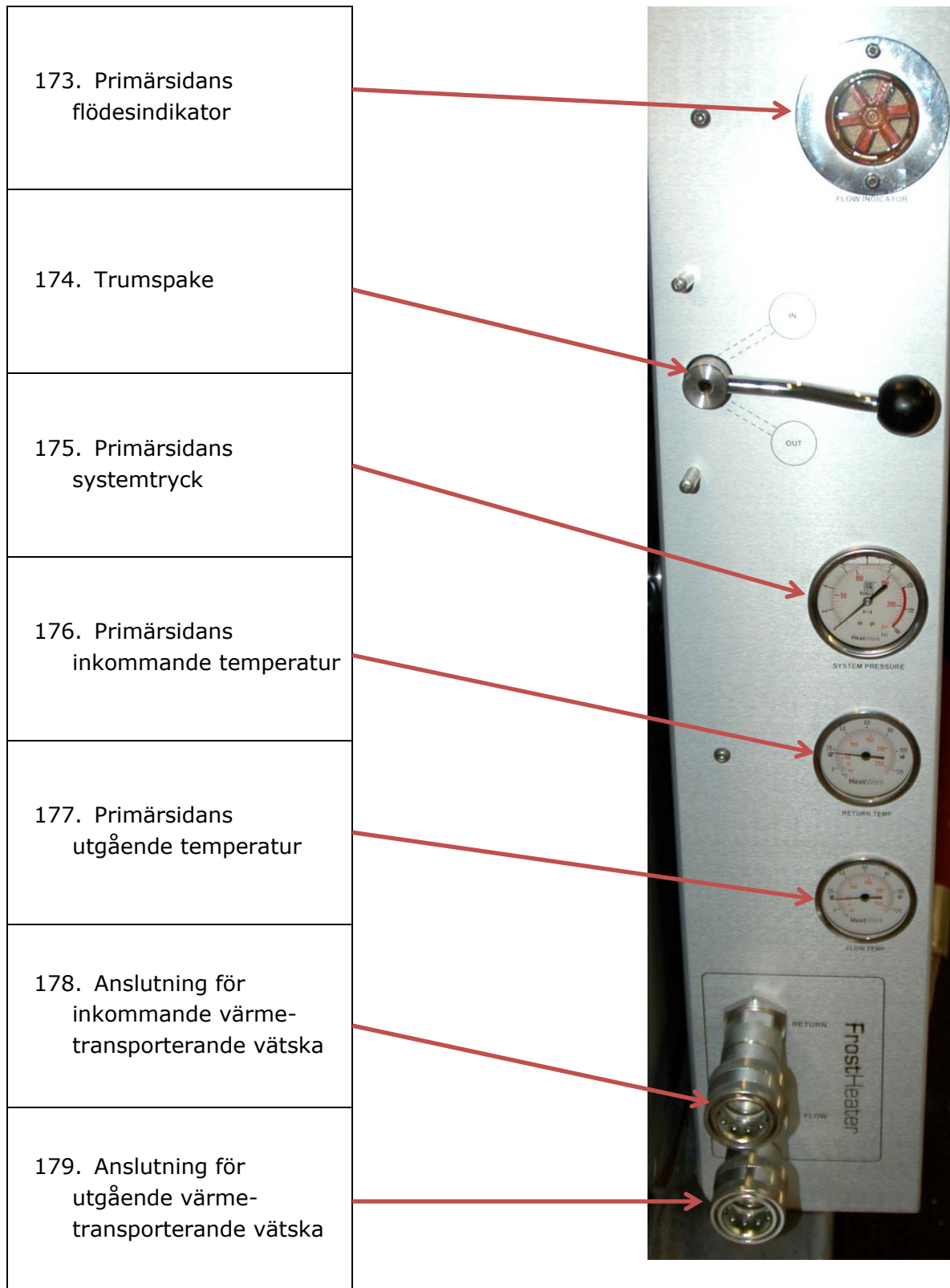
## 14.2. Överblick av kontrollpanelen på HydroHeater



### Invändig sekundärsida



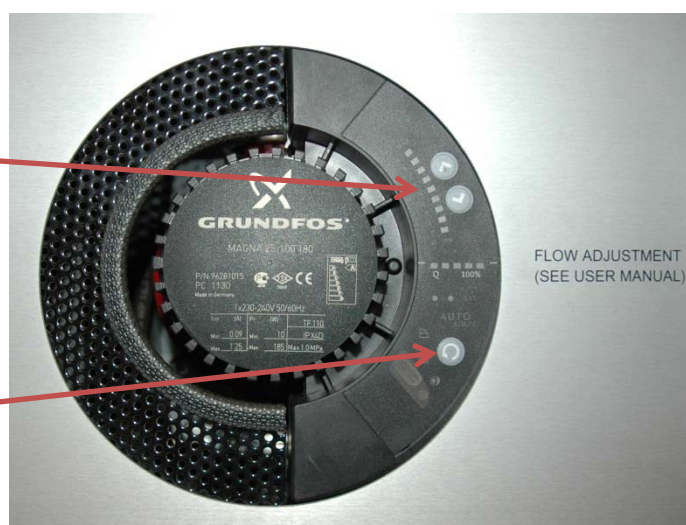




- 180. Vattennivåbrytare
- 181. Sekundärpumpens huvudbrytare
- 182. Vattnets inkommande temperatur
- 183. Sekundärsidans systemtryck
- 184. Sekundärsidans utgående temperatur



- 185. Tryck/mängd upp/ned
- 186. På/av-brytare



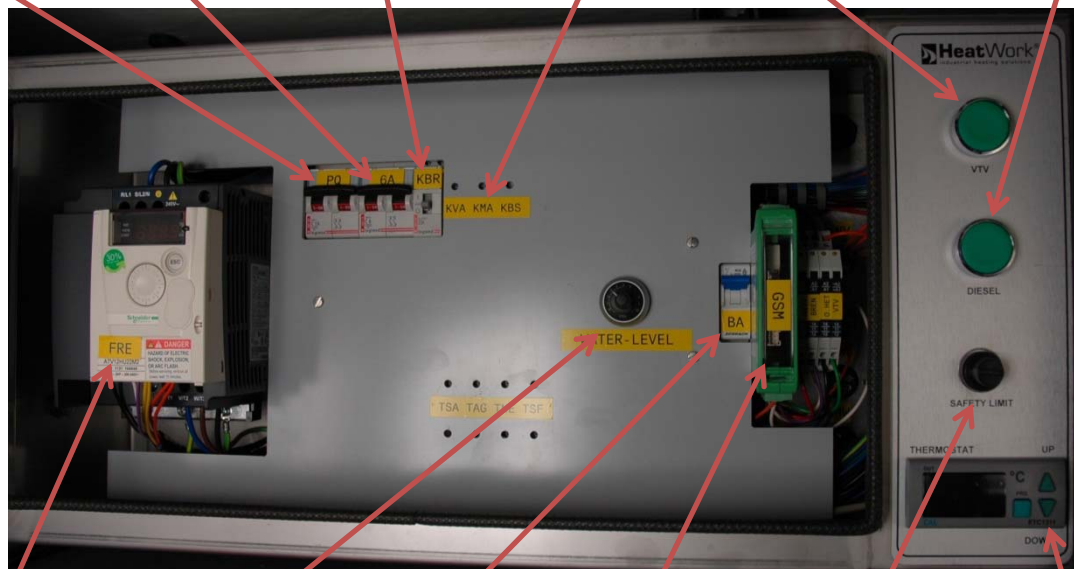
- 187. Töm filter (frostskydd)
- 188. Töm pump (frostskydd)
- 189. Luft ut/in
- 190. Sekundärsidans utgående (vatten)
- 191. Sekundärsidans inkommande (vatten)
- 192. Töm tank (frostskydd)





### 14.3. Elskåp

193. Pumpens säkring (16 A)	194. Säkring för förbrukare (6 A)	195. Kontaktor för brännare	196. Varningslampa	197. Påfyllningspump för värmetransporterande vätska	198. Påfyllnadspump för diesel
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199. Pumpens frekvensomformare	200. Waterlevel pot. meter	201. Batteri (4 A) DC	202. GSM-sändare	203. Överhettningsskydd	204. Temperaturreglering
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## 14.4. HydroHeaters användningsområden

HydroHeater är en mobil enhet på 103 kW som levererar varmt vatten på upp till 100 grader Celcius.

### Fjärrvärme och uppvärmning av vatten

Användningsområdena är talrika och maskinen har konstruerats för uppvärmning av vatten i ett slutet system eller vid behov av varmt konsumtionsvatten.

#### Fjärrvärme och uppvärmning av vatten

- ✓ För provisorisk leverans av energi vid byggen där tillförseln av fjärrvärme måste stängas av vid driftstopp eller underhåll.
- ✓ Värmeläggning av fjärrvärmerör.
- ✓ Drift av golvvärme t.ex. under byggnadsfasen innan man upprättar en varaktig energikälla.
- ✓ Drift av radiatorer och värmebläktar.
- ✓ Produktion av varmt vatten till konsumtion eller förbrukning.
  - Matlagning
  - Dusch
  - Desinfektion.

### Tjälttining och uppvärmning

HydroHeater kan även användas till tjälttining och uppvärmning genom att ansluta den till en extra trumma.

Två slangkretsar (med en extra trumma) ger en mycket flexibel användning och optimerar upptiningsprocessen.

Maskinen har stor kapacitet för upptining av tjäle på stora områden, i kabeldiken och på golvytor samt uppvärmning av byggen, hallar etc. genom anslutning av tilläggsutrustning.

En pump på 3900 l/h och 100 °C i slangarna ger en snabb och miljövänlig upptining.

## 14.5. Specifika säkerhetsanvisningar, HW HydroHeater

Under användning kommer primärsidan (den värmetransporterande vätskan) att nå en temperatur på upp till 115 °C. Sekundärsidan (vattensidan) kommer att nå en temperatur på upp till 99 °C. Höga temperaturer på komponenter, slangar och vätska kan förorsaka brännskador/skållning efter kontakt, vilket är speciellt betydelsefullt vid produktion av konsumtionsvatten och frångkoppling av tillförselslangar. Rekommenderad driftstemperatur vid frångkoppling är under 40 °C.

### Personlig skyddsutrustning

Under drift kan den värmetransporterande vätskans temperatur stiga upp till 115 °C. När det arbetas med apparater som når en så pass hög temperatur är det viktigt att användaren vidtar lämpliga åtgärder med tanke på personlig skyddsutrustning. Användaren tillråds alltid använda arbetskläder som har godkänts för arbete i stark värme, vattentäta arbetsshandskar, skyddssko och arbetshjälm under arbetsuppdrag med HW-maskiner i tillägg till de obligatoriska skyddsglasögonen.



**Obligatoriska  
skyddsglasögon**



**Het vätska under tryck**

Användaren uppmanas medha en förbandslåda och ögonbad i dragfordonet/arbetsbilen eller på något annat varmt ställe i närheten av maskinen. De bör av naturliga orsaker förvaras på ett frostfritt och lätt tillgängligt ställe. Se bilagan för HMS datablad för HW:s värmetransporterande vätska.

## 14.6. Transportering av HydroHeater

Se standardprocedur för transport (kapitel 6). Dessutom bör HydroHeater dräneras och frostskyddas efter avslutad användning och innan transport i kallt klimat.

## 14.7. Förfarande

### Start

Parkera maskinen så nära tillkopplingsstället som möjligt.  
 Längden på maskinens tillförselslang är 25 meter.  
 Koppla till nätström eller slå på autostart/aggreat.  
 Nätströmmen bör ha en säkring på 16 A.

### Förvärmning av primärsida (värmetransporterande vätska)

Vrid Main Switch (fig. 3.5) till 1 (Drain).  
 Ställ Pump (fig. 1.5) på 2 (Operation), kontrollera flödet i Flow Indicator (fig. 2.3).  
 Välj temperatur 40–50 °C på den digitala displayen (elskåpet), ställ Burner (fig 1.3) på 1 (On).  
 Låt maskinen gå i 10–15 min.

### Drift

Lossa slangarna och dra dem ut manuellt eller motoriserat.  
 Vid motoriserad drift, ställ Pump (fig. 1.5) på 1 (HOSE REEL OPERATION).  
 Hastigheten regleras med hjälp av spakarna.

Slangarna kopplas till Flow- (fig. 5.5) och Return- (fig. 5.6) kranarna på Hydro-sidan (camlock) och därefter till uppvärmningsstället.

Stäng kranarna, Drain Filter (fig. 5.1), Drain Tank (fig. 5.4) och Drain Pump (fig. 5.2).

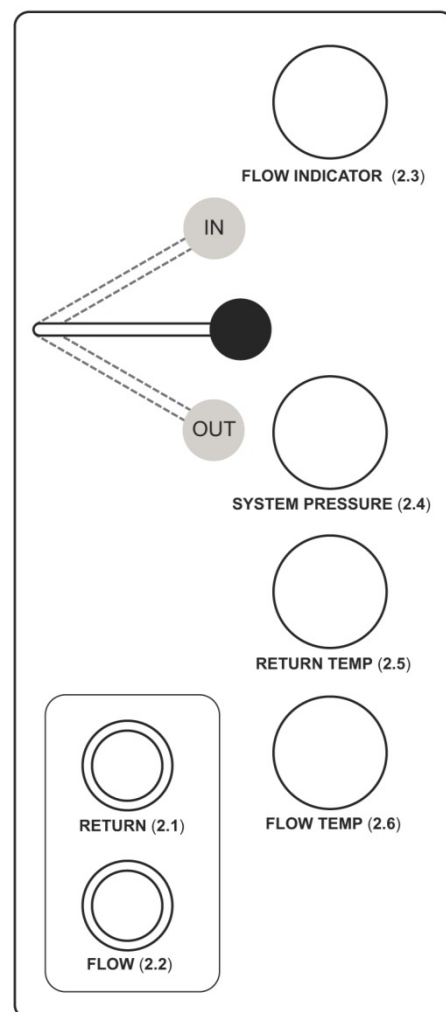
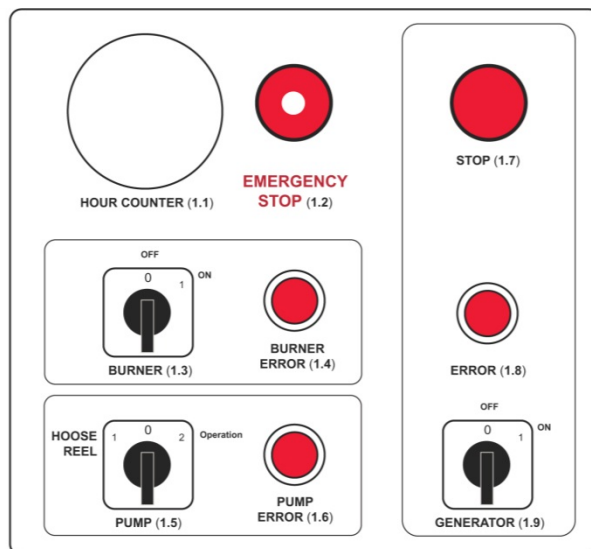
Öppna Bleed System (fig. 5.3), Flow- (fig. 5.5) och Return- (fig. 5.6) kranarna.

Fyll upp maskinen med vatten från Return- (fig. 5.6) kranen. Alternativt kan maskinen fyllas genom påfyllningslocket på vattentanken via takluckan.

Vattennivån kontrollerar du på vattentankens nivåmätare när maskinen fylls via Return- (fig. 5.6) kranen. I så fall kan du använda dig av Waterlevel- (fig. 3.1) funktionen och ställa brytaren på 1 (ON).

När vatten kommer ut ur Bleed System (fig. 5.3) eller önskad vattenmängd har uppnåtts, stängs det av.

Öppna Flow-kranen (fig. 5.5) samt kontrollera vattennivå och tillkopplingar.



## Vattencirkulation i slutna krets

Ställ Main Switch på 2 (ON) (fig. 3.5).

Waterlevel-brytaren ska stå på 0 (OFF) (fig. 3.1).

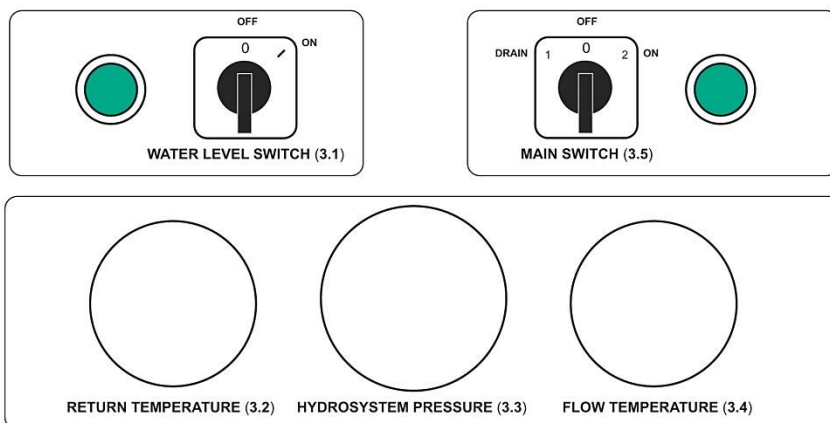
Ställ Pump-brytaren på 2 (OPERATION) (fig. 1.5).

Kontrollera att den värmetransporterande vätskan cirkulerar i Flow Indicator (fig. 2.3).

Ställ Burner-brytaren på 1 (ON) (fig. 1.3), vänta tills brännaren startar.

Välj önskad temperatur på pannan på den digitala displayen (elskåpet).

Sekundärsidans mängd och tryck väljer du via Flow Adjustment (fig. 4.1).



## Produktion av konsumtionsvatten



Ifall maskinen används i annat syfte än för produktion av konsumtionsvatten, bör systemet rengöras och decinficeras före användning.

Koppla det inkommande vattnet till Return- (fig. 5.6) kranen.

Ställ Waterlevel (fig. 3.1) på 1 (ON).

För att justera tiden mellan inslag och utslag på vattennivåns ventil använder du "Water-Level" inne i elskåpet.

Den önskade vattentemperaturen reglerar du på pannans digitala display och med Flow Adjustment (fig. 4.1) -pilen upp/ned.

För att avsluta produktionen av vatten ställer du Main Switch (fig. 3.5) på 1 (DRAIN).



Den sekundära vattencirkulationen bör aldrig avbrytas när man kör höga temperaturer. Risk för tryck i systemet!



Sänk systemtemperaturen till 40 °C innan du stannar maskinen och kopplar ifrån slangarna.

## Nedriggning och frostskydd

Ställ Burner på 0 (OFF) (fig. 1.3).

Låt pumparna gå tills temperaturen är ca. 40 °C.

Ställ Main Switch på 1 (DRAIN) (fig. 3.5).

Stäng kranarna Flow (fig. 5.5) och Return (fig. 5.6).

Koppla ifrån tillförselslangar (**OBS: hett vatten**).

Öppna Bleed System (fig. 5.3), Drain Tank (fig. 5.4), Flow (fig. 5.5), Return (fig. 5.6), Drain Filter (fig. 5.1) och Drain Pump (fig. 5.2).

Låt maskinen dräneras på vatten och låt kranarna stå öppna (**frysrisk**).

Efter dränering ställer du Burner på 1 (ON) (fig. 1.3), och pannan på 40 °C.

Låt den värmetransporterande vätskan cirkulera i 5–10 minuter. Det torkar upp kvarvarande rester av vatten i systemet och frostskyddar maskinen.

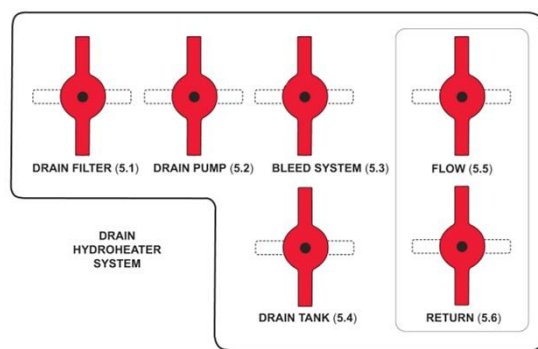
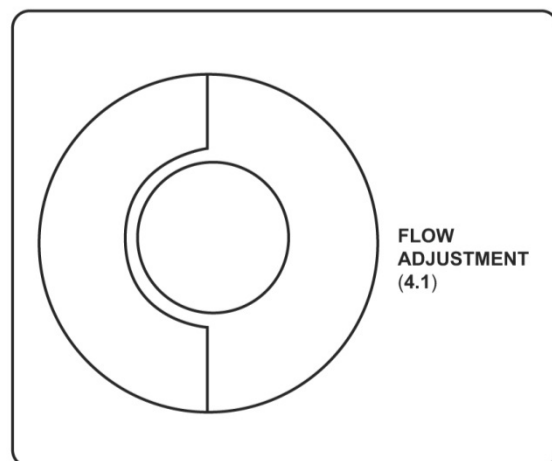
Ställ Burner på 0 (OFF) (fig. 1.3) och Main Switch på 0 (OFF) (fig. 3.5).

Ställ Pump- (fig. 1.5) brytaren på 1 (HOSE REEL OPERATION).

Töm vattnet ur tillförselslangarna vid inspolning.

Rengöring av slangar i samband inspolning rekommenderas.

Slangändarna fästs på trummans sida med hjälp av gummisnoddar.





## 14.8. Indikatorer och felmeddelanden

### Varningslampa för Main Switch på sekundärpumpen

Om Main Switch-indikatorlampan lyser grönt är maskinen i normal drift.

Om indikatorlampan lyser rött står Main Switch i Drain-läge.

### Varningslampa för Water Level Switch på sekundärpumpen

Om indikatorlampan lyser grönt är brytaren på och magnetventilen för vattennivån i tanken har aktiverats.

### Varningslampa för sekundärpumpen

För indikatorer och varningslampor på sekundärpumpen, se separat bilaga för sekundärpumpen.

### Felsökning i HydroHeater

Fel	Möjliga orsaker	Korrigering
Ingen cirkulation i sekundärkretsen (sluten krets)	<ol style="list-style-type: none"> <li>1. Tätt vattenfilter.</li> <li>2. För mycket vatten i vattentanken og Waterlevel-brytaren står på (ON).</li> <li>3. Sekundärpumpen fungerar inte.</li> </ol>	<ol style="list-style-type: none"> <li>1. Byt ut vattenfiltret.</li> <li>2. Ställ Waterlevel-brytaren i (OFF)-läge.</li> <li>3. Kontrollera sekundärpumpens varningslampor och undersök om det finns spänning på pumpen. Kontrollera pumpinställningar.</li> </ol>
Ingen cirkulation i primärkretsen (Flowmeter rör inte på sig)	<ol style="list-style-type: none"> <li>1. Main Switch står på (OFF).</li> <li>2. Skadad magnetventil för värmetransporterande vätska.</li> </ol>	<ol style="list-style-type: none"> <li>1. Main Switch ställs i (DRAIN) eller (ON)-läge.</li> <li>2. Avmontera locket ovanför sekundärpumpen och kontrollera magnetventilen för den värmetransporterande vätskan. Mät spänningen och spolen. Byt ut ventilen ifall den är trasig.</li> </ol>
Dålig cirkulation i sekundärkretsen	<ol style="list-style-type: none"> <li>1. Smutsigt vattenfilter.</li> </ol>	<ol style="list-style-type: none"> <li>1. Byt ut vattenfiltret.</li> </ol>
Vattenmagnetventilen "klappar" och/eller kopplar för ofta in och ut vid produktion av konsumtionsvatten	<ol style="list-style-type: none"> <li>1. Felaktig tidsinställning på Waterlevel pot. meter.</li> <li>2. Fel på vattentankens givare.</li> </ol>	<ol style="list-style-type: none"> <li>1. Justera Waterlevel inne i elskåpet.</li> <li>2. Kontrollera vattentankens givare högst uppe på vattentanken.</li> </ol>
Start i temperaturer under 0 °C: sekundärpumpen startar inte och magnetventilen öppnas inte (ingen cirkulation)	<ol style="list-style-type: none"> <li>1. Frusen vattenhinna inne i sekundärkretsen.</li> </ol>	<ol style="list-style-type: none"> <li>1. Kör startförfarandet för aggregatdrift. Starta aggregatet og primärpumpen. Ställ pannan på ca 50 °C och ställ Main Switch på (DRAIN). Stäng alla luckor och låt maskinen arbeta i ca 15 min. Starta sekundärkretsen.</li> </ol>
Det kokar i vattentanken och tryckventilen i vattentanken löser ut	<ol style="list-style-type: none"> <li>1. Termostaten på primärkretsen ställt för högt (digital termostat).</li> </ol>	<ol style="list-style-type: none"> <li>1. Sänk pannans temperatur. Kör gärna med vattentankens påfyllningslock öppet.</li> </ol>

## 14.9. Kontroll och underhåll

### Utbyte av filter på sekundärsidan

På vattensidan finns filtret på den utgående sidan av tanken och på pumpens sugsida. Det filtrerar vattnet innan det förs in i tanken och genom pumpen. Filtret bör undersökas och bytas ut efter behov.

- Maskinen måste kylas ned till under 40 °C.
- Sekundärpumpen bör stannas.
- Öppna "Drain filter"-kranen.
- Avmontera dräneringsslangen på filtrets botten.
- Lossa filtret genom att skruva det ut.
- Byt ut filtret.

### Maskinens förvaring

Vid förvaring av maskinen ska alla kranar vara öppna och vattentankens lock ska sitta löst.

Se till att alla tillförselslangar har tömts på vatten.

Om sekundärkretsen är nedsmutsad måste systemet spolas före förvaring.



## 14.10. Tekniska data

Tekniska specifikationer	HydroHeater
Pumpkapacitet	3900 l/h på primärsidan Se varmvattenkapacitet för sekundärsidan
Antal pumpar	1 st på primärsidan 1 st på sekundärsidan
Systemtryck	2–6 bar på primärsidan 0–1,5 bar på sekundärsidan
Maximal värmeeffekt	103 kW
Typ av brännare	1-steps
Eldningsteknisk verkningsgrad	94 % – dokumenterat industrins högsta
Vätsketemperatur	Reglerbar 0–100 °C (utgående temperatur) – på primärsidan
Bränsleförbrukning	Max 10 liter/timme vid konstant brännardrift
Diesel	Vinterdiesel, arktisk klass 2
Kapacitet	320 liters dieseltank 100 liters vattentank
Värmetransporterande vätska	HW-värmetransporterande vätska
Den värmetransporterande vätskans tankvolym	50 liter
Antal slangkretsar	2 x 25 m
Elektrisk anslutning / energiförbrukning	230 V–2600 W
Anslutning till extern dieseltank	Inkluderad
Serviceöppningar	4 dörrar för lättare serviceåtkomst
<b>Tilläggsutrustning för montering</b>	
• GSM-kontrollövervakning	Inkluderad
• GPS-positionering	Inkluderad
• Aggregat, ljudisolerat	4,8 kW, vätskekyld 2-cylindersmotor med autostart vid bortfall av nätström

### Maskinens kapacitet, mätt mot flöde och temperatur vid lyfthöjd på sekundärsidan

Inkommande temperatur	Utgående temperatur	Liter/timme
0 °C	12 °C	6000
0 °C	30 °C	2589
0 °C	60 °C	1361
0 °C	95 °C	861
20 °C	37 °C	4500
20 °C	60 °C	1950
20 °C	100 °C	1084

# 15. Bilagor

## 15.1. Elschema

HW Autostart System

HW Boiler System

HW Fluid System

## 15.2. HMS Datablad för värmetransporterande vätska

HMS Datablad VTV-Væske, på Svenska

## 15.3. Bruksanvisning, brännare: Riello DB4

Usermanual, Burner: Riello DB4, på engelska

## 15.4. Bruksanvisning, panna: Atlas 95

Usermanual, Boiler: Atlas 95, på engelska

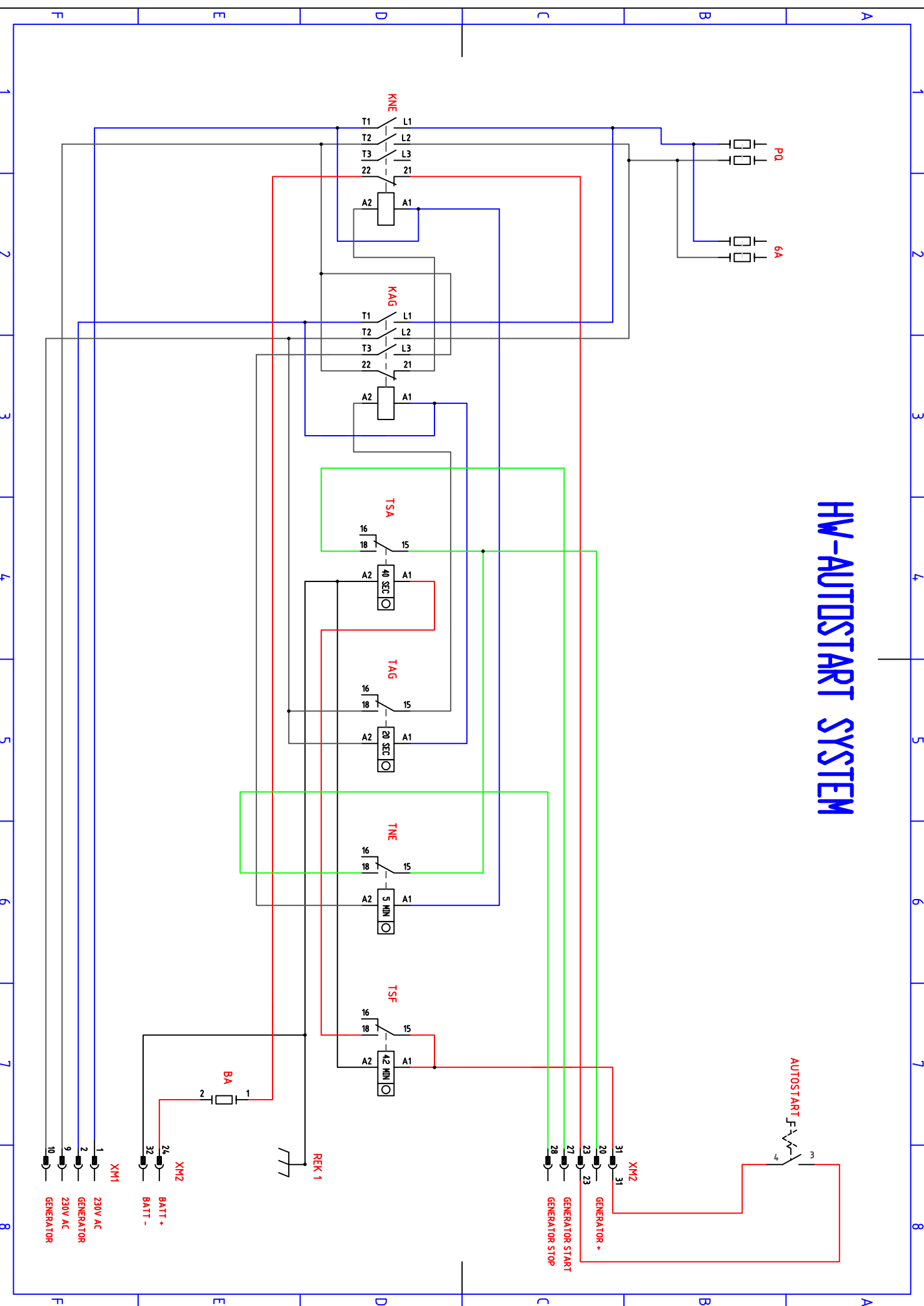
## 15.5. Bruksanvisning, aggregator: Cummins Onan

Usermanual, gen-set: Cummins Onan HDKBB, på engelska

## 15.6. Bruksanvisning, pump: Grundfos Magna 25-100

Usermanual, Pump: Grundfos Magna 25 -100, på engelska

# HW-AUTOSTART SYSTEM



P0  
6A

KME

KAG

TSA

TAG

TNE

TSF

BA

REK 1

AUTOSTART

GENERATOR +

GENERATOR START  
GENERATOR STOP

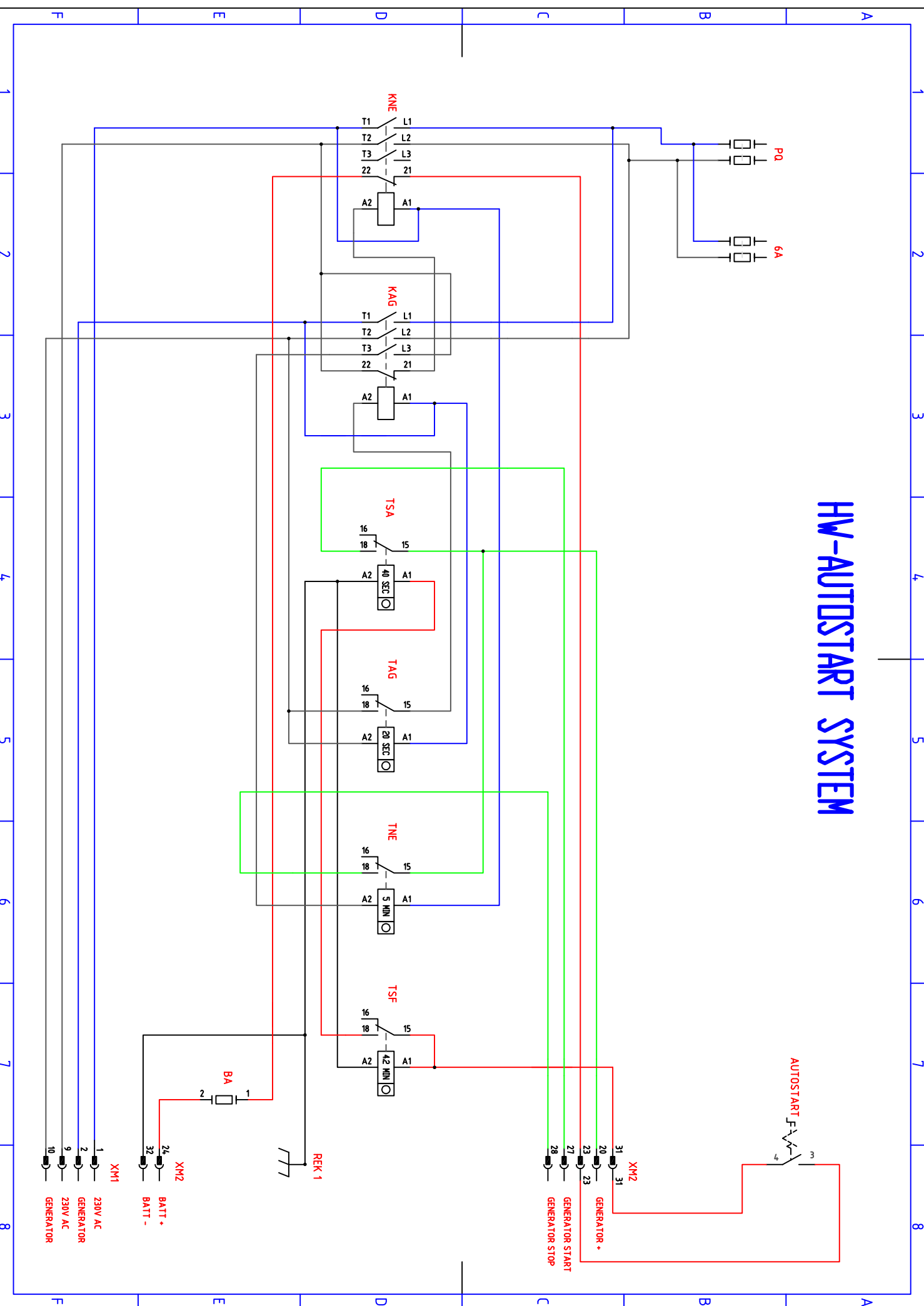
XM1

XM2

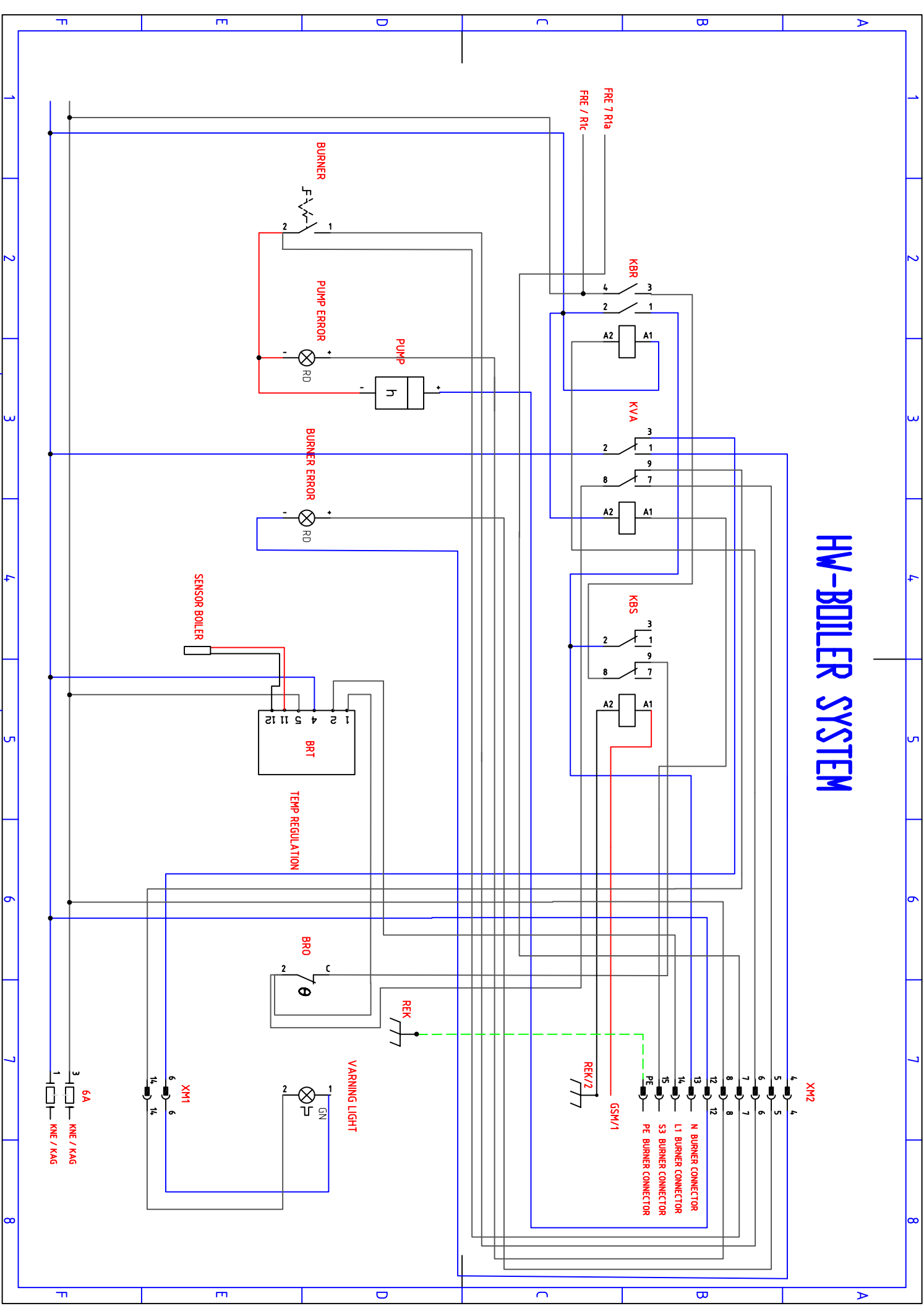
BATT +  
BATT -

230V AC  
GENERATOR

230V AC  
GENERATOR

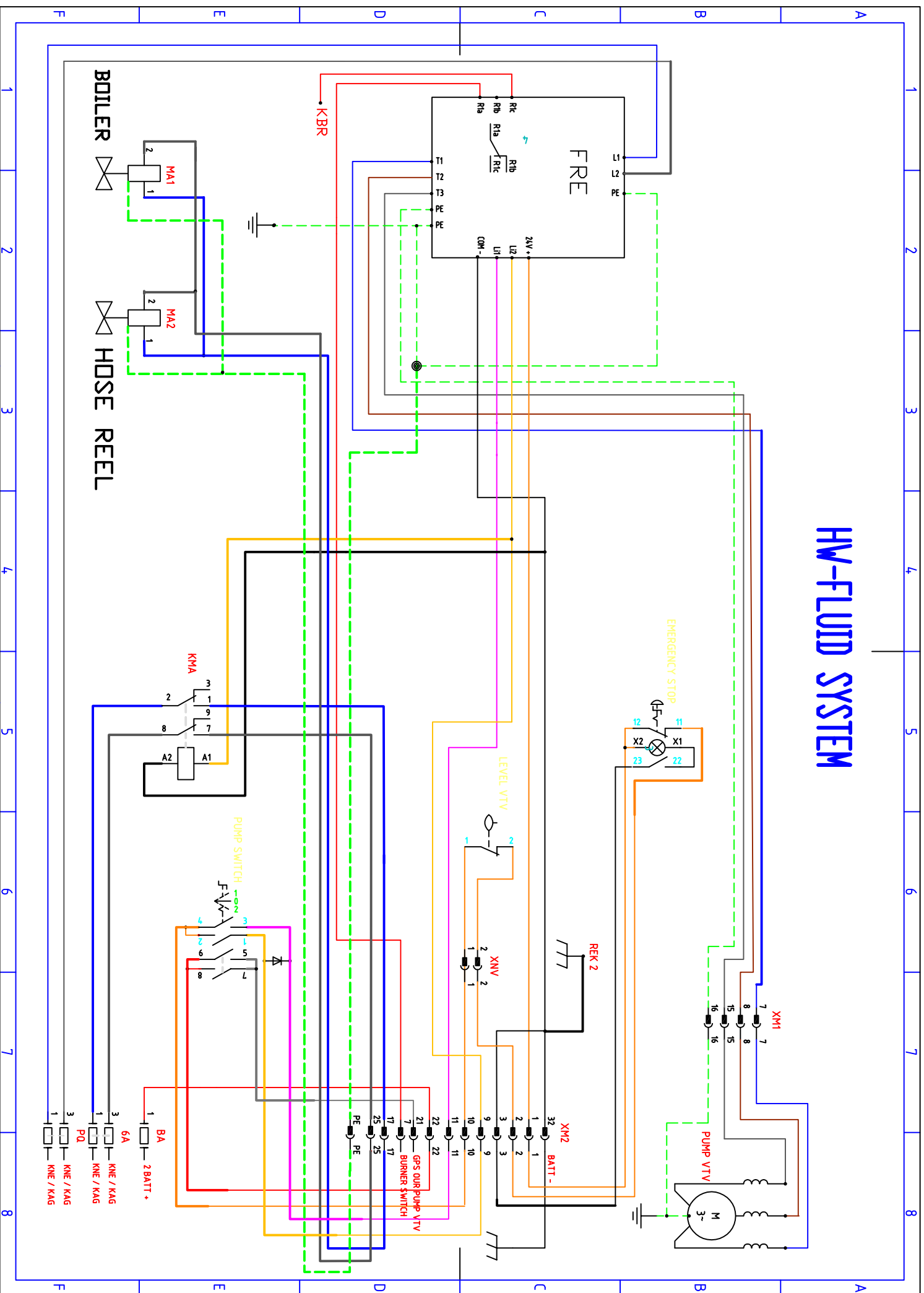


# HW-BOILER SYSTEM





# HW-FLUID SYSTEM



# SÄKERHETS DATABLAD

Enligt 453/2010 och 1272/2008

(Alla hänvisningar till EU-förordningar och direktiv är förkortade till endast nummerbeteckningen)

Utgivningsdag 03.02.2012



## AVSNITT 1: NAMNET PÅ ÄMNET/BLANDNINGEN OCH BOLAGET/FÖRETAGET

### 1.1 Produktbeteckning

Handelsnamn: VTV-væske

1.2 Relevanta identifierade användningar av ämnet eller blandningen och användningar som det avråds från

Identifierade användningar: Frostskyddsvätska

Användningar som avrådes från:

### TILLVERKARE/IMPORTÖR

Företag	HeatWork AS
Adress	Postboks 113
Postnummer/ort	8501 Narvik
Land	Norge
Telefon	+47 769 658 90

### 1.3 Närmare upplysningar om den som tillhandahåller säkerhetsdatablad

TILLVERKARE I EU/EES, IMPORTÖR TILL EU/EES

Företag	Arom-dekor kemi AB
Adress	Marknadsvägen 10 SE-51994 BJÖRKETORP
Telefon	+46 320 605 00
E-post	<a href="mailto:info@aromdekor.se">info@aromdekor.se</a>

### 1.4 Telefonnummer för nödsituationer

I nödläge kontakta giftinformationscentralen, larmnr 112. Giftinformationscentralen (Sverige) icke-akut:  
Tel 08-33 12 31; <http://www.giftinformationscentralen.se>.

## AVSNITT 2: FARLIGA EGENSKAPER

### 2.1 Klassificering av ämnet eller blandningen

#### Klassificering enligt 1272/2008

Produkten är inte klassificerad som farlig vid bedömning enligt 1272/2008.

#### Klassificering enligt 1999/45/EG

Denna produkt har bedömts och ska ej åsättas R-fras eller därmed jämställd fara.

### 2.2 Märkningsuppgifter

#### Märkningsuppgifter enligt 1272/2008

Faropiktogram Ej tillämpligt

Signalord Ej tillämpligt

Faroangivelser Ej tillämpligt

#### Märkningsuppgifter enligt 1999/45/EG

Se Avsnitt 16.

### 2.3 Andra faror

## AVSNITT 3: SAMMANSÄTTNING/INFORMATION OM BESTÅNDSDELAR

Denna produkt består av en homogen vätskeblandning.

### 3.2 Blandningar

Observera att tabellen visar kända faror för ingredienserna i absolut ren form (Propylenglykol IH).

Farorna minskas eller elimineras när de blandas eller späds ut, se Avsnitt 16d.

Beståndsdel	Klassificering	Koncentration
<b>PROPYLENGLYKOL</b>		
CAS nr 57-55-6 EG nummer 200-338-0	<i>Combust Liq, Not Acute Tox, Non-Skin Irrit, Eye Irrit 2; H319</i> ;-	100 %
<b>PROPYLENGLYKOL</b>		
CAS nr 57-55-6 EG nummer 200-338-0	<i>Combust Liq, Not Acute Tox, Non-Skin Irrit, Eye Irrit 2; H319</i> ;-	5 %
<b>NOMEN OBLITUM</b>		
	- *,-	<0,1 %

Summa av alla max-koncentrationer 100 %

Förklaringar till ingrediensernas klassificering och märkning ges i Avsnitt 16e. Officiella förkortningar är skrivna med normal stil. Med kursiv stil anges specifikationer och/eller kompletteringar som använts vid beräkning av blandningens klassifikation, se Avsnitt 16b.

# AVSNITT 4: ÅTGÄRDER VID FÖRSTA HJÄLPEN

## 4.1 Beskrivning av åtgärder vid första hjälpen

### Generellt

Ingen speciell åtgärd anses behövas. Om symptom ändå uppkommer, kontakta läkare.

### Vid inandning

Låt den skadade vila på varm plats med frisk luft. Om symptom kvarstår, sök läkare.

### Vid kontakt med ögonen

Ta om möjligt omedelbart ut eventuella kontaktlinser. Skölj genast med tempererat vatten 15 - 20 min med vidöppna ögon. Om symptom kvarstår, sök läkare.

### Vid hudkontakt

Normal tvättning av huden anses som tillräckligt. Om symptom ändå uppkommer, kontakta läkare. Ta av förorenade kläder.

### Vid förtäring

Skölj först munnen noggrant med mycket vatten men SVÄLG EJ. Drick minst en halv liter vatten och kontakta läkare. INGEN kräkning.

## 4.2 De viktigaste symptomen och effekterna, både akuta och fördröjda

Uppgifter om symptom ej entydiga eller saknas för denna produkt.

# AVSNITT 5: BRANDBEKÄMPNINGSSÅTGÄRDER

## 5.0 Allmänna åtgärder vid brand eller hotande brand

Larma räddningstjänsten tel 112. Rädda personer i fara. För undan gastuber, brandfarliga varor och oxiderande ämnen.

## 5.1 Släckmedel

### Lämpliga släckmedel

Släckes med pulver eller kolsyra. Brandman kan använda spridd vattenstråle.

### Olämpliga släckmedel

Bör inte släckas med vatten under högt tryck.

## 5.2 Särskilda faror som ämnet eller blandningen kan medföra

### Farliga förbränningsgaser

Brinner under utveckling av rök innehållande hälsoskadliga gaser (kolmonoxid och koldioxid) samt, vid ofullständig förbränning, aldehyder och andra giftiga, hälsofarliga, irriterande eller farliga ämnen.

### Särskilda risker vid brandsläckning

## 5.3 Råd till brandbekämpningspersonal

Vid brand använd friskluftsmask.

## 5.4 Annan information

### Produktens brandegenskaper

Inte brandfarlig.

Produkten är inte oxiderande.

### Speciella risker vid brand

# AVSNITT 6: ÅTGÄRDER VID OAVSIKTLIGA UTSLÄPP

## 6.1 Personliga skyddsåtgärder, skyddsutrustning och åtgärder vid nödsituationer

Använd lämpliga allergitestade skyddshandskar. Andningsskydd med gasfilter typ A (brun filterbänderoll) kan behövas. Inandas ej produkten och undvik kontakt med hud och ögon.

## 6.2 Miljöskyddsåtgärder

Förhindra att produkten rinner ner i avloppsledning. Om så ändå sker kontakta omedelbart avloppsreningsverket. Undvik utsläpp till mark, vatten eller luft. Vid mycket stora utsläpp 1 - 50 ton i flod eller insjö kontakta räddningstjänsten, tel 112.

## 6.3 Metoder och material för inneslutning och sanering

Spill samlas upp med lämpligt uppsugande material som t ex absol och lämnas till destruering. Förorenad produkt lämnas som kemikalieavfall och deklarerar som icke farligt gods.

## 6.4 Hänvisning till andra avsnitt

För val av skyddshandskar se Avsnitt 8.

# AVSNITT 7: HANTERING OCH LAGRING

## 7.1 Försiktighetsmått för säker hantering

### \* 7.1.1.a Rekommendationer om hur man säkerställer en säker hantering av ämnet eller blandningen

Hantera substansen som potentiellt hälsofarlig. Förvaras oåtkomligt för barn och husdjur.

### \* 7.1.2 Allmänna råd om hygien på arbetsplatsen

Denna produkt ska förvaras oåtkomligt för små barn och väl avskild från livsmedel, berusningsmedel och djurfoder. Håll denna produkt avskild från matvaror och utom räckhåll för barn och husdjur. Ät, drick och rök inte i lokaler där denna produkt hanteras.

## 7.2 Förhållanden för säker lagring, inklusive eventuell oförenlighet

### \* 7.2.b3 Hur man begränsar effekterna av temperatur

Lagras ej över normal rumstemperatur.

### \* 7.2.d1 Ventilationskrav

Hanteras i lokal med modern ventilationsstandard.

### \* 7.2.d2 Särskild utformning av lagerlokaler eller lagringskärl

Förvaras i väl ventilerat utrymme, ej över ögonhöjd.

### \* 7.2.d4 Kompatibla förpackningar

Förvaras endast i originalförpackningen.

# AVSNITT 8: BEGRÄNSNING AV

# EXPONERINGEN/PERSONLIGT SKYDD

## 8.1 Kontrollparametrar

### \* 8.1.1 Nationella gränsvärden

Alla ingredienser (se Avsnitt 3) saknar hygieniska gränsvärden.

## 8.2 Begränsning av exponeringen på arbetsplatsen

### \* 8.2.1 Lämpliga tekniska kontrollåtgärder

För förebyggande av risker i arbetet behöver ingen speciell hänsyn tas till denna produkt utöver de allmänna krav som följer av EU-direktiv 89/391 samt nationell arbetsmiljölagstiftning.

### \* 8.2.2 Individuella skyddsåtgärder, t ex personlig skyddsutrustning

#### \* 8.2.2.a Ögonskydd/ansiktsskydd

Ögonskydd bör användas vid risk för direktkontakt eller stänk.

##### 8.2.2.b1 Handskydd

Skyddshandskar behövs normalt inte med anledning av egenskaperna hos denna produkt. Skyddshandskar kan behövas på grundval av andra arbetsförhållanden, t ex nötning, temperaturförhållanden eller mikrobiologiska faror.

Särskilt känsliga personer kan använda handskar märkta "Low Chemical resistant" eller "Waterproof" eller med vidstående piktogram.



### 8.2.2.b2 Annat hudskydd

### 8.2.2.c Andningsskydd

Andningsskydd ska endast behövas i extrema arbetssituationer. Rådgör med tillverkaren.

### \* 8.2.3 Begränsning av miljöexponeringen

För begränsning av miljöexposition, se Avsnitt 12.

## AVSNITT 9: FYSIKALISKA OCH KEMISKA EGENSKAPER

### 9.1 Information om grundläggande fysikaliska och kemiska egenskaper

a) Utseende	* Form: vätska
	Färg: grön
d) pH-värde	Ej tillämpligt
n) Löslighet	Helt löslig i vatten (100 %)
s) Explosiva egenskaper	Ej tillämpligt

## AVSNITT 10: STABILITET OCH REAKTIVITET

### Stabilitet

Produkten är stabil.

## AVSNITT 11: TOXIKOLOGISK INFORMATION

### 11.1.2.1a Akut toxicitet

Förklaring till förkortningar i tabellen:  $w_i$  = Maximal mass-fraktion av ämnet i blandningen;  $ATE_{exp}$  = Experimentellt erhållet värde på uppskattad akut toxicitet;  $ATE_{pe}$  = omvandlat punktestimat för akut toxicitet;  $ATE_{mixt} = 1/SUM(w_i/ATE_i)$ ;  $ATE_i$  = ATE för denna ingrediens.

Exponeringsväg och enhet: Oral (mg/kg kroppsvikt).

Ej tillämpligt.

Exponeringsväg och enhet: Gjennom huden (mg/kg kroppsvikt).

Ej tillämpligt.

Exponeringsväg och enhet: Gaser (ppmV).

Ej tillämpligt.

Exponeringsväg och enhet: Ångor (mg/l).

Ej tillämpligt.

Exponeringsväg och enhet: Damm/dimma (mg/l).

Ej tillämpligt.

### 11.1.2.1b Irritation

Blandningens irriterande egenskaper (se Avsnitt 2) har bedömts med beaktande av reglerna i 1272/2008 Bilaga I 3.2.3 och 3.3.3.

### 11.1.2.1c Frätande effekt

Blandningens irriterande egenskaper (se Avsnitt 2) har bedömts med beaktande av reglerna i 1272/2008 Bilaga I.

#### **11.1.2.1d Sensibilisering**

Blandningens sensibiliserande effekter (se Avsnitt 2) har bedömts med beaktande av reglerna i 1272/2008 Bilaga I.

#### **11.1.2.1e Toxicitet vid upprepad dosering**

Blandningens specifika organtoxicitet vid upprepad dosering (se Avsnitt 2) har bedömts med beaktande av reglerna i 1272/2008 Bilaga I.

#### **11.1.2.1f Cancerogenitet**

Blandningens cancerogenicitet (se Avsnitt 2) har bedömts med beaktande av reglerna i 1272/2008 Bilaga I.

#### **11.1.2.1g Mutagenitet**

Blandningens mutagenicitet (se Avsnitt 2) har bedömts med beaktande av reglerna i 1272/2008 Bilaga I.

#### **11.1.2.1h Reproduktionstoxicitet**

Blandningens reproduktionstoxicitet (se Avsnitt 2) har bedömts med beaktande av reglerna i 1272/2008 Bilaga I.

#### **11.1.7 Information om sannolika exponeringsvägar**

Exponeringen måste bedömas enligt nedströmsanvändarens kemikaliesäkerhetsbedömning enligt 1907/2006 Artikel 37.

#### **11.1.9 Fördröjda och omedelbara effekter samt kroniska effekter av korttids- och långtidsexponering**

Såvitt vi vet har inga kroniska effekter rapporterats för detta ämne.

#### **11.1.10 Interaktiva effekter**

Såvitt vi vet har inga synergistiska effekter rapporterats för denna produkt eller någon av dess ingredienser.

#### **11.1.13 Annan information**

Såvitt vi vet påverkar denna produkt inte omdömet i avsedd användning. Inverkan på människans mikroflora kan ej påvisas eller är obetydlig.

## **AVSNITT 12: EKOLOGISK INFORMATION**

### **Ekotoxicitet**

#### **Allmän information**

Denna produkt består av lätt nedbrytbara naturligt förekommande eller naturidentiska substanser från huvudsakligen förnyelsebara källor, varvid den globala miljöbelastningen kan anses som försumbar. I närmiljön kan mindre ekologiska effekter uppkomma vid stora utsläpp.

### **Rörlighet**

#### **Allmän information om rörlighet i naturen**

Uppgift om rörlighet i naturen saknas men det finns ingen anledning att anta att produkten är miljöskadlig av denna anledning.

### **Persistens och nedbrytbarhet**

Produkten är nedbrytbar i naturen.

### **Bioackumuleringsförmåga**

Denna produkt eller dess ingredienser ackumuleras ej i naturen.

### **Andra skadliga effekter**

#### **Påverkan på närmiljön**

Denna produkt bryts snabbt ner men stora utsläpp under kort tid kan skada närmiljön.

# AVSNITT 13: AVFALLSHANTERING

## Avfallshantering för produkten

### Allmänna anvisningar för avfallshantering

Produkten är inte klassad som farligt avfall. Beakta även lokala regler för avfallshantering. Se även Avfallsförordningen SFS 2001:1063.

### Återvinning av produkten

Denna produkt återvinns normalt inte.

### Transport av avfallet

Klass J(0) - Icke miljö- eller hälsoskadligt.

# AVSNITT 14: TRANSPORTINFORMATION

Denna produkt förväntas endast transporteras på väg eller järnväg och är därför endast bedömd enligt regelverken ADR/RID. Skulle annat transportsätt bli aktuellt, kontakta utgivaren av detta säkerhetsdatablad.

## Ej farligt gods

### 14.7 Bulktransport enligt bilaga II till MARPOL 73/78 och IBC-koden

Ej tillämpligt

### 14.8 Övrig transportinformation

# AVSNITT 15: GÄLLANDE FÖRESKRIFTER

## 15.1 Föreskrifter/lagstiftning om ämnet eller blandningen när det gäller säkerhet, hälsa och miljö

Ej tillämpligt.

## 15.2 Kemikaliesäkerhetsbedömning

Bedömning och kemikaliesäkerhetsrapport enligt 1907/2006 Bilaga I har ännu ej utförts.

# AVSNITT 16: ANNAN INFORMATION

## \* 16a Upplysningar om vilka förändringar som har gjorts av den föregående versionen

### Revisioner av detta dokument

Detta är första versionen.

## \* 16b Förklaring till förkortningarna i säkerhetsdatabladet

### Fulltext för koder för faroklass och kategori nämnda i Avsnitt 3

<i>Combust Liq</i>	Brännbar vätska med flampunkt > 93 °C
<i>Not Acute Tox</i>	Ingen akut toxicitet
<i>Non-Skin Irrit</i>	Ingen hudirritation har visat sig vid test
Eye Irrit 2	Ögonirritation (Kategori 2)

## Förklaringar till förkortningar i Avsnitt 14

ADR Europeiska överenskommelsen om internationell transport av farligt gods på väg

RID Reglementet för internationell transport av farligt gods på järnväg

### \* 16c Hänvisningar till viktig litteratur och datakällor

#### Datakällor

Primärdata för beräkningen av farorna har i första hand hämtats från den officiella europeiska

klassifikationslistan, 1272/2008 Bilaga I , uppdaterad till 31.05.2012.

Där sådana uppgifter saknas har i andra hand använts den dokumentation som ligger till grund för den officiella klassificeringen, t ex IUCLID (International Uniform Chemical Information Database). I tredje hand har använts information från ansedda internationella kemikalieföretag, och i fjärde från övrig tillgänglig information, t ex från andra leverantörers säkerhetsdatablad eller från ideella organisationer, varvid en expertbedömning skett av källans trovärdighet. Om, trots detta, tillförlitlig information inte hittats, så har farorna bedömts av expertis på grundval av kända faror från liknande ämnen, varvid principerna i 1907/2006 och 1272/2008 har följts.

#### Fulltext för författningar nämnda i detta säkerhetsdatablad

453/2010	Kommissionens förordning (EU) nr 453/2010 av den 20 maj 2010 om ändring av Europaparlamentets och rådets förordning (EG) nr 1907/2006 om registrering, utvärdering, godkännande och begränsning av kemikalier (REACH)
1272/2008	Europaparlamentets och rådets förordning (EG) nr 1272/2008 av den 16 december 2008 om klassificering, märkning och förpackning av ämnen och blandningar, ändring och upphävande av direktiven 67/548/EEG och 1999/45/EG samt ändring av förordning (EG) nr 1907/2006
1999/45/EG	Europaparlamentets och rådets direktiv 1999/45/EG av den 31 maj 1999 om tillnärmning av medlemsstaternas lagar och andra författningar om klassificering, förpackning och märkning av farliga preparat
89/391	Europaparlamentets och rådets direktiv 89/391/EG
1907/2006	Europaparlamentets och rådets förordning (EG) nr 1907/2006 av den 18 december 2006 om registrering, utvärdering, godkännande och begränsning av kemikalier (REACH), inrättande av en europeisk kemikaliemyndighet, ändring av direktiv 1999/45/EG och upphävande av rådets förordning (EEG) nr 793/93 och kommissionens förordning (EG) nr 1488/94 samt rådets direktiv 76/769/EEG och kommissionens direktiv 91/155/EEG, 93/67/EEG, 93/105/EG och 2000/21/EG Artikel 37 KOMMISSIONENS FÖRORDNING (EG) nr. 1907/2006

### \* 16d Metoder för att utvärdera information som avses 1272/2008 Artikel 9 som användes för klassificeringen

Beräkningen av farorna med denna blandning har gjorts som en sammanvägd bedömning med hjälp av en expertbedömning i enlighet med 1272/2008 Bilaga I, där all tillgänglig information som kan ha betydelse för att fastställa farorna med blandningen vägs samman, och i enlighet med 1907/2006 Bilaga XI.

### \* 16e Förteckning över relevanta R-fraser, faroangivelser, skyddsfraser och skyddsangivelser

### \* 16f Råd om lämplig utbildning för anställda för att skydda människors hälsa och miljön

#### Varning för felaktig användning

Denna produkt kan orsaka skada vid felaktig användning. Tillverkaren, distributören eller leverantören ansvarar ej för skador till följd av annan användning än den för vilken produkten är avsedd.

### \* Övrig relevant information

### Märkningsuppgifter enligt 1999/45/EG

Farosymbol	Ej tillämpligt
R-fraser	Ej tillämpligt
S-fraser	Ej tillämpligt

## Kerosene burners

One stage operation



**RDB**



CODE	MODEL	TYPE
3748950	RDB3 CF	489T50
3748850	RDB4 CF	488T50





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## 1 Declaration

### Declaration of conformity in accordance with ISO / IEC 17050-1

Manufacturer:	RIELLO S.p.A.	
Address:	Via Pilade Riello, 7 37045 Legnago (VR)	
Product:	Kerosene burners	
Model:	RDB3 CF RDB4 CF	
These products are in compliance with the following Technical Standard:		
EN 292		
EN 267		
and according to the European Directives:		
MD	2006/42/EC	Machine Directive
LVD	73/23/EEC - 2006/95/EC	Low Voltage Directive
EMC	89/336/EEC - 2004/108/EC	Electromagnetic Compatibility

The quality is guaranteed by a quality and management system certified in accordance with UNI EN ISO 9001.

Legnago, 30.07.2010

Mr. G. Conticini  
Burners Division Department  
RIELLO S.p.A.



**2 Information and general warnings**

**2.1 Information about the instruction manual**

**2.1.1 Introduction**

The instruction manual supplied with the burner:

- is an integral and essential part of the product and must not be separated from it; it must therefore be kept carefully for any necessary consultation and must accompany the burner even if it is transferred to another owner or user, or to another system. If the manual is lost or damaged, another copy must be requested from the Technical Assistance Service of the area;
- is designed for use by qualified personnel;
- offers important indications and instructions relating to the installation safety, start-up, use and maintenance of the burner.

**Symbols used in the manual**

In some parts of the manual you will see triangular DANGER signs. Pay great attention to these, as they indicate a situation of potential danger.

**2.1.2 General dangers**

The **dangers** can be of **3 levels**, as indicated below.



**Maximum danger level!**  
This symbol indicates operations which, if not carried out correctly, cause serious injury, death or long-term health risks.



This symbol indicates operations which, if not carried out correctly, may cause serious injury, death or long-term health risks.



This symbol indicates operations which, if not carried out correctly, may cause damage to the machine and/or injury to people.

**2.1.3 Danger: live components**



This symbol indicates operations which, if not carried out correctly, lead to electric shocks with lethal consequences.

**Other symbols**



**ENVIRONMENTAL PROTECTION**

This symbol gives indications for the use of the machine with respect for the environment.

- This symbol indicates a list.

**Abbreviations used**

Ch.	Chapter
Fig.	Figure
Page	Page
Sec.	Section
Tab.	Table

**Delivery of the system and the instruction manual**

When the system is delivered, it is important that:

- the instruction manual is delivered to the user by the system manufacturer, with the recommendation to keep it in the room where the heat generator is to be installed.
- The instruction manual shows:
  - the serial number of the burner;

.....

- the address and telephone number of the nearest Assistance Centre.

.....

.....

.....

- The system supplier must carefully inform the user about:
  - the use of the system;
  - any further tests that may be required before activating the system;
  - maintenance, and the need to have the system checked at least once a year by a representative of the manufacturer or another specialised technician.  
To ensure a periodic check, the manufacturer recommends the drawing up of a Maintenance Contract.

## 2.2 Guarantee and responsibility

The manufacturer guarantees its new products from the installation date, in accordance with the regulations in force and/or the sales contract. At the moment of the first start-up, check that the burner is integral and complete.



Failure to observe the information given in this manual, operating negligence, incorrect installation and carrying out of non authorised modifications will result in the annulment by the manufacturer of the guarantee that it supplies with the burner.

In particular, the rights to the guarantee and the responsibility will no longer be valid, in the event of damage to things or injury to people, if such damage/injury was due to any of the following causes:

- incorrect installation, start-up, use and maintenance of the burner;
- improper, incorrect or unreasonable use of the burner;
- intervention of unqualified personnel;
- carrying out of unauthorised modifications on the equipment;
- use of the burner with safety devices that are faulty, incorrectly applied and/or not working;
- installation of untested supplementary components on the burner;
- powering of the burner with unsuitable fuels;
- faults in the fuel supply system;
- continuation of use of the burner when a fault has occurred;
- repairs and/or overhauls incorrectly carried out;
- modification of the combustion chamber with inserts that prevent the regular development of the structurally established flame;
- insufficient and inappropriate surveillance and care of those burner components most likely to be subject to wear and tear;
- the use of non-original components, including spare parts, kits, accessories and optional;
- force majeure.

**The manufacturer furthermore declines any and every responsibility for the failure to observe the contents of this manual.**

Riello warranty is subject to correct burner, appliance and application matching, and set up in line with Riello's instructions and guidelines. All components within the hydraulic circuit suitable for bio fuel use and supplied by Riello will be identified as Bio compatible. No warranty is given in relation to the use of components which are not so identified with bio fuel blends. If in any doubt please contact Riello for further advice.

If any Riello burners are used with fuel with a bio content >10% then the components within the hydraulic circuit maybe affected and are not covered under warranty.

The hydraulic circuit consists of:

- Pump
- Hydraulic ram (where applicable)
- Valve block
- Flexible oil lines (considered as a consumable component)

- 1 Irrespective of any warranty given by Riello in relation to normal use and manufacturing defects, when fuels not meeting the relevant standards are used, or where fuel storage issues have not been addressed correctly, or the equipment used is not compatible, if failures occur which are directly or indirectly attributed to such issues and/or to the non-observance of this guidance, then no warranty or liability is implied or accepted by Riello.
- 2 Riello have carefully chosen the specification of the bio compatible components including the flexible oil lines to protect the pump, safety valve and nozzle. The Riello warranty is dependent upon the use of Riello genuine components including the oil lines, being used.
- 3 Riello warranty does not cover defects arising from incorrect commissioning or servicing by non Riello employed service engineers, and any issues impacting the burner arising from external site related issues.

## 2.3 Guidance for the use of bio fuel blends up to 10% where gas oil use is permitted by the appliance Manufacturer

### Background

With increasing focus on renewable and sustainable energy requirements, Bio fuel usage is set to increase. Riello is committed to promoting energy conservation and the use of renewable energy from sustainable resources including liquid bio fuels, however there are some technical aspects that must be considered at the planning stage of using such fuels to reduce the potential for equipment failure or the risks of fuel leakage.

Liquid Bio fuel is a generic description used for oil that can come from numerous feed stocks including recycled cooking oils. These types of oils have to be considered and treated differently from standard mineral or fossil fuels, as they are generally more acidic, hygroscopic and less stable.

Due to this, a holistic approach is needed from the specification of the liquid Bio fuel, the storage of the fuel, its oil supply line and ancillary equipment, and very importantly the oil filtration and the burner itself. The specification for FAME (Fatty Acids Methyl Ester) liquid Bio fuel is critical to reliable equipment operation.

It is a minimum requirement that the fuel blend (up to 10% Bio) is obtained with gasoil in accordance with the relevant EN standards, regional regulations and FAME in accordance with EN 14214. It is also important that the fuel blends meet the require-

ments related to operational environment conditions within the relevant EN standards.

When choosing your Riello oil products where you know Bio fuels will be in use, please make sure that a Bio compatible burner and/or components have been supplied. If an existing burner is to be used with a liquid Bio fuel then a kit may be required to make it compatible and the guidance notes enclosed concerning oil storage and filtration must be adhered to. The end user is responsible for the thorough verification of the potential risks associated with the introduction of a bio fuel blend and the suitability of the appliances and installation applicable.

Irrespective of any warranty given by Riello in relation to normal use and manufacturing defects, when fuels not meeting the relevant standards are used, or where fuel storage issues have not been addressed correctly, or the equipment used is not compatible, if failures occur which are directly or indirectly attributed to such issues and/or to the non-observance of this guidance, then no warranty or liability is implied or accepted by Riello.



### 2.3.1 Information and general instructions

To ensure consistency, the supplier of the fuel must be able to demonstrate compliance with a recognised Quality Control and management system to ensure high standards are maintained within the storage, blending and delivery processes.

The installation oil storage tank and its ancillaries must also be prepared BEFORE liquid Bio fuel is introduced.

Checks and preparation should include:

- For new installations, make sure that all materials and seals in the oil storage and supply line to the burner are compatible with Bio fuels. For all installations, there must be a good quality bio compatible oil filter at the tank and then a secondary filter of 60 Microns protecting the burner from contamination.
- If an existing oil storage tank is to be used then in addition to the materials checks as detailed above, it will be essential that the tank is first inspected for condition and checked for water or other contamination. Riello strongly recommends that the tank is cleaned and oil filters replaced prior to Bio fuel delivery. If this is not completed then due to the hydroscopic nature of Bio fuel, it will effectively clean the tank, absorb water present which in turn will result in equipment failure that is not covered by the manufacturer's warranty.
- Depending on the capacity of the oil storage tank and oil usage, fuels may remain static within the tank for some considerable time and so Riello recommends that the oil distributor is consulted regarding the use of additional Biocides within the fuel to prevent microbial growth from occurring within the tank. Riello suggests that fuel suppliers and or service companies are contacted for guidance on fuel filtration. Special attention should be applied to fuel applications where oil may be stored for long periods of time.
- The burner must be set according to the appliance application and commissioned checking that all combustion parameters are as recommended in the appliance technical manual.
- Riello recommends that the in line and burner oil pump filters are inspected and if required replaced at least every 4 months during burner use, before the burner start-up following a long period of discontinue operation and even more frequently where contamination has occurred. Particular attention is needed when inspecting and checking for fuel leakages from seals, gaskets and hoses.

### 2.3.2 Product Disclaimer Statement

**CAREFULLY READ THE FOLLOWING DISCLAIMER. YOU ACCEPT AND AGREE TO BE BOUND BY THIS DISCLAIMER BY PURCHASING RIELLO BIO COMPATIBLE BURNERS AND/OR COMPONENTS.**

Although the information and recommendations (hereinafter "Information") in this guidance is presented in good faith, believed to be correct and has been carefully checked, Riello (and its subsidiaries) makes no representations or warranties as to the completeness or accuracy of the Information. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Riello (and its subsidiaries) be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information.

Other than set forth herein, Riello (and its subsidiaries) makes no additional warranties with respect to the bio compatible burner, either express or implied, including that of merchantability or fitness for a particular purpose or use.

In no event shall Riello (and its subsidiaries) be liable for any indirect, incidental, special or consequential damages including, without limitation, loss of profits, damages for loss of business profits, business interruption, loss of business information, loss of equipment, or other pecuniary loss or compensation for services whether or not it is advised of the possibility of such damages.

With the exception of injuries to persons, Riello's liability is limited to the customer's right to return defective/non-conforming products as provided by the relevant product warranty.

## 3 Safety and prevention

### 3.1 Introduction

The burners have been designed and built in compliance with current regulations and directives, applying the known technical rules of safety and envisaging all the potential danger situations. It is necessary, however, to bear in mind that the imprudent and clumsy use of the equipment may lead to situations of death risk for the user or third parties, as well as the damaging of the burner or other items. Inattention, thoughtlessness and excessive confidence often cause accidents; the same applies to tiredness and sleepiness.

It is a good idea to remember the following:

- The burner must only be used as expressly described. Any other use should be considered improper and therefore dangerous.

In particular:

it can be applied to boilers operating with water, steam, diathermic oil, and to other uses expressly named by the manufacturer;

the type and pressure of the fuel, the voltage and frequency of the electrical power supply, the minimum and maximum deliveries for which the burner has been regulated, the pressurisation of the combustion chamber, the dimensions of the combustion chamber and the room temperature must all be within the values indicated in the instruction manual.

- Modification of the burner to alter its performance and destinations is not allowed.
- The burner must be used in exemplary technical safety conditions. Any disturbances that could compromise safety must be quickly eliminated.
- Opening or tampering with the burner components is not allowed, apart from the parts requiring maintenance.
- only those parts detailed as available as spare parts by the manufacturer can be replaced.

### 3.2 Safety warnings

The dimension of the boiler's combustion chamber must respond to specific values, in order to guarantee a combustion with the lowest polluting emissions rate.

The Technical Service Personnel will be glad to give you all the information for a correct matching of this burner to the boiler.

This burner must only be used for the application it was designed for.

The manufacturer accepts no liability within or without the contract for any damage caused to people, animals and property due to installation, adjustment and maintenance errors or to improper use.

### 3.3 Basic safety rules

- Children or inexperienced persons must not use the appliance.
- Under no circumstances must the intake grids, dissipation grids and ventilation vents in the installation room be covered up with cloths, paper or any other material.
- Unauthorised persons must not attempt to repair the appliance.
- It is dangerous to pull or twist the electric leads.
- Cleaning operations must not be performed if the appliance is not disconnected from the main power supply.
- Do not clean the burner or its parts with inflammable substances (e.g. petrol, alcohol, etc.). The cover must be cleaned with soapy water.
- Do not place anything on the burner.
- Do not block or reduce the size of the ventilation vents in the installation room.
- Do not leave containers and inflammable products or combustible materials in the installation room.

### 3.4 Personnel training

The user is the person, body or company that has acquired the machine and intends to use it for the specific purpose. He is responsible for the machine and for the training of the people working around it.

The user:

- undertakes to entrust the machine exclusively to suitably trained and qualified personnel;
- must take all the measures necessary to prevent unauthorised people gaining access to the machine;
- undertakes to inform his personnel in a suitable way about the application and observance of the safety instructions. With that aim, he undertakes to ensure that everyone knows the use and safety instructions for his own duties;
- must inform the manufacturer if faults or malfunctioning of the accident prevention systems are noticed, along with any presumed danger situation.
- Personnel must always use the personal protective equipment envisaged by legislation and follow the indications given in this manual.
- Personnel must observe all the danger and caution indications shown on the machine.
- Personnel must not carry out, on their own initiative, operations or interventions that are not within their province.
- Personnel must inform their superiors of every problem or dangerous situation that may arise.
- The assembly of parts of other makes, or any modifications, can alter the characteristics of the machine and hence compromise operating safety. The manufacturer therefore declines any and every responsibility for any damage that may be caused by the use of non-original parts.

## 4 Technical description of the burner

### 4.1 Technical data

Type	489 T50	488 T50
Output - Thermal power (with air at 20 °C)	3.0 - 5.8 kg/h 35.6 - 68.7 kW	4.7 - 9.5 kg/h 55.7 - 113 kW
Fuel	Kerosene, viscosity 1.6 – 6 mm <sup>2</sup> /s at 20 °C (H <sub>i</sub> = 11.97 kWh/kg) Gas oil, viscosity 4 – 6 mm <sup>2</sup> /s at 20 °C ◆ (H <sub>i</sub> = 11.86 kWh/kg)	
Electrical supply	Single phase, ~ 50Hz 230 V ± 10%	
Motor	Run current 1.3 A – 2750 rpm – 288 rad/s	
Capacitor	5 µF	
Ignition transformer	Secondary 8 kV – 16 mA	
Pump	Kerosene, maximum pressure 10 bar (145 psi) Gas oil, maximum pressure 15 bar (218 psi)	
Absorbed electrical power	0.16 kW	

◆ Gas oil is not permitted on low level discharge of flue gas products.

Tab. A

### 4.2 Burner description

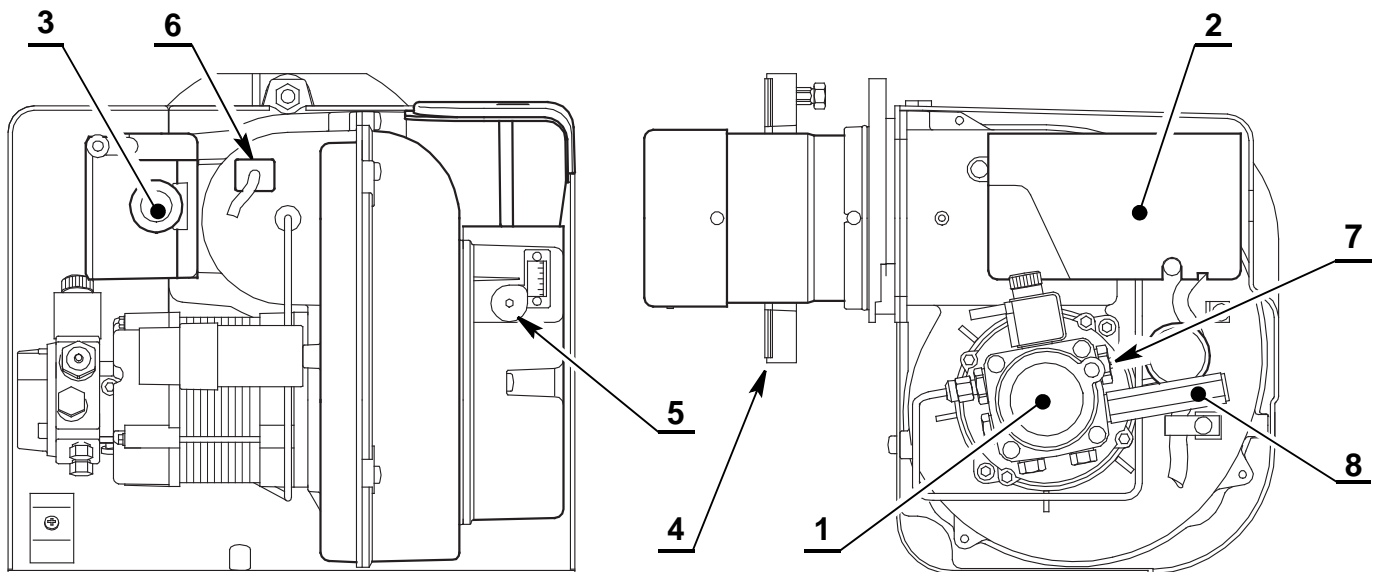


Fig. 1

- |   |                                 |   |                                |
|---|---------------------------------|---|--------------------------------|
| 1 | Pump                            | 5 | Air damper adjustment screw    |
| 2 | Control-box                     | 6 | Photoresistance                |
| 3 | Reset button with lock-out lamp | 7 | Pump pressure adjustment screw |
| 4 | Flange with insulating gasket   | 8 | Pressure gauge port            |

### 4.3 Burner equipment

Flange with insulating gasket.....	No. 1
Bolts for flange to be fixed to boiler.....	No. 4
Screw and nuts for flange .....	No. 1
Hoses with nipples .....	No. 1
Screw of by-pass pump.....	No. 1
Hexagonal key .....	No. 1
Screws and terminal screw for feeding cable.....	No. 3



The hoses supplied with this burner set for Kerosene use are not suitable for use with Gas oil containing a Bio blend.

Please refer to the spare part list for the specific hoses suitable for bio fuel use.

In case of use with gas oil containing up to 10% Bio blend, it will be essential to use flexible oil lines suitable for bio fuel use.

Please contact Riello for further information.

4.4 Burner dimensions

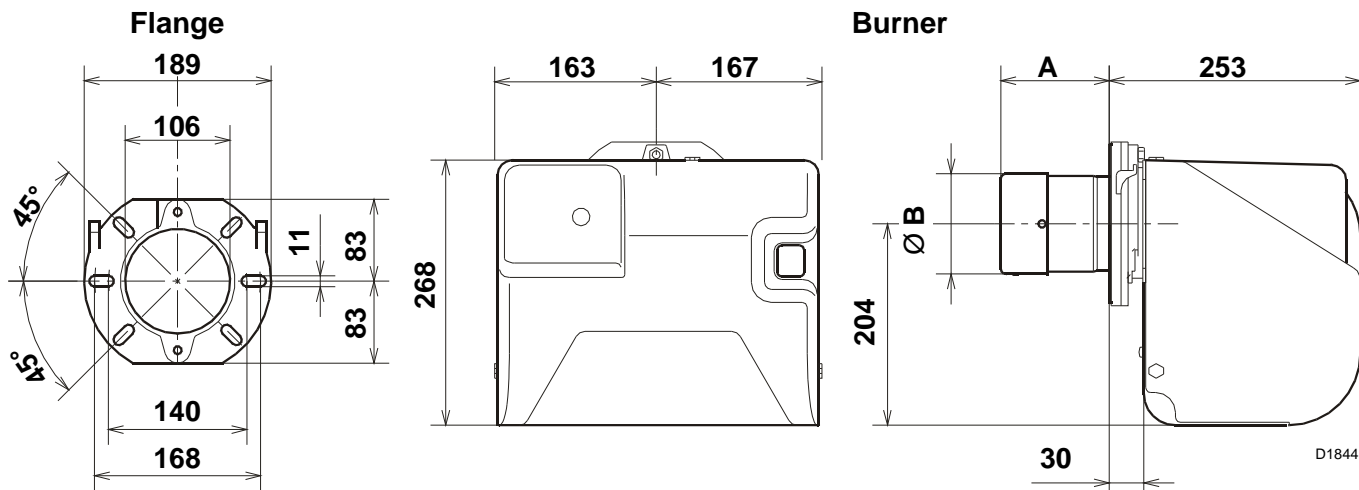


Fig. 2

	489T50	488T50
A	78	111
Ø B	88	105

4.5 Firing rates

The **MAXIMUM OUTPUT** is chosen from within the diagram area (Fig. 3).

The **MINIMUM OUTPUT** must not be lower than the minimum limit of the diagram.

The burner delivery must be selected within area of the diagrams (Fig. 3). This area is called firing rates and provides the maximum delivery of the burner in relation to the pressure in the combustion chamber.

The work point may be found by plotting a vertical line from the desired delivery and a horizontal line from the pressure in the combustion chamber. The intersection of these two lines is the work point which must lie within the firing rates.



The firing rate area values have been obtained considering a surrounding temperature of 20 °C, and an atmospheric pressure of 1013 mbar (approx. 0 m above sea level) and with the combustion head adjusted as shown on page 19.

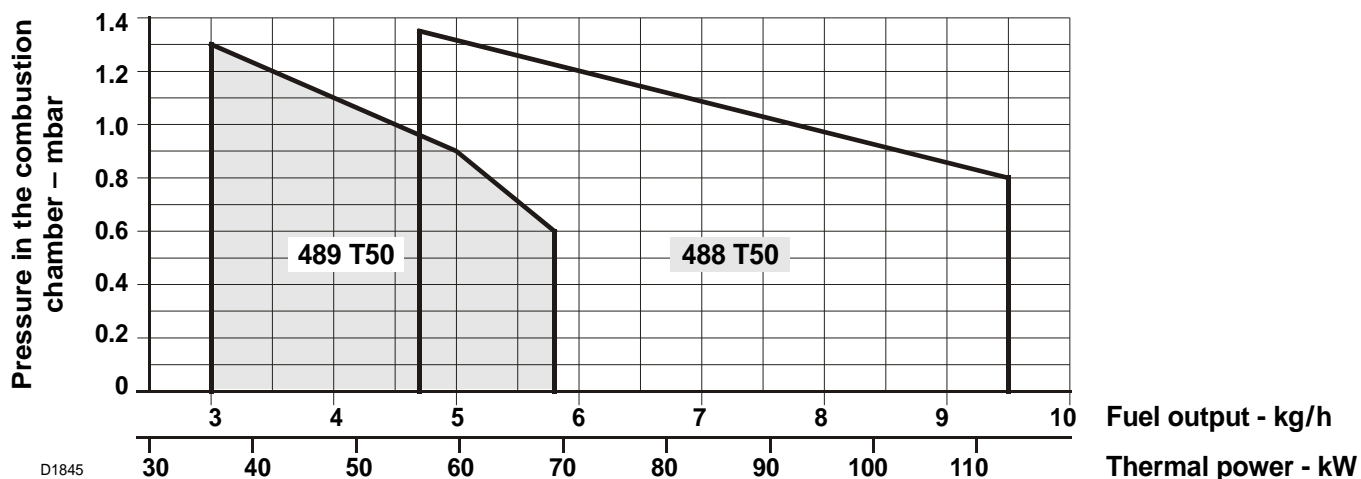


Fig. 3

**5 Installation**

**5.1 Notes on safety for the installation**

After carefully cleaning all around the area where the burner will be installed, and arranging the correct lighting of the environment, proceed with the installation operations.



All the installation, maintenance and disassembly operations must be carried out with the electricity supply disconnected.



The installation of the burner must be carried out by qualified personnel, as indicated in this manual and in compliance with the standards and regulations of the laws in force.

**5.2 Handling**

The packaging of the burner includes a carton box, so it is possible to move the burner (still packaged) with a transpallet truck or fork lift truck.



The handling operations for the burner can be highly dangerous if not carried out with the greatest attention: keep any unauthorised people at a distance; check the integrity and suitability of the available means of handling. Check also that the area in which you are working is empty and that there is an adequate escape area (i.e. a free, safe area to which you can quickly move if the burner should fall). When handling, keep the load at not more than 20-25 cm from the ground.



After positioning the burner near the installation point, correctly dispose of all residual packaging, separating the various types of material. Before proceeding with the installation operations, carefully clean all around the area where the burner will be installed.

**5.3 Preliminary checks**

**Checking the consignment**



After removing all the packaging, check the integrity of the contents. In the event of doubt, do not use the burner; contact the supplier.



The output of the burner must be within the boiler's firing rate;



The packaging elements (wooden cage or cardboard box, nails, clips, plastic bags, etc.) must not be abandoned as they are potential sources of danger and pollution; they should be collected and disposed of in the appropriate places.



A burner label that has been tampered with, removed or is missing, along with anything else that prevents the definite identification of the burner makes any installation or maintenance work difficult.

**Checking the characteristics of the burner**

R.B.L.	<b>A</b>		<b>B</b>	<b>G</b>
<b>D</b>	<b>C</b>	D ≤	<b>G</b>	
<b>B</b>	<b>E</b>			
<b>F</b>				
RIELLO S.p.A. I-37045 Legnago (VR)				CE xxxx

**Fig. 4**

Check the identification label of the burner, showing:

- the model **A**(Fig. 4) and type of burner **B**);
- the year of manufacture, in cryptographic form **C**);
- the serial number **D**);
- the electrical input power **E**);
- the types of fuel used and the relative supply pressures **F**);
- the data of the burner's minimum and maximum output possibilities **G**)(see Firing rate)

## 5.4 Installer/Service notes for the use of Gas oil with Bio blends up to 10% where gas oil use is permitted by the appliance Manufacturer

- During the burner installation, check that the gasoil and bio fuel blends are in accordance with Riello specifications (please refer to the chapters "Technical Data" and "Guidance for the use of bio fuel blends up to 10%" within the burner technical manual).
- If a Bio blend is in use the installer must seek information from the end user that their fuel supplier can evidence that the blends of fuel conform to the relevant standards.
- Check that the materials used in the construction of the oil tank and ancillary equipment are suitable for bio fuels, If not these must be upgraded or replaced with Bio compatible parts.
- Particular attention should be given to the oil storage tank and supply to the burner. Riello recommends that existing oil storage tanks are cleaned, inspected and any traces of water are removed BEFORE bio fuel is introduced (Contact the tank manufacturer or oil supplier for further advice). If these recommendations are not respected this will increase the risk of contamination and possible equipment failure.
- In line oil filters should be replaced making sure that they are Bio compatible. Riello recommends a good quality bio compatible oil filter at the tank and a secondary 60 micron filter are used to protect the burner pump and nozzle from contamination.
- The burner hydraulic components and flexible oil lines must be suitable for bio fuel use (check with Riello if in doubt). Riello have carefully chosen the specification of the bio compatible components including the flexible oil lines to protect the pump, safety valve and nozzle. The Riello warranty is dependent upon the use of Riello genuine components including the oil lines, being used. The burner must be commissioned and combustion parameters set to appliance manufacturer's recommendations.
- Regularly check visually for any signs of oil leakage from seals, gaskets and hoses.
- It is strongly recommended that with Bio fuel use, oil filters are inspected and replaced every 4 months. More regularly where contamination is experienced.
- During extended periods of non operation and/or where burners are using oil as a standby fuel, it is strongly recommended that the burner is put into operation for shorts periods at least every three months.

## 5.5 Working position



The burner is designed to operate only in the positions **1**, and **3** (Fig. 5). Installation **1** is preferable, as it is the only one that allows performing maintenance operations as described in this manual. Installations **2**, **3** and **4** allow working operations but not maintenance with hooking to the boiler.



Any other position could compromise the correct operation of the appliance. Installation **5** is forbidden for safety reasons.

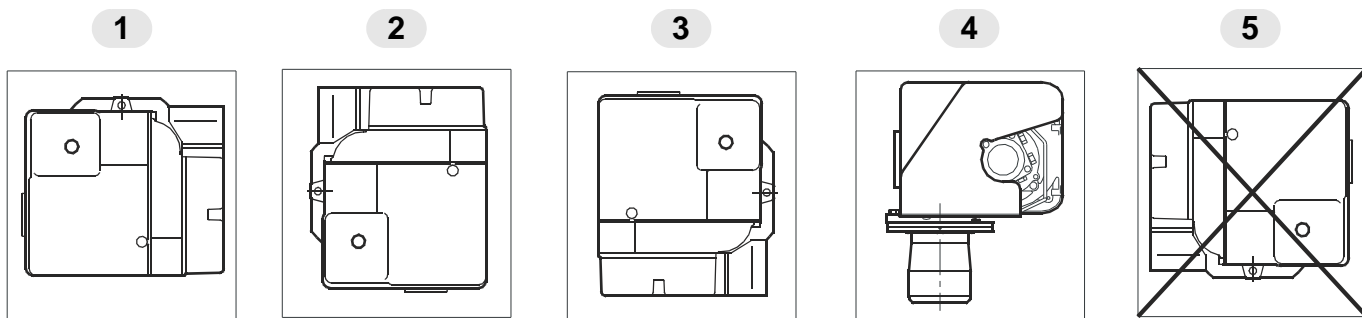


Fig. 5

D4618

5.6 Boiler fixing

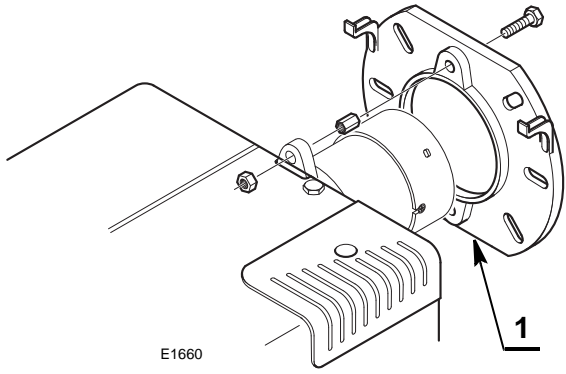


Fig. 6

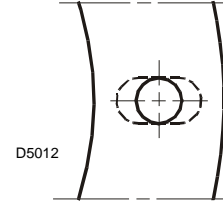


Fig. 7

- Put on the flange 1)(Fig. 6) the screw and two nuts.
- Widen, if necessary, the insulating gasket holes (5), (see Fig. 7).
- Fix the flange 1)(Fig. 8) to the boiler door 4) using screws 2) and (if necessary) the nuts 3) interposing the insulating gasket 5).



The seal between burner and boiler must be airtight.

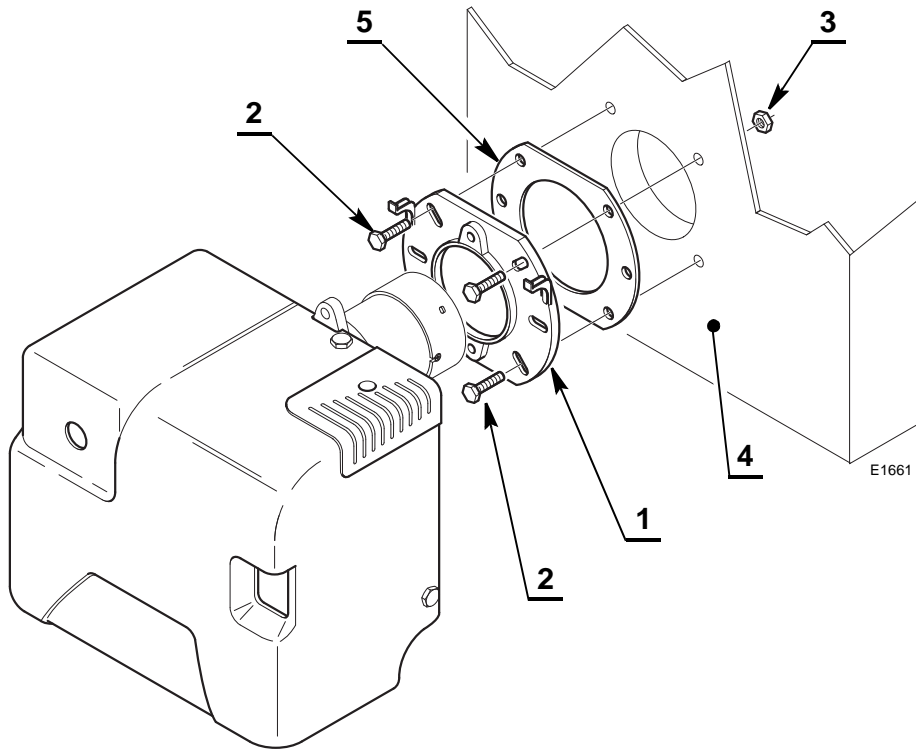


Fig. 8



5.7 Burner assembly

**CF Application**

In case of **CF** applications, the burner shall not operate without protection **(A)** of the suction inlet.

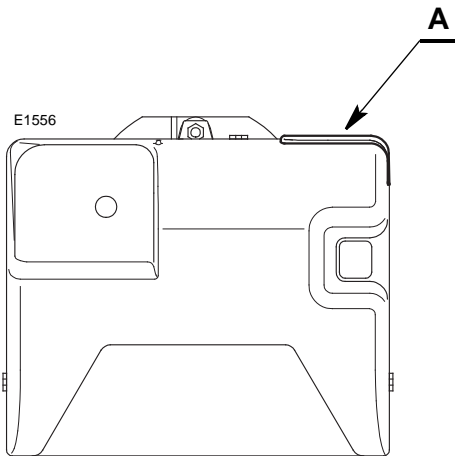


Fig. 9

**BF Application**



The temperature of the incoming air must not exceed 70 °C.



For correct BF application, the burner must be installed on an appropriate BF boiler.

In case of **BF** applications an optional snorkel and gasket are available replacing **(A)** with **(B)**. This item can be supplied separately.

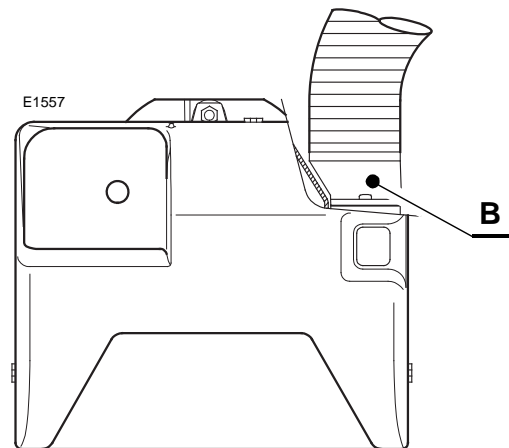


Fig. 10

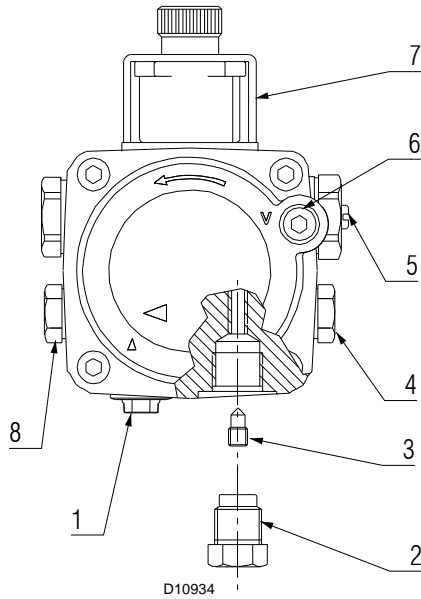
**6 Hydraulic systems**

**6.1 Fuel supply**

**6.1.1 Pump**

The pump is designed to allow working with one pipe.

In order to obtain two pipes working it is necessary to unscrew the return plug 2)(Fig. 11), screw the by-pass screw 3),supplied as burner equipment and then screw the return hose.



**Fig. 11**

Key (Fig. 11)

- |                    |                                 |
|--------------------|---------------------------------|
| 1 Suction line     | 5 Pressure adjuster             |
| 2 Return line      | 6 Vacuum gauge connection       |
| 3 By-pass screw    | 7 Valve                         |
| 4 Gauge connection | 8 Auxiliary pressure test point |



Where gas oil containing bio diesel is in use, it is recommended to avoid over oxygenation of the blended fuels.

Where at all possible avoid the use of two pipe systems where the circulated fuel is returned to the tank.

If this cannot be avoided make sure that the return pipe is normally below the surface of the fuel level within the storage tank. See Fig. 14.



The suction plug 1) is made of plastic. Once removed, it must not be used again.

In single pipe installations, the plug in the return line 2) must be totally in steel.



In case of use with gas oil containing up to 10% Bio blend, it will be essential to use flexible oil lines suitable for bio fuel use.

Please contact Riello for further information.

## 6.2 One pipe system

Pressurised one pipe systems (Fig. 12) have a positive fuel pressure on intake to the burner.

Usually the tank is higher than the burner, or the fuel pumping systems are on the outside of the boiler.

Vacuum one pipe systems (Fig. 13) have a negative fuel pressure (depression) on intake to the burner.

Usually the tank is lower than the burner.



You are advised to use additional filters on the fuel supply line.

Riello recommends a good quality fuel filter at the tank (Fig. 12 - Fig. 13) and a secondary filter (60  $\mu$  for gas oil and 15  $\mu$  for kerosene) are used to protect the burner pump and nozzle from contamination.

In case of Biodiesel use, pay attention to install Biocompatible filters.

### 6.2.1 Priming pump

On the system in Fig. 12 it is sufficient to loosen the plug of the vacuum gauge 6)(Fig. 11) and wait until the fuel flows out.

On the system in Fig. 13 start the burner and wait for the priming. Should lock-out occur prior to the arrival of the fuel, await at least 20 seconds before repeating the operation.



The installer must ensure that the supply pressure is not above 0.5 bar.

Above that level, the pump seal is subject to too much stress.

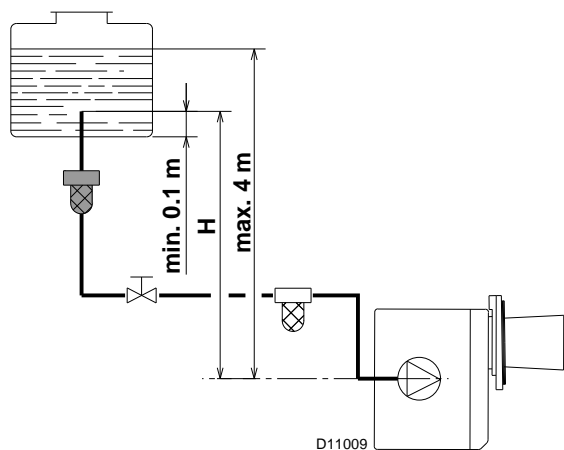


Fig. 12

H metres	L metres	
	I.D. (8 mm)	I.D. (10 mm)
0.5	10	20
1	20	40
1.5	40	80
2	60	100

Tab. B

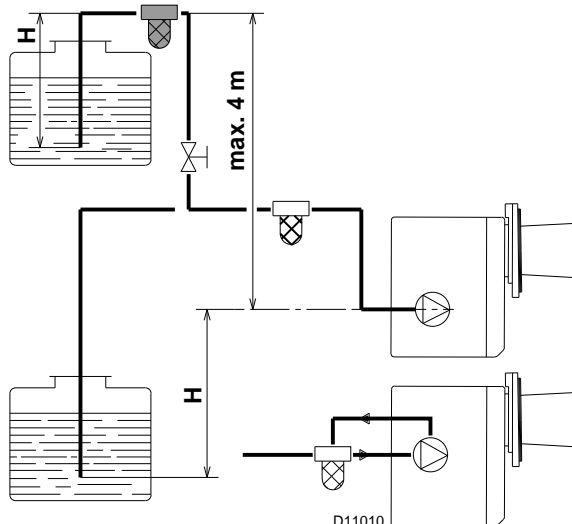


Fig. 13

H metres	L metres	
	I.D. (8 mm)	I.D. (10 mm)
0	35	100
0.5	30	100
1	25	100
1.5	20	90
2	15	70
3	8	30
3.5	6	20

Tab. C

- H difference of level
- L max. length of the suction line
- I.D. interterminal diameter of the oil pipes

**NOTE:**

The Tab. B and Tab. C show the maximum approximate lengths for the supply line, depending on the difference in level, length, and the diameter of the fuel conduit.

### 6.3 Two pipe system

Vacuum two pipe systems (Fig. 14) have a negative fuel pressure (depression) on intake to the burner. Usually the tank is lower than the burner.

The return line should terminate in the oil tank at the same level as the suction line; in this case a non-return valve is not required.

Should however the return line arrives over the fuel level, the non-return valve is indispensable. This solution however is less safe than previous one, due to the possibility of leakage of the valve.



You are advised to use additional filters on the fuel supply line.

Riello recommends a good quality fuel filter at the tank (Fig. 14) and a secondary filter (60  $\mu$  for gas oil and 15  $\mu$  for kerosene) are used to protect the burner pump and nozzle from contamination.

In case of Biodiesel use, pay attention to install Biocompatible filters.

#### 6.3.1 Priming pump



Before starting the burner make sure that the return pipe-line is not clogged: any obstruction would cause the pump seals to break.

On the system in Fig. 14 start the burner and wait for the priming. Should lock-out occur prior to the arrival of the fuel, await at least 20 seconds before repeating the operation.



The pump vacuum should not exceed a maximum of 0.4 bar (30 cm Hg). Beyond this limit gas is released from the oil.

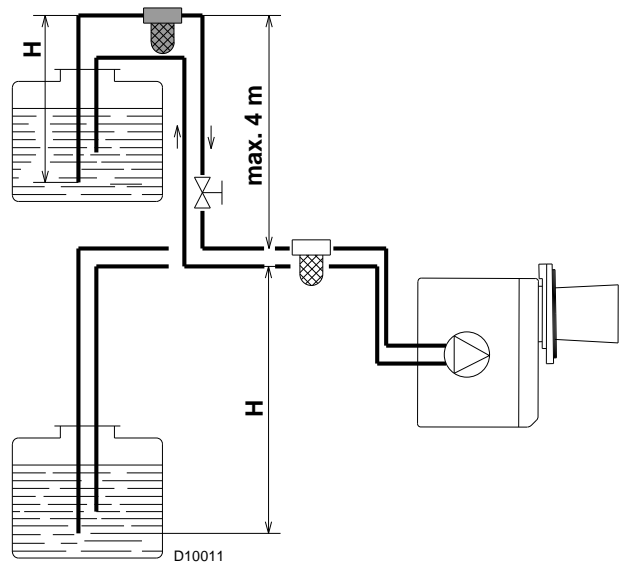


Fig. 14

H metres	L metres	
	I.D. (8 mm)	I.D. (10 mm)
0	35	100
0.5	30	100
1	25	100
1.5	20	90
2	15	70
3	8	30
3.5	6	20

Tab. D

**H** difference of level

**L** max. length of the suction line

**I.D.** interterminal diameter of the oil pipes

**NOTE:**

The Tab. D shows the maximum approximate lengths for the supply line, depending on the difference in level, length, and the diameter of the fuel conduit.

## 7 Electrical system

### 7.1 Notes on safety for the electrical wiring



**DANGER**

- The electrical wiring must be carried out with the electrical supply disconnected.
- Electrical wiring must be carried out by qualified personnel and in compliance with the regulations currently in force in the country of destination. Refer to the wiring diagrams.
- The manufacturer declines all responsibility for modifications or connections different from those shown in the wiring diagrams.
- Do not invert the neutral with the phase in the electrical supply line. Any inversion would cause a lockout due to firing failure.
- Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- The burners have been set for intermittent operation. This means they should compulsorily be stopped at least once every 24 hours to enable the control box to perform checks of its own start-up efficiency. Normally the boiler's thermostat/pressure switch ensures the stopping of the burner. If this is not the case, it is necessary to apply in series with IN a timer switch that turns off the burner at least once every twenty-four hours. Refer to the wiring diagrams.
- The electrical safety of the device is obtained only when it is correctly connected to an efficient earthing system, made according to current standards. It is necessary to check this fundamental safety requirement. In the event of doubt, have the electrical system checked by qualified personnel.
- The electrical system must be suitable for the maximum input power of the device, as indicated on the label and in the manual, checking in particular that the section of the cables is suitable for the input power of the device.
- For the main power supply of the device from the electricity mains:
  - do not use adapters, multiple sockets or extensions;
  - use an omnipolar switch, as indicated by the current safety standards.
- Do not touch the device with wet or damp body parts and/or in bare feet.
- Do not pull the electric cables.

Before carrying out any maintenance, cleaning or checking operations:



**DANGER**

disconnect the electrical supply from the burner by means of the main system switch;



**DANGER**

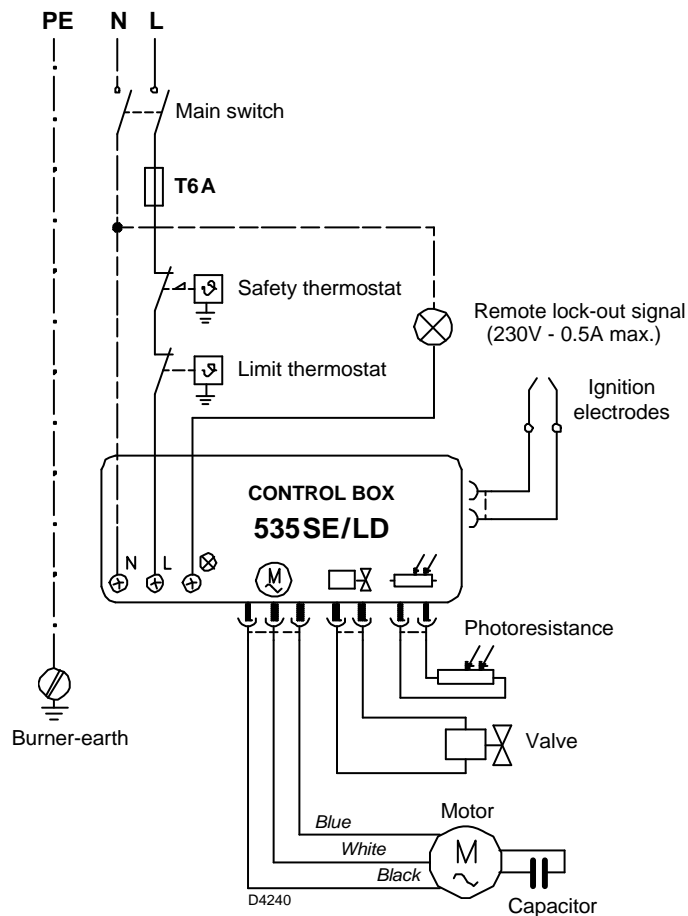
isolate the fuel supply

If the cover is still present, remove it and proceed with the electrical wiring according to the wiring diagrams.

Use flexible cables in compliance with the EN 60 335-1 standard.

**7.2 Electrical wiring**

~ 50Hz - 230V



**Fig. 15**



**WARNING**

- Do not swap neutral and phase over, follow the diagram shown carefully and carry out a good earth connection.
- The electrical wiring carried out by the installer must be in compliance with the rules in force in the country.
- The section of the conductors must be at least 1mm<sup>2</sup>. (Unless requested otherwise by local standards and legislation).

**TESTING:**

Check the shut-down of the burner by opening the thermostats and the lock-out by darkening the photoresistance.

**7.2.1 Control box**

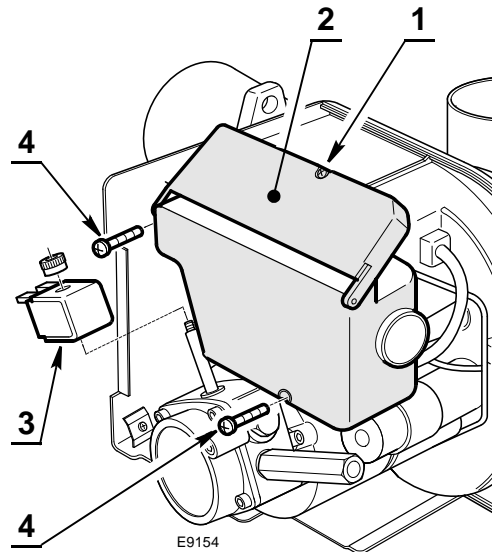


**DANGER**

This operation must be performed with the burner turned off and mains power disconnected.

To remove the control box (Fig. 16) from the burner follow of the instruction:

- Loosen the screw 1), open the protection 2) and remove all components.
- Remove the coil 3).
- Loosen the two screws 4).
- Move a little the control box and remove the high voltage leads.



**Fig. 16**

## 8 Start-up, calibration and operation of the burner

### 8.1 Notes on safety for the first start-up



The first start-up of the burner must be carried out by qualified personnel, as indicated in this manual and in compliance with the standards and regulations of the laws in force.



Check the correct working of the adjustment, command and safety devices.

### 8.2 Combustion adjustment

In conformity with Efficiency Directive 92/42/EEC the application of the burner on the boiler, adjustment and testing must be carried out observing the instruction manual of the boiler, including verification of the CO and CO<sub>2</sub> concentration in the flue gases, their temperatures and the average temperature of the water in the boiler.



Combustion air is drawn in from outside, meaning there may be notable changes in temperature, which can affect the percentage of CO<sub>2</sub>. You are advised to adjust CO<sub>2</sub> in accordance with the graph featured. Example: outside air temperature 10 °C, adjust CO<sub>2</sub> to 11.6% (± 0.2%).

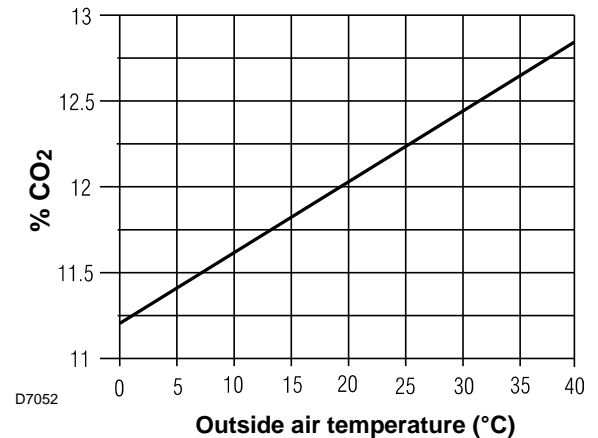


Fig. 17

	Nozzle	GPH	Angle	Pump pressure bar	Burner output kg/h ± 4%	Combustion head adjustment Set-point	Air damper adjustment Set-point
489 T50	GAS OIL	0.75	60°	12	3.0	0.5	1.0
		0.85	60°	12	3.4	0.5	1.4
		1.00	60°	12	4.0	1.5	2.0
		1.10	60°	12	4.4	3.0	2.6
		1.25	60°	12	5.0	4.5	3.0
		1.35	60°	13	5.6	6.0	4.0
	KEROSENE	1.10	60°	7	3.08	0.0	1.1
		1.25	60°	8	3.74	0.0	1.4
		1.35	60°	8	4.04	0.5	1.9
		1.50	60°	8	4.49	1.5	2.2
		1.65	60°	8	4.93	3.0	2.5
		1.75	60°	8	5.23	4.5	3.1
		1.75	60°	10	5.85	6.0	4.0

Tab. E



	Nozzle	Pump pressure	Burner output	Combustion head adjustment	Air damper adjustment			
						GPH	Angle	bar
488 T50	GAS OIL		1.10	60°	12	4.4	2.0	2.8
			1.25	60°	12	5.0	2.5	3.4
			1.35	60°	12	5.4	2.5	3.7
			1.50	60°	12	6.0	3.0	4.3
			1.65	60°	12	6.6	3.0	5.0
			1.75	60°	12	7.0	3.5	5.5
			2.00	60°	12	8.0	4.0	7.5
	KEROSENE		1.65	60°	7	4.65	2.0	2.8
			1.75	60°	8	5.23	2.5	3.1
			2.00	60°	8	5.98	2.5	3.9
			2.25	60°	8	6.73	3.0	5.1
			2.50	60°	8	7.48	3.5	5.9
			2.75	60°	8	8.22	4.0	7.4
			3.00	60°	9	9.51	5.0	8.5

Tab. F

### 8.3 Nozzles installation

The burner complies with the emission requirements of the EN 267 standard.

In order to guarantee that emissions do not vary, recommended and/or alternative nozzles specified by the manufacturer in the Instruction and warning booklet should be used.



It is advisable to replace nozzles every year during regular maintenance operations.



The use of nozzles other than those specified by the manufacturer and inadequate regular maintenance may result into emission limits non-conforming to the values set forth by the regulations in force, and in extremely serious cases, into potential hazards to people and objects.

The manufacturing company shall not be liable for any such damage arising from nonobservance of the requirements contained in this manual.

#### 8.3.1 Nozzles recommended

- Hago type ES - B;
- Delavan type W - B;
- Steinen type S;
- Danfoss type S.

Angle 60°: in most cases.

Angle 80°: in case of flame detachment, during ignitions at low temperatures.

### 8.4 Pump pressure

The pump leaves the factory set for kerosene working.

**10 bar:** maximum pressure for kerosene.

#### For gas oil increase pressure

**12 bar:** pressure suitable for gas oil in most cases.

**14 bar:** improves flame retention; it is therefore suitable for ignitions at low temperatures.

### 8.5 Maintenance position

#### Access to the combustion head, electrodes and nozzle.

- Remove the burner out of the boiler, after loosing the fixing nut to the flange.
- Hook the burner to the flange (1), by removing the blast tube (2) after loosing the fixing screws (3).
- Remove the electrodes assembly (5) from the nozzle holder (4) after loosing its fixing screw (A, Fig. 20).
- Screw the nozzle (6).

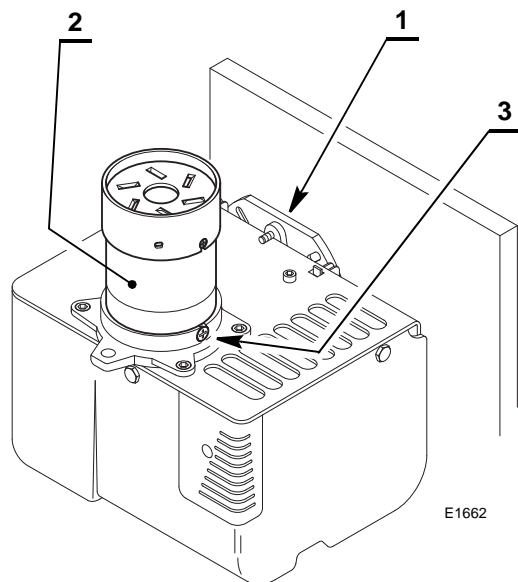


Fig. 18

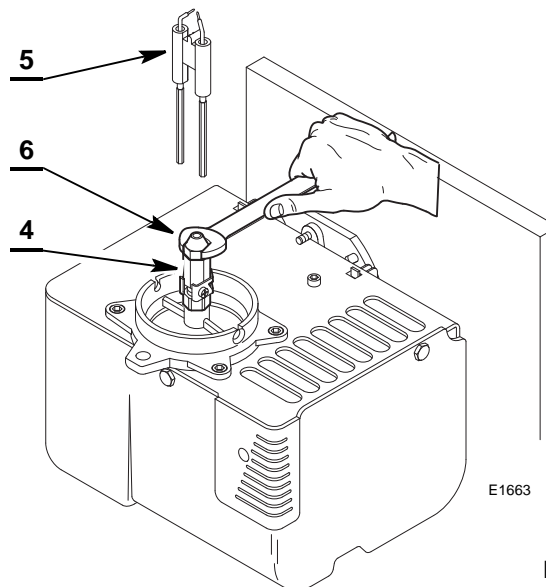


Fig. 19

### 8.6 Air damper adjustment

The settings indicated in the schedule refer to the combustion-chamber with “zero” depression. This regulation is purely indicative.

Each installation however, has its own unpredictable working conditions: actual nozzle output; positive or negative pressure in the combustion-chamber, the need of excess air, etc.

All these conditions may require a different air damper setting.

### 8.7 Electrodes setting



The position of the electrodes cannot be regulated. In case of failure, check that the measurements as shown on the figure are respected.

Before removing or assembling the nozzle, loosen the screw (A, Fig. 20) and move the electrodes ahead.

TYPE	D
489T50	2 – 2.5 mm
488T50	4 ± 0.5 mm

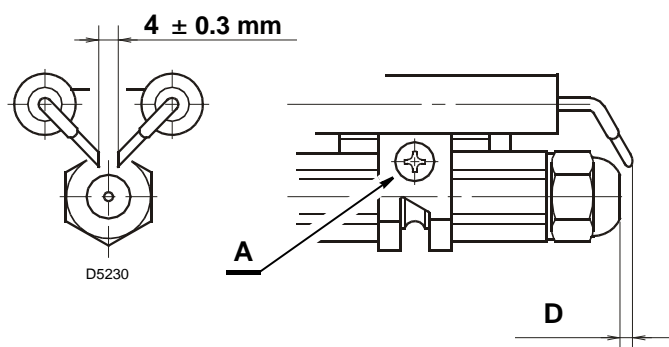


Fig. 20

## 8.8 Combustion head setting

This is done when fitting the nozzle, with the blast tube removed. It depends on the output of the burner and is carried out by rotating the regulating rod, till the terminal plane of the blast tube is level with the set-point, as indicated in the schedule.

### 489 T50

In the sketch on the left, the combustion head is set for an output of 1.65 GPH at 8 bar (for kerosene) or 1.10 GPH at 12 bar (for gas oil).

### 488 T50

In the sketch on the left, the combustion head is set for an output of 1.50 GPH at 12 bar (for gas oil) or 2.25 GPH at 8 bar (for kerosene).

The shutter is level with set-point 3, as required by the schedule at page 19.

Combustion head settings indicated in the schedule are valid for most cases.

The setting of the fan output according to the installation should normally be done only through the air damper.

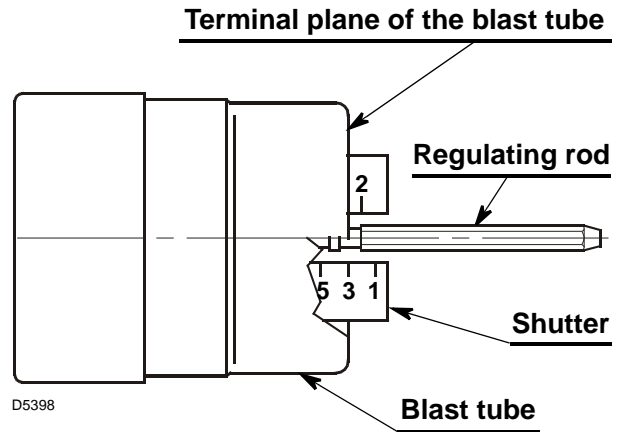


Fig. 21

## 8.9 Burner start-up cycle

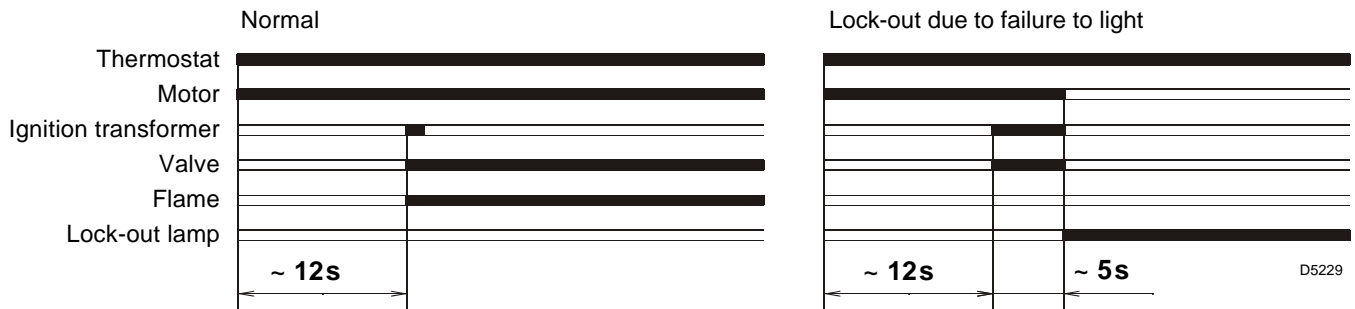


Fig. 22

Lock out is indicated by a lamp on the control box (3, Fig. 1 to page 8)

## 9 Maintenance

### 9.1 Notes on safety for the maintenance

The periodic maintenance is essential for the good operation, safety, yield and duration of the burner.

It allows you to reduce consumption and polluting emissions and to keep the product in a reliable state over time.



The maintenance interventions and the calibration of the burner must only be carried out by qualified, authorised personnel, in accordance with the contents of this manual and in compliance with the standards and regulations of current laws.

Before carrying out any maintenance, cleaning or checking operations:



disconnect the electricity supply from the burner by means of the main switch of the system;



isolate the fuel supply.

### 9.2 Maintenance programme

#### 9.2.1 Maintenance frequency

The combustion system should be checked at least once a year by a representative of the manufacturer or another specialised technician.

#### 9.2.2 Checking and cleaning

##### Combustion head

Open the burner and make sure that all components of the combustion head are in good condition, not deformed by the high temperatures, free of impurities from the surroundings and correctly positioned.

Clean the combustion head in the fuel exit area, on the diffuser disc.

##### Burner

Check for excess wear or loose screws and clean the outside of the burner.

##### Fan

Check to make sure that no dust has accumulated inside the fan or on its blades, as this condition will cause a reduction in the air flow rate and provoke polluting combustion.

##### Photoresistance

Clean the photoresistance.

##### Electrodes

Check the correct position of electrodes

##### Nozzles

It is advisable to replace nozzles every year during regular maintenance operations.

Do not clean the nozzle openings; do not even open them.

##### Filters

Check the filtering baskets on line and at nozzle present in the system. Clean or replace if necessary.

If rust or other impurities are observed inside the pump, use a separate pump to lift any water and other impurities that may have deposited on the bottom of the tank.

##### Pump

Delivery pressure must correspond with the table on Tab. E to page 19. Please check that the supply line and filters are clear. The use of a pump vacuum gauge will assist in this. This measure permits the cause of the anomaly to be traced to either the suction line or the pump.

If the problem lies in the suction line, check to make sure that the filter is clean and that air is not entering the piping.

##### Hoses

- Check periodically the flexible pipes conditions. They have to be replaced at least **every 2 years**.
- In case of use of gas oil and bio fuel blends, it is strongly recommended to inspect **even more frequently** the hoses and replace them where contamination has occurred.
- Check to make sure that the hoses are still in good condition.



The hoses supplied with this burner set for Kerosene use are not suitable for use with Gas oil containing a Bio blend.

Please refer to the spare part list for the specific hoses suitable for bio fuel use.

In case of use with gas oil containing up to 10% Bio blend, it will be essential to use flexible oil lines suitable for bio fuel use.

Please contact Riello for further information.

##### Fuel tank

If water or contamination is present within the fuel tank, it is essential that this is removed before the equipment is to be used. This is extremely important when gas oil containing Bio diesel is in use. If in doubt about how to achieve this then please contact the fuel or oil tank supplier.

##### Boiler

Clean the boiler as indicated in the appliance accompanying instructions in order to maintain all the original combustion characteristics intact, especially the flue gas temperature and combustion chamber pressure.

##### Combustion

In case the combustion values found at the beginning of the intervention do not respect the standards in force or, in any case, do not correspond to a proper combustion, contact the Technical Assistant and have him carry out the necessary adjustments.

Allow the burner to work for 10 min. and then check the combustion readings with the parameters indicated within the appliance instruction manual. **Then carry out a combustion check verifying:**

- Smoke temperature at the chimney;
- Content of CO<sub>2</sub> (%);
- Content of CO (ppm);
- Smoke value according to opacity smokes index according to Bacharach scale.

### 10 Faults / Solutions

Here below you can find some causes and the possible solutions for some problems that could cause a failure to start or incorrect operation of the burner.

A fault usually makes the lock-out lamp light which is situated inside the reset button of the control box (3, Fig. 1 to page 8).

When lock out lamp lights the burner will attempt to light only after pushing the reset button. After this if the burner functions correctly, the lock-out can be attributed to a temporary fault.

If however the lock out continues the cause must be determined and the solution found.

FAULTS	POSSIBLE CAUSES	SOLUTION
The burner will not start when the limit thermostat closes.	Lack of electrical supply.	Check presence of voltage in the L - N clamps of the control box. Check the conditions of the fuses. Check that safety thermostat limit is not lock out.
	The photoresistance sees false light.	Eliminate the light.
	The connections in the control box are wrongly inserted.	Check and connect completely all the plugs.
Burner runs normally in the prepurge and ignition cycle and locks out after 5 seconds ca.	The photoresistance is dirty.	Clean it.
	The photoresistance is defective.	Change it.
	Flame moves away or fails.	Check pressure and output of the fuel. Check air output. Change nozzle. Check the coil of solenoid valve.
Burner starts with an ignition delay.	The ignition electrodes are wrongly positioned.	Adjust them according to the instructions of this manual.
	Air output is too high.	Set the air output.
	Nozzle dirty or worn.	Replace it.



The manufacturer cannot accept responsibility for any damage to persons, animals or property due to error in installation or in the burner adjustment, or due to improper or unreasonable use or non observance of the technical instruction enclosed with the burner, or due to the intervention of un-qualified personnel.





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## EN

### 1. GENERAL INSTRUCTIONS

- Carefully read the instructions contained in this instruction booklet.
- After boiler installation, inform the user regarding its operation and give him this manual, which is an integral and essential part of the product and must be kept with care for future reference.
- Installation and maintenance must be carried out by professionally qualified personnel, according to current regulations and the manufacturer's instructions. Do not carry out any operation on the sealed control parts.
- Incorrect installation or inadequate maintenance can result in damage or injury. The Manufacturer declines any liability for damage due to errors in installation and use or failure to follow the instructions.
- Before carrying out any cleaning or maintenance operation, disconnect the unit from the power supply using the system switch and/or the special cut-off devices.
- In case of a fault and/or poor operation, deactivate the unit and do not attempt to repair it or directly intervene. Contact professionally qualified personnel. Repair/replacement of the products must only be carried out by professionally qualified using original spare parts. Failure to comply with the above could affect the safety of the unit.
- This unit must only be used for its intended purpose. Any other use is considered improper and therefore dangerous.
- The packing materials are potentially hazardous and must not be left within the reach of children.
- The images given in this manual are a simplified representation of the product. In this representation there may be slight and insignificant differences with respect to the product supplied.

### 2. OPERATING INSTRUCTIONS

#### 2.1 Introduction

Dear Customer,

Thank you for choosing a **FERROLI** boiler featuring advanced design, cutting-edge technology, high reliability and quality construction. Please read this manual carefully since it provides important information on safe installation, use and maintenance.

**ATLAS** is a high-efficiency heat generator for the production of heating hot water, suitable for operation with blown oil or gas burners. The boiler shell consists of cast iron elements, assembled with steel stays and double cones, whose profile is specially designed with optimum division of the fins, offering high thermal efficiency and therefore high energy-saving.

#### 2.2 Control panel

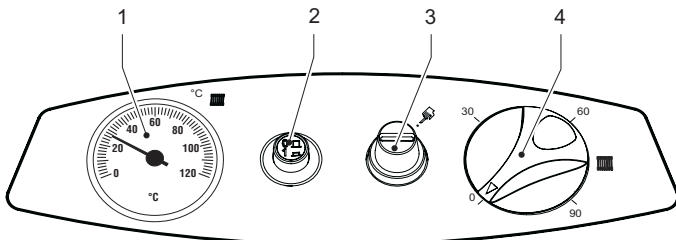


fig. 1 - Control panel for models ATLAS 32-78

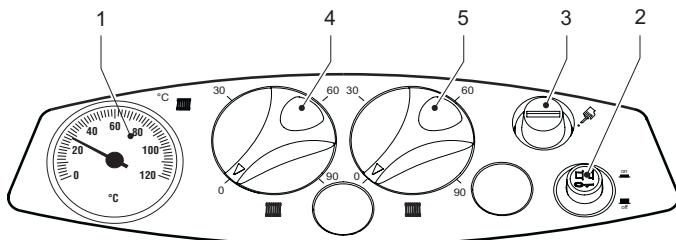


fig. 2 - Control panel for models ATLAS 95

- Key
- 1 = Thermohydrometer
  - 2 = On switch
  - 3 = Manual-reset safety thermostat
  - 4 = 1st stage temperature adjustment knob
  - 5 = 2nd stage temperature adjustment knob

#### 2.3 Turning on and off

##### Boiler lighting

Open the fuel shutoff valves.

Switch on the power to the unit.

Press button 2 of fig. 1 to feed the boiler and burner. Refer to the burner manual for operation.

##### Turning the boiler off

For brief shutdown periods just press button 2 of fig. 1 on the control panel, bringing it to position "0". For long shutdown periods, as well as operating button 2 also close the fuel shutoff valve. To avoid damage caused by freezing during long shutdowns in winter, add a suitable antifreeze to the system or completely drain the system.

### 2.4 Adjustments

#### Heating temperature setting

Set the required system temperature with the control thermostat 4 of fig. 1.

For the model **ATLAS 95**, with the control thermostat **5** then set the temperature of the 2nd stage to a temperature **10°C lower than that of the 1st stage**.

**IMPORTANT:** The temperature setting of the 2nd stage must always be lower than that of the 1st stage.

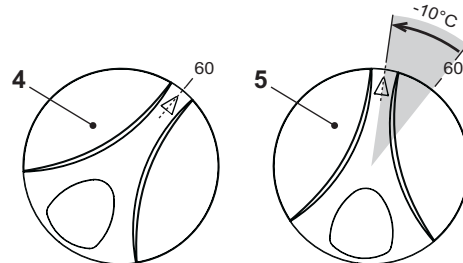


fig. 3 - Temperature adjustment for model ATLAS 95

#### Room temperature adjustment (with optional room thermostat)

Using the room thermostat, set the temperature desired in the rooms. If the room thermostat is not installed the boiler will keep the heating system at its setpoint temperature.

### 3. INSTALLATION

#### 3.1 General Instructions

BOILER INSTALLATION MUST ONLY BE PERFORMED BY QUALIFIED PERSONNEL, IN ACCORDANCE WITH ALL THE INSTRUCTIONS GIVEN IN THIS TECHNICAL MANUAL, THE PROVISIONS OF CURRENT LAW, THE PRESCRIPTIONS OF NATIONAL AND LOCAL STANDARDS AND THE RULES OF PROPER WORKMANSHIP.

#### 3.2 Place of installation

The boiler must be installed in a special room with ventilation openings towards the outside in conformity with current regulations. If there are several burners or extraction units that can work together in the same room, the ventilation openings must be sized for simultaneous operation of all the units. The place of installation must be free of flammable objects or materials, corrosive gases, volatile substances or dusts which, sucked by the burner fan, can obstruct the pipes inside the burner or the combustion head. The room must be dry and not exposed to rain, snow or frost.

If the unit is enclosed in a cabinet or mounted alongside, a space must be provided for removing the casing and for normal maintenance operations. In particular, after boiler installation with burner on the front door, make sure the front door can open freely without the burner striking walls or other obstacles.

#### 3.3 Plumbing connections

The heating capacity of the unit must be previously established by calculating the building's heat requirement according to current regulations. The system must be provided with all the components for correct and regular operation. It is advisable to install shutoff valves between the boiler and heating system allowing the boiler to be isolated from the system if necessary.

The safety valve outlet must be connected to a funnel or collection pipe to prevent water spurting onto the floor in case of overpressure in the heating circuit. Otherwise, if the discharge valve cuts in and floods the room, the boiler manufacturer cannot be held liable.

Do not use the water system pipes to earth electrical appliances.

Before installation, carefully wash all the pipes of the system to remove any residuals or impurities that could affect proper operation of the unit.

Carry out the relevant connections according to the diagram in and the cap. 5 symbols given on the unit.

The unit is not supplied with an expansion tank; its connection must therefore be carried out by the installer. The pressure in the system, when cold, must be 1 bar.

#### Water system characteristics

In the presence of water harder than 25° Fr (1°F = 10ppm CaCO<sub>3</sub>), use suitably treated water in order to avoid possible scaling in the boiler. Treatment must not reduce the hardness to values below 15°F (Decree 236/88 for uses of water intended for human consumption). Treatment of the water used is indispensable in case of very large systems or with frequent introduction of replenishing water in the system.

If water softeners are installed at the boiler cold water inlet, make sure not to reduce the water hardness too much, as this could cause early deterioration of the magnesium anode in the hot water tank.

**Antifreeze system, antifreeze fluids, additives and inhibitors**

The boiler is equipped with an antifreeze system that turns on the boiler in heating mode when the system delivery water temperature falls under 6°C. The device will not come on if the electricity and/or gas supply to the unit are cut off. If it becomes necessary, it is permissible to use antifreeze fluid, additives and inhibitors only if the manufacturer of these fluids or additives guarantees they are suitable for this use and cause no damage to the heat exchanger or other components and/or materials of the boiler unit and system. It is prohibited to use generic antifreeze fluid, additives or inhibitors that are not expressly suited for use in heating systems and compatible with the materials of the boiler unit and system.

**3.4 Burner connection**

An oil or gas burner, with blown air for pressured furnaces, can be used if its operation characteristics are suitable for the size of the boiler furnace and its overpressure. The choice of burner must be made beforehand, following the manufacturer's instructions, according to the work range, fuel consumption and pressures, as well as the length of the firebox. Install the burner in compliance with the Manufacturer's instructions.

**3.5 Electrical connections**

**Connection to the electrical grid**



The unit's electrical safety is only guaranteed when correctly connected to an efficient earthing system executed according to current safety standards. Have the efficiency and suitability of the earthing system checked by professionally qualified personnel. The manufacturer is not responsible for any damage caused by failure to earth the system. Also make sure that the electrical system is adequate for the maximum power absorbed by the unit, as specified on the boiler dataplate.

The boiler is prewired and provided with a Y-cable and plug for connection to the electricity line. The connections to the grid must be made with a permanent connection and equipped with a bipolar switch whose contacts have a minimum opening of at least 3 mm, interposing fuses of max. 3A between the boiler and the line. It is important to respect the polarities (LINE: brown wire / NEUTRAL: blue wire / EARTH: yellow-green wire) in making connections to the electrical line. During installation or when changing the power cable, the earth wire must be left 2 cm longer than the others.



The user must never change the unit's power cable. If the cable gets damaged, switch off the unit and have it changed solely by professionally qualified personnel. If changing the electric power cable, use solely "HAR H05 VV-F" 3x0.75 mm2 cable with a maximum outside diameter of 8 mm.

**Accessing the electrical terminal block**

Undo the two screws "A" located on the top part of the control panel and remove the cover "B".

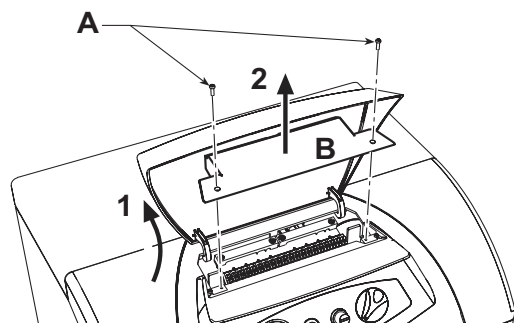


fig. 4 - Accessing the terminal block

**3.6 Connection to the flue**

The unit must be connected to a flue designed and built in compliance with current regulations. The pipe between the boiler and flue must be made from material suitable for the purpose, i.e. heat and corrosion resistant. Ensure the seal at the joints and insulate the entire pipe between boiler and flue, to prevent the formation of condensate.

**4. SERVICE AND MAINTENANCE**

All adjustment, conversion, start-up and maintenance operations described below must only be carried out by Qualified Personnel (meeting the professional technical requirements prescribed by current regulations) such as those of the Local After-Sales Technical Service.

FERROLI declines any liability for damage and/or injury caused by unqualified and unauthorised people tampering with the unit.

**4.1 Adjustments**

**Burner adjustment**

Boiler efficiency and correct operation depend above all on accurate burner adjustments. Carefully follow the Manufacturer's instructions. The two-stage burners must have the first stage adjusted to a power level not below the boiler's rated min. power. The power of the second stage must not be higher than the boiler's rated max. power.

**4.2 Start-up**



Checks to be made at first lighting and after all maintenance operations that involved disconnecting from the systems or an operation on safety devices or parts of the boiler:

**Before lighting the boiler**

- Open any on-off valves between the boiler and the systems.
- Check the seal of the fuel system.
- Check correct prefilling of the expansion tank.
- Fill the water system and make sure that all air contained in the boiler and the system has been vented, by opening the air valve on the boiler and any air valves on the system.
- Make sure there are no water leaks in the system, domestic hot water circuits, connections or boiler.
- Check correct connection of the electrical system and efficiency of the earthing system
- Make sure there are no flammable liquids or materials in the immediate vicinity of the boiler

**Checks during operation**

- Light the unit on as described in sec. 2.3.
- Make sure the fuel circuit and water systems are tight.
- Check the efficiency of the flue and air/fume ducts while the boiler is working.
- Make sure the water is circulating properly between the boiler and the systems.
- Check proper lighting of the boiler by doing several tests, turning it on and off with the room thermostat or remote control.
- Make sure the fuel consumption indicated on the meter matches that given in the technical data table on sec. 5.3.
- Make sure the fumebox and burner door are tight.
- Make sure the burner works properly. This check must be made with the special instruments, following the manufacturer's instructions.

**4.3 Maintenance**

**Periodical check**

To ensure correct operation of the unit over time, have qualified personnel carry out a yearly check, providing for the following:

- The control and safety devices must function correctly.
- The fume evacuation circuit must be perfectly efficient.
- Make sure there are no obstructions or dents in the fuel supply and return pipes.
- Clean the filter of the fuel suction line.
- Measure the correct fuel consumption
- Clean the combustion head in the fuel outlet zone, on the swirl disc.
- Leave the burner on at max. for about ten minutes, then analyse the combustion, checking:
  - Correct setting of the elements specified in this manual.
  - Temperatures of fumes at the flue
  - CO<sub>2</sub> percentage content
- The air/fume terminal and ducts must be free of obstructions and leaks
- The burner and exchanger must be clean and free of deposits. For cleaning do not use chemical products or wire brushes.
- The fuel and water systems must be tight.
- The water pressure in the system when cold must be approx. 1 bar; otherwise bring it to that value.
- The circulating pump must not be blocked.
- The expansion tank (not supplied) must be filled.



The boiler casing, control panel and aesthetic parts can be cleaned with a soft damp cloth, if necessary soaked in soapy water. Do not use any abrasive detergents and solvents.

**Boiler cleaning**

1. Disconnect the power supply to the boiler.
2. Remove the front top and bottom panel.
3. Open the door by undoing the knobs.
4. Clean the inside of the boiler and the entire path of exhaust fumes, using a tube brush or compressed air.
5. Then close the door, securing it with the knob.

To clean the burner, refer to the Manufacturer's instructions.

**4.4 Troubleshooting**

**Fault**

Two shutdown conditions resettable by the user can occur :

- A** Burner shutdown signalled by the special indicator. Refer to the burner manual.
- B** Cutting in of the safety thermostat, which occurs when the boiler temperature reaches a value beyond which a dangerous condition may be created. To restore operation, unscrew cap 3 of fig. 1 and press the reset button below.

If the problem persists, request the assistance of Qualified Personnel or the After-Sales Centre.

In case of a fault and/or poor operation, deactivate the unit, do not try to fix the problem or directly carry out any operation. Contact authorised and professionally qualified personnel.

## 5. TECHNICAL DATA AND CHARACTERISTICS

### 5.1 Dimensions, connections and main components

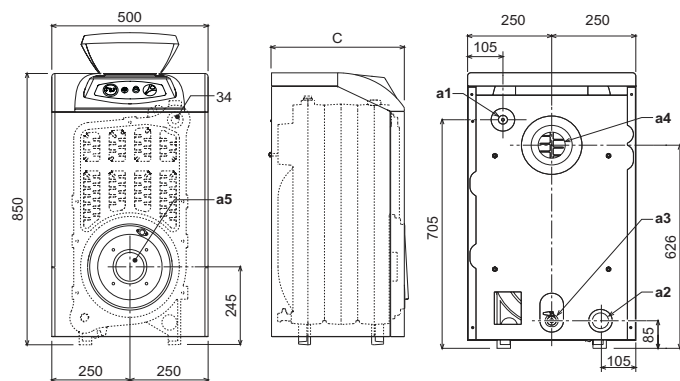


fig. 5 - Dimensions, connections and main components

Model	C mm	a4 Ø mm	a5 Ø mm
ATLAS 32	400	120+130	115
ATLAS 47	500	120+130	115
ATLAS 62	600	120+130	115
ATLAS 78	700	120+130	115
ATLAS 95	800	120+130	115

- a1 System delivery - 1" 1/2"
- a2 System return - 1" 1/2"
- a3 Heating system drain - 1/2"
- a4 Flue connection
- a5 Burner connection
- 34 Safety and heating temperature bulb

### 5.2 Pressure loss

#### Pressure loss water side

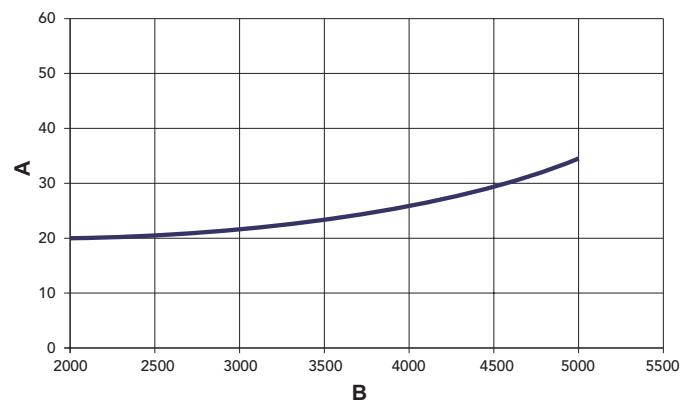


fig. 6 - Pressure loss

- A mbar
- B Flowrate l/h

### 5.3 Technical data table

Model		ATLAS 32	ATLAS 47	ATLAS 62	ATLAS 78	ATLAS 95	
Number of elements	no.	3	4	5	6	7	
Max. heating capacity	kW	34.9	51.6	67.7	85.6	103	(Q)
Min. heating capacity	kW	17.0	34.3	45.8	59.0	70.8	(Q)
Max. heat output in heating	kW	32	47	62	78	95	(P)
Min. heat output in heating	kW	16	32	43	55	66	(P)
Efficiency Pmax (80-60°C)	%	91.7	91.1	91.5	91.1	92	
Efficiency 30%	%	94.3	93.5	94.0	93.5	94.0	
Efficiency class Directive 92/42 EEC		★ ★					
Max. working pressure in heating	bar	6	6	6	6	6	(PMS)
Min. working pressure in heating	bar	0.8	0.8	0.8	0.8	0.8	
Max. heating temperature	°C	95	95	95	95	95	(tmax)
Heating water content	litres	18	23	28	33	38	
Protection rating	IP	X0D	X0D	X0D	X0D	X0D	
Power supply voltage	V/Hz	230/50	230/50	230/50	230/50	230/50	
Empty weight	kg	127	166	205	244	283	
Combustion chamber length	mm	350	450	550	650	750	
Combustion chamber diameter	mm	300	300	300	300	300	
Pressure loss fume side	mbar	0.27	0.3	0.45	0.4	0.63	

5.4 Wiring diagram

Main wiring diagram ATLAS 32-78

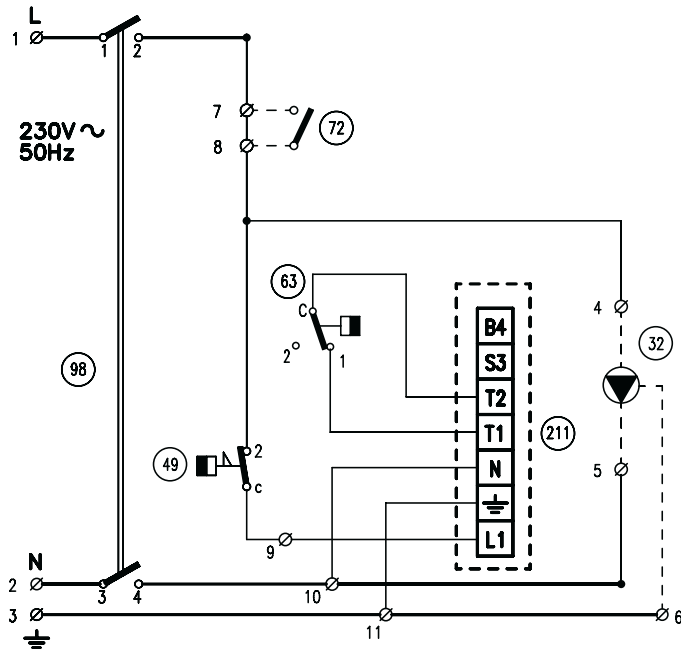


fig. 7 - Main wiring diagram ATLAS 32-78

Key fig. 7 and fig. 8

- 32 Heating circulating pump (not supplied)
- 49 Safety thermostat
- 72 Room thermostat (not supplied)
- 63 Boiler control thermostat
- 98 Switch
- 211 Burner connector (not supplied)

Electrical connection diagram ATLAS 32-78

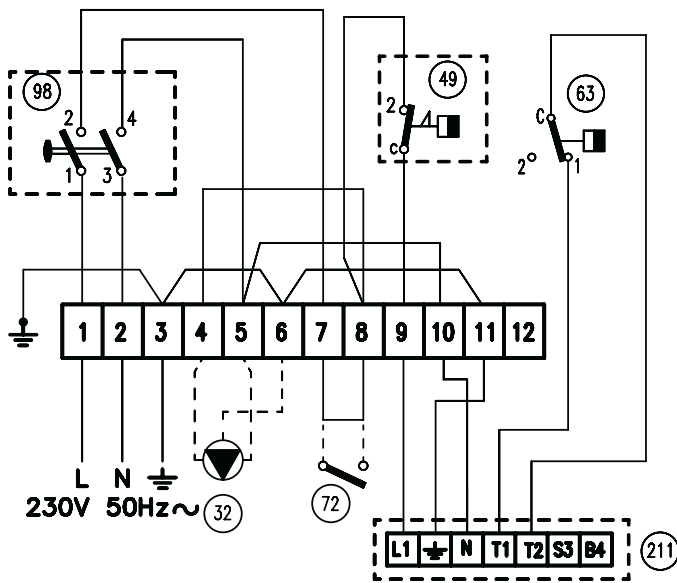


fig. 8 - Electrical connection diagram ATLAS 32-78

Main wiring diagram ATLAS 95

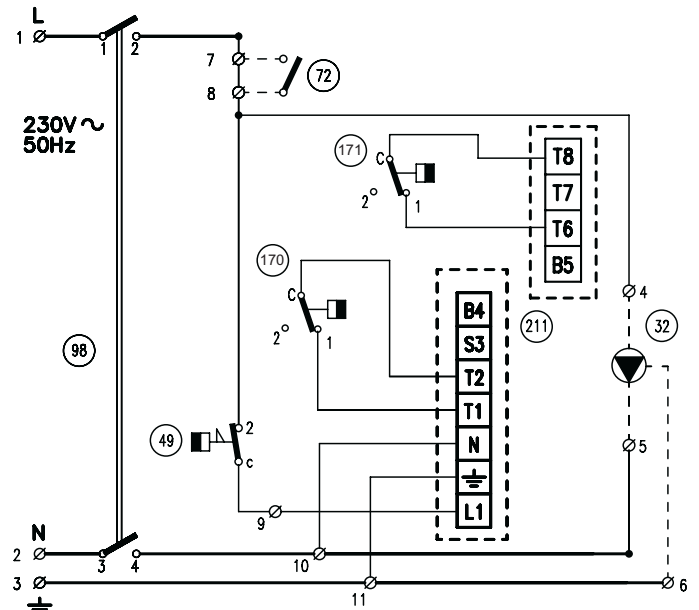


fig. 9 - Main wiring diagram ATLAS 95

Key fig. 9 and fig. 10

- 32 Heating circulating pump (not supplied)
- 49 Safety thermostat
- 72 Room thermostat (not supplied)
- 98 Switch
- 170 1st Stage boiler control thermostat
- 171 2nd Stage boiler control thermostat
- 211 Burner connector (not supplied)

Electrical connection diagram ATLAS 95

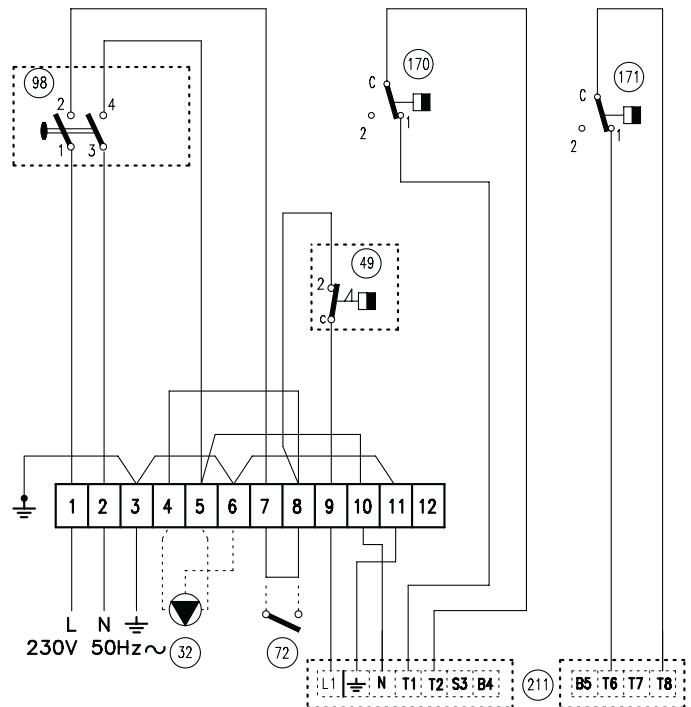


fig. 10 - Electrical connection diagram ATLAS 95



# Operator Manual

Cummins **Onan**

Performance you rely on.™



## Commercial Mobile Generator Set

HDKBB (Spec A–F)

HDKBC (Spec D–F)

**California**

**Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.



**WARNING**



Do not use this genset on a boat  
Such use may violate U. S. Coast Guard  
regulations and can result in  
severe personal injury or death from  
fire, electrocution, or  
carbon monoxide poisoning



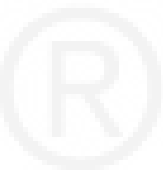
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# SAFETY PRECAUTIONS

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Thoroughly read the OPERATOR'S MANUAL before operating the genset. Safe operation and top performance can only be obtained when equipment is properly operated and maintained.

Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards shall remove, dismantle and dispose of the generator set. See service manual.

Some generator set installation procedures present hazards that can result in severe personal injury or death. Only trained and experienced personnel with knowledge of fuels, electricity, and machinery hazards should perform generator set installation procedures

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

**⚠ DANGER** Used to alert you to a lethal hazard against which you must take steps to prevent severe personal injury or death, as when you are in the vicinity of High Voltage equipment.

**⚠ WARNING** Used to alert you to a hazard or unsafe practice that can result in severe personal injury or death.

**⚠ CAUTION** Used to alert you to a hazard or unsafe practice that can result in personal injury or equipment damage.

Electricity, fuel, exhaust, moving parts and batteries present hazards which can result in severe personal injury or death.

## ENGINE EXHAUST IS DEADLY

- Inspect for exhaust leaks at every startup and after every eight hours of running.
- Learn the symptoms of carbon monoxide poisoning in the genset Operator's Manual.
- Never sleep in the vehicle while the genset is running unless the vehicle is equipped with a working carbon monoxide detector.
- Do not operate the genset when the vehicle is parked in a confined space, such as a garage.
- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic

starting device before storing the vehicle or parking it in a garage or other confined space.

- The exhaust system must be installed in accordance with the genset Installation Manual.
- Engine cooling air must not be used for heating the vehicle.

## GENERATOR VOLTAGE IS DEADLY

- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before servicing the genset.
- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.

**⚠ WARNING** *Interconnecting the generator set and shore power can lead to electrocution or utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.*

- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

## DIESEL FUEL IS COMBUSTIBLE

- Do not smoke or turn electrical switches ON or OFF where fuel fumes are present or in areas sharing ventilation with fuel tanks or equipment. Keep flames, sparks, pilot lights, arc-producing equipment and all other sources of ignition well away.
- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.

## MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before servicing the genset.
- Do not wear loose clothing or jewelry near moving parts such as PTO shafts, fans, belts and pulleys.
- Keep hands away from moving parts.
- Keep guards in place over fans, belts, pulleys, and other moving parts.

## BATTERY GAS IS EXPLOSIVE

- Wear splash-proof safety glasses.
- Do not smoke or permit flames or sparks to occur near the battery at any time.
- To reduce arcing when disconnecting or reconnecting battery cables, always disconnect the negative (-) battery cable first and reconnect it last.

## FLAMMABLE VAPOR CAN CAUSE A DIESEL ENGINE TO OVERSPEED

**⚠WARNING** *Do not operate a diesel-powered genset where a flammable vapor environment can be created by fuel spill, leak, etc.*

Flammable vapor can cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. The owners and operators of the genset are solely responsible for operating the genset safely.

## GENERAL PRECAUTIONS

- Keep children away from the genset.
- Do not use evaporative starting fluids. They are highly explosive.
- To prevent accidental or remote starting while working on the genset, disconnect the negative (-) battery cable at the battery.
- Keep the genset and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Make sure all fasteners are secure and torqued properly.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- Used engine oil has been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.

- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep multi-purpose fire extinguishers handy. Multi-purpose fire extinguishers are used for fires that involve ordinary combustible materials such as wood and cloth; combustible and flammable liquid fuel and gaseous fuels; live electrical equipment. (North America or US: ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.
- Generator sets with a sound shield shall not be run with the service doors remove/missing.
- Engine components can be hot and cause severe burns. Hot coolant under pressure can spray and cause severe burns.
- Use personal protective equipment when performing periodic maintenance operations such as gloves, safety glasses, etc.

## THE HAZARDS OF CARBON MONOXIDE

**⚠WARNING** *Engine-driven generators can produce harmful level of carbon monoxide that can injure or kill you.*

## ONLY YOU CAN PROTECT YOURSELF FROM CO POISONING!

- Watch constantly for people near the exhaust of the generator set while it is running.
- Make sure exhaust cannot enter the living quarters through a window, vent or door.
- Make sure all CO detectors or audible alarms are working properly.
- Pay attention to the signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction and leaks each time you start the generator set and every eight hours if you run it continuously.

## SUBSTANCE HAZARDOUS TO HEALTH

Generator sets use substances, and emit and create wastes that can cause health risks. Generator set operators must use appropriate personal protective equipment (such as clothing, gloves, protective glasses/goggles, and respiration equipment) when exposed to fuel, oil, coolant, wet batteries, grease, cleaning agents, or other substances exposed to lungs, eyes, or skin. Use appropriate containers for transport, storage, and disposal of waste substances. Follow local regulations for disposal and recycling.

### ANTIFREEZE (FLEETGUARD – ES COMPLEAT/EG PREMIX)

This antifreeze is also known as an ethylene glycol based coolant; summer coolant; coolant additive. It is purple coloured, viscous liquid, with a mild chemical odour, is soluble in water and harmful. It contains ethylene glycol, and diethylene glycol. Ethylene glycol is a potentially hazardous constituent.

The substance has a boiling point of 107° C, and a flash point of 121° C.

It is used as an engine coolant additive, and can be found in engine cooling systems, and head exchangers. Installers, operators and maintainers are likely to encounter this substance.

### HAZARDOUS REACTIONS

Ethylene glycol is combustible when exposed to heat or flame and can react vigorously with oxidants. Moderate explosive hazard in form of vapour when exposed to heat or flame. Hazardous products resulting from combustion or decomposition include carbon monoxide, carbon dioxide and acrid smoke. Self-contained breathing apparatus must be worn in the event of fume build up.

Avoid strong oxidizing agents – incompatible with sulfuric acid, nitric acid, caustics and aliphatic amines.

It may cause neurological signs and symptoms, and kidney damage. It is also a skin and eye irritant.

Very toxic in particulate form upon inhalation. Harmful if swallowed, lethal dose for humans reported to be 100ml.

## PROTECTIVE MEASURES

Refrain from eating, drinking or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapour, or particulate, use a suitable organic vapour mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

### STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight, away from naked flames and strong acids, do not freeze. Store well away from food-stuffs and drinking water. Take special care to avoid discharge into drains, sewers and water-courses.

Contain leak/spill with sand, earth or non-combustible, absorbent material to prevent entry of substance into drainage/sewerage system, water-courses and land. Eliminate all ignition sources, use plastic shovel to transfer to suitable container and dispose of unwanted or absorbed substance through authorized contractor to a licensed site.

### EMERGENCY ACTION

- Fire  
Extinguishing media: CO<sub>2</sub>, alcohol resistant foam, dry powder, or water spray.  
Fire fighters to use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterways, drains and drinking water supplies.
- Ingestion  
Toxic by ingestion. If swallowed induce vomiting only under the advice of a Doctor or poison control centre. Delayed treatment may result in fatality.
- Inhalation (of vapour)  
Remove from further exposure. In case of irritation to lungs or throat, seek medical advice.
- Aspiration (inhalation of liquid)  
Obtain immediate medical assistance.
- Eyes  
Flush copiously with water or preferably eye-

wash solution for at least five minutes. Seek medical advice.

- Skin  
Wash thoroughly with soap and water, and seek medical attention if irritation develops. Change clothing if necessary and wash before re-use.
- Spillage  
Soak-up using an absorbent material and dispose of this as directed under Storage/Transport (Section 5.1.3)

## **GAS OIL**

This product is also known as Red Diesel, Fuel Oil, and type A1 or A2. It can be pale red or a clear liquid with a characteristic mild odour. It contains catalytically cracked oil, petroleum distillates, quinizarin, and gas oil maker dye red. The catalytically cracked oil and petroleum distillates are potentially hazardous constituents.

The substance has an initial boiling point of 180°C, a flash point greater than 56°C, and a vapour pressure less than 0.7mm Hg at 20°C and has negligible solubility in water.

It is used as a fuel for off-road diesel powered vehicles and stationary engines, and can be found in fuel tanks, pipes and injection systems. The substance should not be used for any other purpose without contacting the manufacturer or supplier. Installers, operators and maintainers are likely to encounter this substance.

## **HAZARDOUS REACTIONS**

This liquid is flammable. Avoid smoking, heat sources, such as welding and naked flames, sparks and static electricity build-up. Thermal decomposition products are hazardous, containing CO<sub>x</sub>, NO<sub>x</sub> and SO<sub>x</sub> compounds.

The vapour is explosive. High vapour concentrations can cause respiratory irritation, dizziness, nausea, and loss of consciousness. Excessive and prolonged exposure to the mist can cause chronic inflammatory reaction of the lungs and form of pulmonary fibrosis.

Avoid strong oxidising agents, e.g. chlorates which may be use in agriculture.

Gas oil is slightly irritating to the skin and has a de-fatting action. Toxicity following single exposure to high level of gas oil is of low order. Prolonged, repeated skin contact may de-fat the skin resulting in possible skin irritation and dermatitis. In some cases warty, cancerous growths have occurred.

## **PROTECTIVE MEASURES**

Ensure good ventilation and avoid heat sources. Observance of good housekeeping rules will ensure general safety. Do not smoke. Avoid breathing mist.

When working on, or testing, injection equipment, special care is required to avoid perforation of skin by high pressure fuel. Use eye protection in the event of suspected high pressure leak.

Adopt a high standard of personal hygiene. In the case of skin contact, wash well with soap and water.

Use glove and overalls, and eye protection goggles if there is a risk of splashing. Use oil impervious gloves and avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly. Contaminated clothing should be removed, soaked with water, and laundered before re-use.

No special respiratory precautions are necessary in normal use.

DO NOT use as a solvent for removing dirt/grease etc, from skin.

## **STORAGE/TRANSPORT**

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight and away from naked flames. Electrical continuity is required between the transport and storage vessels during product transfer.

Contain leak/spill with sand, earth or other suitable material, and prevent entry of substance into drainage/sewerage system, water-courses and land. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

Inform local and fire authorities should the product reach waterways, drains etc.

## EMERGENCY ACTION

- Fire  
Extinguishing media:  
Large fire – Foam/water fog. Never use water jet.  
Small fire – foam/dry powder, AAAF, CO<sub>2</sub>, sand, earth.  
Avoid making sparks. Fire fighters to use self-contained breathing apparatus. Keep fire exposed containers cool, using water fog/spray. Prevent run-off from entering waterway, drains and drinking water supplies.
- Ingestion  
Do not induce vomiting. Wash the mouth out with water, and send to hospital immediately.
- Inhalation (of vapour)  
Remove from further exposure. Obtain medical assistance immediately.
- Aspiration (inhalation of liquid)  
If, following ingestion of gas oil, vomiting occurs, there is danger of aspiration into the lungs. This would cause intense local irritation and chemical pneumonitis that can be fatal. Obtain immediate medical assistance.
- Eyes  
Irrigate copiously with water or preferably eye-wash solution for at least five minutes. If irritation persists seek medical advice.
- Skin  
Wash thoroughly with soap and water. Change clothing if necessary.  
If high pressure injection has occurred prompt surgical attention is required.
- Spillage  
Absorb using sand, earth or other suitable material. Dispose of unwanted or absorbed flammable material as directed under Storage/Transport (Section 5.7.3).

## LUBRICATION OIL – PREMIUM BLUE E 15W40

Also known as oil, lube oil, sump oil, new oil is dark, viscous liquid with a slight, characteristic odour. The base oil contains: distillates (petroleum), solvent-dewaxed heavy paraffinic. It is not classified as dangerous according to Directive 1999/45/EC and its amendments, and is not classified according to the EU regulations.

It has a boiling point greater than 150°C, a flash point Open Cup of 220°C (Cleveland), and is insoluble in cold water.

It is used in engine lubricant oil systems, sump pan and filters, make-up tanks and piping systems as a lubrication oil for use in wide range of diesel engines operating under severe conditions. Installers, operators and maintainers are likely to encounter this product.

## HAZARDOUS REACTIONS

This product is stable although slightly re-active with oxidising agents. Results of decomposition are carbon oxides (CO, CO<sub>2</sub>) and water.

Although harmful if swallowed or aspirated (breathed in), repeated or prolonged exposure is not known to aggravate medical conditions.

Used oil may contain harmful combustion by-products and unburnt fuel that will cause skin reactions as detailed for fuel. Particular care must be taken if oil from a severely overheated engine is handled – use impervious gloves, lab coat and safety glasses.

Do not breathe vapour/spray.

## PROTECTIVE MEASURES

Ensure good ventilation and avoid heat sources.

Adopt a high standard of personal hygiene. In case of skin contact, wash thoroughly with soap and water.

Use safety glasses, impervious gloves and lab coat. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

No special respiratory precautions are necessary in normal use. Do not breathe vapour/spray when handling hot materials.

## STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers tightly sealed when not in use. Keep in a cool, well ventilated area, out of sunlight and away from naked flames. Store well away from food-stuffs and drinking water.

Wear splash goggles, full suit, boots and gloves. Absorb leak/spill with an inert material and dispose of unwanted or absorbed substance through an authorized contractor to a licensed site. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

## EMERGENCY ACTION








- Fire  
Extinguishing media:  
Large fire – Use water spray, fog or foam. Do not use water jet.  
Small fire – Use dry chemical powder or CO<sub>2</sub>  
Fire-fighters to use self contained breathing apparatus and full turnout gear. Keep fire exposed containers cool.
- Ingestion  
Do not induce vomiting, Obtain medical advice immediately.
- Inhalation (of vapour)  
Remove from further exposure. Obtain medical attention.
- Aspiration (inhalation of liquid)  
Obtain immediate medical assistance.
- Eyes  
Flush copiously with water or preferably eye-wash solution for at least fifteen minutes. Obtain medical advice.
- Skin  
Wash thoroughly with soap and water. Obtain medical advice if irritation develops. Change clothing if necessary and wash before re-use.
- Spillage  
Absorb with an inert material and dispose of this as directed under Storage/Transport.





## Generator Set Warning Labels

Warning signs are provided on the generator set at or near the point of risk. To avoid injury, always take the necessary precautions – as indicated on the sample signs shown below:

	Caution / Warning. Indicates a risk of personal injury.
	Caution / Warning of Temperature Hazard. Indicates a risk of personal injury from high temperature.
	Caution / Warning of High Voltage Hazard. Indicates a risk of personal injury from electric shock/electrocution.
	Caution / Warning. Indicates a risk of personal injury from equipment that may be subject to automatic starting or remote starting.
	Caution / Warning. Indicates to read Operator manual for additional information.
	Caution / Warning of Belt and Rotating Part Hazard. Indicates a risk of personal injury from entanglement in moving parts.
	Caution / Warning of Pressure Hazard. Indicates a risk of personal injury from pressurized fluids.

# 1.Introduction

## ABOUT THIS MANUAL

This is the Operator Manual for the generator sets (gensets) listed on the front cover. Read and carefully observe all of the instructions and precautions in this manual. Keep this manual with the other vehicle manuals.

*Operation, Periodic Maintenance and Troubleshooting* provide the instructions necessary for operating the genset and maintaining it at top performance. The owner is responsible for performing maintenance in accordance with the PERIODIC MAINTENANCE SCHEDULE (Page 20).

**⚠WARNING** *This genset is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or an alarm system must be used if genset operation is critical.*

**⚠WARNING** *This generator set is not “ignition protected” and shall not be used in a flammable vapor environment.*

**⚠WARNING** *Improper service or replacement of parts can lead to severe personal injury or death and to damage to equipment and property. Service personnel must be qualified to perform electrical and mechanical service.*

*Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.*

## MODEL IDENTIFICATION

Be ready to provide the genset model and serial numbers on the nameplate when contacting Cummins Onan for parts, service or information. Figure 1 illustrates the nameplate and its location. The gray boxes illustrate where to look for the model and serial numbers.

Record these numbers in the figure that they are easy to find when needed. Each character in these numbers is significant. The last character of the model number is the specification letter, which is important for obtaining the right parts. Genuine Cummins Onan

replacement parts are recommended for best results. Refer to the genset Parts Catalog.

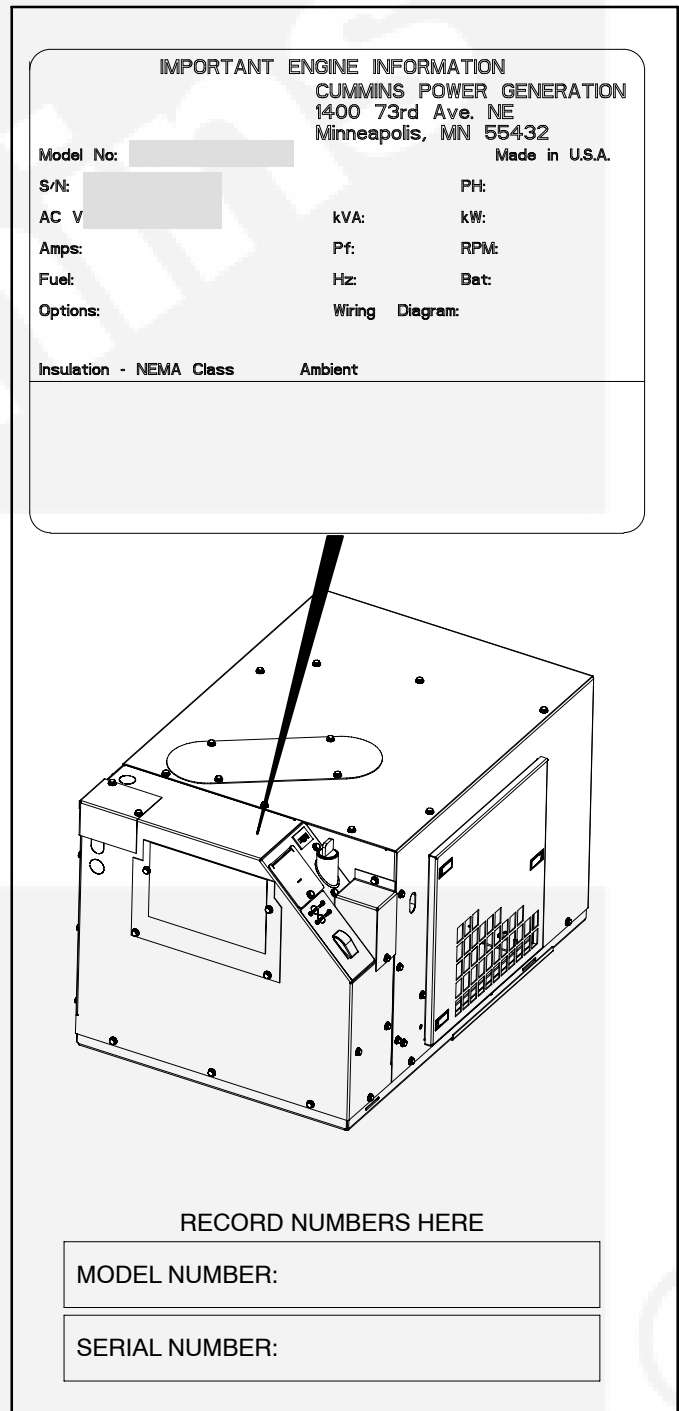


FIGURE 1. TYPICAL NAMEPLATE

## NOISE

Generator sets emit noise. As noise level and time of exposure increase, risk of hearing damage increases. The Specifications page in the Operator manual states noise level for this generator set. Select and use personal hearing protection appropriate for your exposure to generator set noise.

Note for use in countries where compliance to the EU Noise directive is required: This generator set has not been evaluated and is not marked for use in open air. Install the generator set in accordance with the Installation manual. Obey local noise restrictions when you operate the generator set.

## ELECTROMAGNETIC COMPATIBILITY

Generator sets emit and receive electromagnetic (radio frequency) energy. If the generator set affects operation of nearby devices, or nearby devices affect generator set operation, increase the distance between them.

Note for use in countries where compliance to the EMC directive is required: This generator set has been evaluated for use in residential, commercial, and light industrial environments.

## ENGINE EMISSIONS COMPLIANCE

Labels that state compliance with applicable engine emissions regulations are located on the side of the engine valve cover and in the lower left hand corner on the front of the genset. Refer also to the FEDERAL EMISSION DESIGN AND DEFECT LIMITED WARRANTY FOR C. I. ENGINES (DIESELS) that was shipped in the same package as the Operator Manual.

## FUEL RECOMMENDATIONS

**⚠️WARNING** *Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near fuel tanks or fuel-burning equipment or in areas sharing ventilation with such equipment. Keep flames, sparks, pilot flames, electrical arcs and switches and all other sources of ignition well away. Keep a multi-class ABC fire extinguisher handy.*

High quality diesel fuel is necessary for good performance and long engine life.

- The specifications for the type and sulfur content (ppm, % weight) of the diesel fuel used must

comply with all emissions regulations applicable in the areas where the genset is to be operated.

- Diesel fuels meeting ASTM D975 or EN 590 specifications are recommended. Use Grade 1-D diesel fuel where ambient temperatures are below 14° F (–10° C). A minimum Fuel Cetane Rating of 45 is recommended. Where ambient temperatures are below –4 F (–20° C), or the elevation is above 5000 ft (1500 m), a minimum Cetane Rating of 50 is recommended.
- Current US EPA regulations for Non-Road engines limit diesel fuel sulfur content to a maximum of 500 ppm (0.05% weight). Therefore, use Grade 2-D S500 or 2-D S15 diesel fuel. Where ambient temperatures are below 14° F (–10° C), use Grade 1-D S500 or 1-D S15 diesel fuel. Note that beginning in year 2010, US EPA regulations for Non-Road engines will limit diesel fuel sulfur content to a maximum of 15 ppm (0.0015% weight).
- Do not use diesel fuel having a sulfur content greater than 10,000 ppm (1.0% weight).
- Diesel fuel must meet the ASTM D975 standard for lubricity and pass a minimum load level of 3100 grams as measured by ASTM D6078, or maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156–1.
- B5 Bio-Diesel fuel that meets industry specifications and quality is suitable for use with this genset.

## ENGINE OIL RECOMMENDATIONS

### Oil Performance Class

Use API (American Petroleum Institute) classified engine oils according to the following guidelines:

- **Emissions-Regulated Areas:** It is mandatory to use CF, CF–4, CG–4, CH–4 or CI–4 class oil with low sulfur fuel (sulfur content less than 500 ppm, 0.05% weight) or ultra low sulfur fuel (sulfur content less than 15 ppm, 0.0015% weight).
- **Non-Regulated Areas:** CF class oil is recommended when using high sulfur fuel—sulfur content between 500 ppm (0.05% weight) and 5000 ppm (0.5% weight). If CF–4, CG–4, CH–4 or CI–4 class oil is used, the oil and oil filter must be changed twice as often as specified in the PERIODIC MAINTENANCE SCHEDULE (Page 20).

- **Non-Regulated Areas:** Use CF, CF-4, CG-4, CH-4 or CI-4 class oil when using high sulfur fuel—sulfur content between 5000 ppm (0.5% weight) and 10,000 ppm (1.0% weight). The oil and oil filter must be changed twice as often as specified in the PERIODIC MAINTENANCE SCHEDULE (Page 20).

### Oil Viscosity

Look for the SAE (Society of Automotive Engineers) viscosity grade. Referring to Figure 2, choose the viscosity grade appropriate for the ambient temperatures expected until the next scheduled oil change. Multi-grade oils such as SAE 15W-40 are recommended for year-round use.

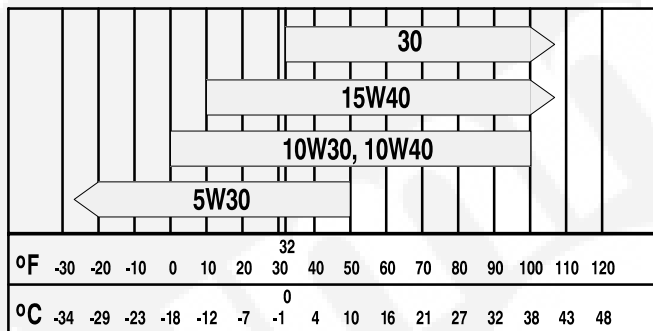


FIGURE 2. OIL VISCOSITY VS. TEMPERATURE

### STARTING BATTERIES

The genset requires a 12 volt battery to power its control and starting circuits. Reliable genset starting and starter service life depend upon adequate battery system capacity and maintenance. See *Specifications* (Page 38) for battery requirements and **MAINTAINING THE BATTERY AND BATTERY CONNECTIONS** (Page 24) for battery care.

### TYPICAL GENSET

Figure 3 illustrates a typical genset.

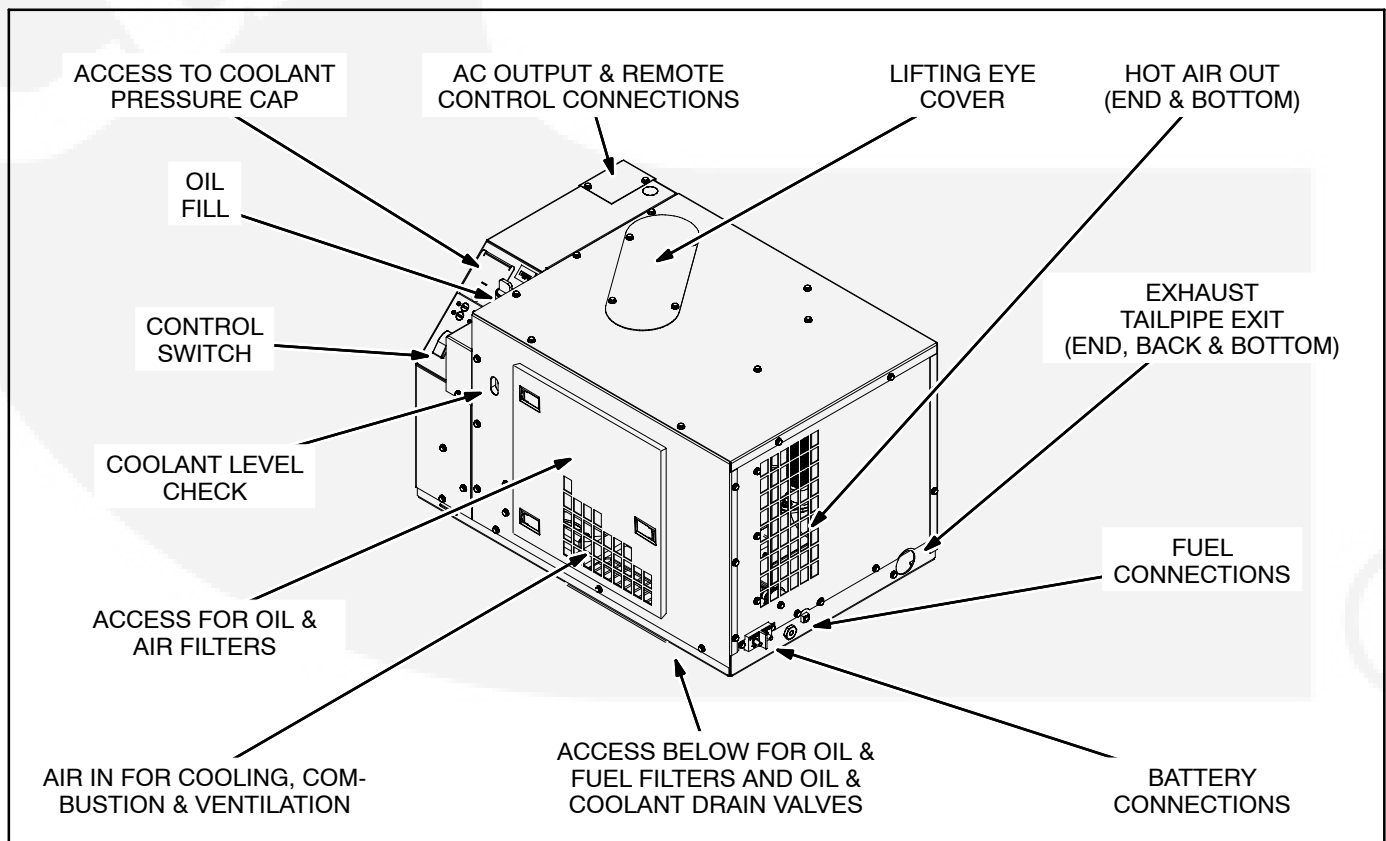


FIGURE 3. TYPICAL GENSET

## OPERATOR CONSOLE

The console (Figure 4) has the following features:

### Control Switch

This switch is used to start and stop the genset, prime the engine fuel system and restore the fault code (blinking status light).

### Status Light

This is an LED (light emitting diode) in the control switch which blinks rapidly during preheat and cranking. After the genset starts up, this light stays on continuously, indicating that the genset is running and that the starter has disconnected. If the genset shuts down, this light blinks in coded fashion to indicate the nature of the fault shutdown (see *Troubleshooting*, Page 30).

(Rapid blinking before cranking starts indicates that the glow plugs are preheating the combustion chambers. The controller automatically varies the time based on engine temperature.)

### Line Circuit Breakers

The line circuit breakers protect the AC power leads connected to the genset.

### Coolant Pressure Cap

The coolant pressure cap is under the access plate. Fill coolant here when refilling the system.

### Coolant Recovery Tank

The recovery tank is mounted inside the genset and provides for coolant expansion. The coolant level is visible through the sight hole on the front of the genset. The fill cap is under the access cover. Replenish the normal loss of coolant here.

### Oil Fill Cap and Dipstick

Check and fill engine oil.

## REMOTE CONTROL PANEL

The vehicle probably has a control panel inside the vehicle for remote control of the genset. Cummins Onan offers three remote control kits as follows:

- Remote switch / status lamp
- Remote switch / status lamp and hour meter
- Remote switch / status lamp and DC voltmeter

The DC voltmeter indicates whether voltage across the 12 VDC control system and battery is normal. If the indicator consistently stays above or below the normal zone, see *MAINTAINING THE BATTERY AND BATTERY CONNECTIONS* (Page 24).

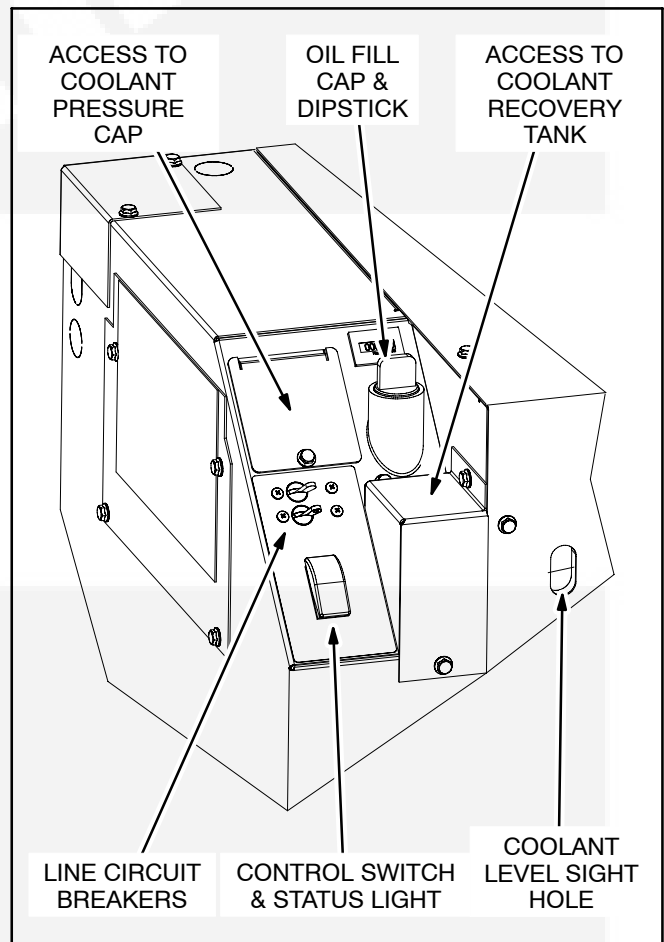


FIGURE 4. OPERATOR'S CONSOLE

## BUILD STANDARDS

The generator set and its control system have been designed, constructed and tested generally in accordance with the following Standards where applicable refer to Table 1.

**TABLE 1. BUILD STANDARDS**

BS EN 1037:1995+A1:2008	Safety of machinery – Prevent of unexpected start up.
BS EN ISO 14121–1:2007	Safety of machinery. Risk assessment. Principles
BS EN ISO 13857:2008	Safety of machinery. Safety distance to prevent hazard zones being reached by upper and lower limbs.
BS EN 349:1993+a1:2008	Safety of machinery – Minimum gaps to avoid crushing parts on the human body.
BS EN 547–1: 1996+A1:2008	Safety of machinery – Human body dimensions – Part 1: Principles of determining the dimensions required for openings for whole body access into machinery.
BS EN 547–2:1996+A1:2008	Safety of machinery – Human body dimensions – Part 2: Principles for determining the dimensions required for access openings.
BS EN 547–3:1996+A1:2008	Safety of machinery – Human body dimensions – Part 3: Anthropomorphic data.
BS EN 60204–1:2006+A1:2009	Safety of machinery. Electrical equipment of machines. General requirements
BS EN 614–1:2006+A1:2009	Safety of machinery. Ergonomic design principles. Terminology and general principles
BS EN 953:1997+A1:2009	Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards.
BS EN ISO 12100–1:2003+A1:2009	Safety of machinery. Basic concepts, general principles for design. Basic terminology, methodology
BS EN ISO 12100–2:2003+A1:2009	Safety of machinery. Basic concepts, general principles for design. Technical principles
BS EN ISO 13732–1:2008	Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces. Hot surfaces
BS EN ISO 13849–1:2008	Safety of machinery – Safety related parts of control systems
BS EN ISO 13850:2006	Safety of machinery – Emergency stop. Principles for design.
BS EN 61310–1:2008	Safety of machinery – Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals.
BS EN 61310–2:2008	Safety of machinery – Indication, marking and actuation – Part 2: Requirements for marking.
BS EN 61000–6–1:2007	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for residential, commercial and light–industrial environments

BS EN 61000-6-3:2007	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments
BS EN 1299:1997+A1:2008	Mechanical vibration and shock – Vibration isolation of machines – Information for the application of source isolation
BS EN 1679-1:1998	Reciprocating internal combustion engines – Safety – Part 1: Compression ignition engines
BS EN 12601:2001	Reciprocating internal combustion engine driven generating sets – Safety



# 2. Operation

**⚠️WARNING** *EXHAUST GAS IS DEADLY! All engine exhaust contains carbon monoxide; an odorless, colorless, poisonous gas that can cause unconsciousness and death. Symptoms of carbon monoxide poisoning include:*

- *Dizziness, Headache or Throbbing Temples*
- *Weakness or Muscular Twitching*
- *Sleepiness or Confusion*
- *Nausea or Vomiting*

**⚠️WARNING** *IF YOU EXPERIENCE ANY OF THESE SYMPTOMS, GET INTO FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the genset and do not operate it until it has been inspected and repaired.*

**⚠️WARNING** *Never sleep in the vehicle while the genset is running unless the vehicle has a working carbon monoxide detector. The exhaust system must be installed in accordance with the genset Installation Manual. Make sure there is ample fresh air when operating the genset in a confined area.*

## PRE-START CHECKS

Before the first start of the day and after every eight hours of operation, inspect the genset as instructed under CONDUCTING GENERAL INSPECTIONS (Page 14). Keep a log of maintenance and the hours run and perform any maintenance that may be due. See Returning the Genset to Service (Page 18) if the vehicle has been in storage.

Before each start:

1. Make sure all vehicle CO detectors are working.
2. Check for signs of fuel and exhaust leaks and damage to the exhaust system.
3. To prevent overheating and to reduce fouling with dust and debris, make sure the genset's normal ground clearance is not being reduced by sloping ground, curbs, logs or other objects. Re-

park the vehicle if necessary and/or remove any objects blocking the air inlet or air outlet.

4. Turn off air conditioners and other large equipment.

## PRIMING THE FUEL SYSTEM

The fuel system should be primed after replacing the fuel filter or running the genset out of fuel. To prime the fuel system hold the control switch down in its **Stop** position for at least 1 minute (starts in 2 seconds).

## STARTING THE GENSET

Start the genset from the genset control panel or remote control panel inside the vehicle.

**⚠️CAUTION** *Excessive cranking can overheat and damage the starter motor. Do not crank for more than 30 seconds at a time. Wait at least 2 minutes before trying again.*

1. Visually inspect for fuel, exhaust and coolant leaks. Do not start the genset if there is a fuel, exhaust or coolant leak and have it repaired.
2. Push and hold the switch at **START** until the genset starts. The status indicator light on the switch flashes during preheat and cranking. It will come on solid when the starter disconnects, indicating that the genset is running. (Depending on how cold it is, preheat can take up to 15 seconds, extending the time that the light blinks.)
3. See *Troubleshooting* (Page 30) if the genset does not start after several tries.
4. For top performance and engine life, especially in colder weather, let the engine warm up for two minutes before connecting loads.

## STOPPING THE GENSET

Turn off air conditioners and other large loads and let the genset run for two minutes to cool down. Then push the switch to **STOP**.



## AUTOMATIC STARTING AND STOPPING

The vehicle may be equipped with an inverter-charger or other automatic genset starting device (AGS). Always follow the instructions and safety precautions provided by the manufacturer of the automatic starting device when enabling automatic genset starting.

**⚠WARNING** **EXHAUST GAS is deadly. MOVING PARTS and ELECTRICITY can cause severe personal injury or death. To reduce exposure to these hazards, always disable automatic genset starting before:**

- **Sleeping, unless vehicle CO detector is enabled**
- **Parking vehicle in garage or confined space**
- **Parking vehicle for storage**
- **Servicing genset**
- **Servicing batteries**
- **Servicing electrical appliances**
- **Fueling vehicle**

## LOADING THE GENSET

The genset can power AC motors, air conditioners, AC/DC converters and other loads. How much load\* can be powered depends upon the genset power rating. The genset will shut down or its circuit breakers will trip if the sum of the loads exceeds genset power. See *Troubleshooting* (Page 30).

To avoid overloading the genset and causing shutdowns, compare the sum of the loads that are likely to be used at the same time to the power rating of the genset. ***It may be necessary to run fewer loads at the same time—the sum of the loads must not be greater than genset rating.***

Note that the genset may shut down due to overload when a large motor or air conditioner is started or

cycles off and then on again, even though the sum of the loads is less than genset rating. The reason for this is that a motor's startup load is much larger than its running load. ***It may be necessary to run fewer loads when large motors and air conditioners are cycling on and off.***

Note also that maximum power decreases as altitude increases because air density decreases. For every 1000-foot (305 m) increase in elevation you can expect power to decrease approximately 3 percent. Table 2 shows the results of typical calculations. ***It may be necessary to run fewer loads at higher altitudes.***

TABLE 2. POWER VS. ALTITUDE

Elevation above Sea Level	Maximum Power
at/below 500 ft (152 m)	5000 W (rated)
at 2500 ft (762 m)	4700 W
at 5500 ft (1676 m)	4250 W
above 5500 ft (1676 m)	4250 W minus 150 W every 1000 ft (305 m)

## CONNECTING TO UTILITY POWER

A vehicle with provisions for connecting utility power must have an approved device to keep the genset and utility from being interconnected. See the genset Installation Manual for more information.

**⚠WARNING** ***Interconnecting the genset and the public utility (or any other power source) can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.***

\* Equipment load and genset power are measured in terms of watts (W) or kilowatts (kW), where 1 kilowatt (kW) = 1000 watts (W).

## RESETTING CIRCUIT BREAKERS

If a circuit breaker in the main power distribution panel of the vehicle or on the genset (Figure 5) trips, either a circuit shorted or too many loads were running. Note that the genset will continue to run after a circuit breaker trips.

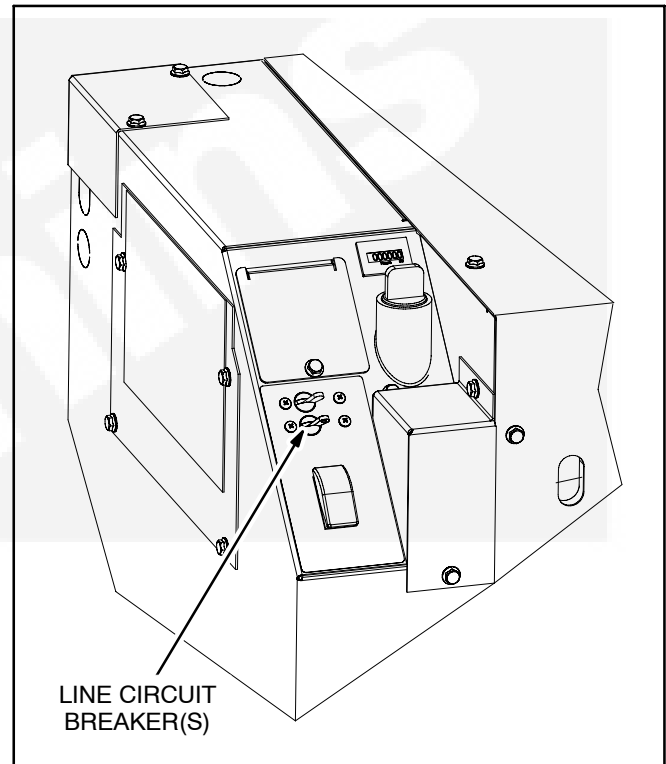
If a circuit breaker trips, disconnect or turn off as many loads as possible and reset the circuit breaker. (Push the circuit breaker to **OFF** to reset it and then to **ON** to reconnect the circuit.) If the circuit breaker trips right away, either the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician.

If the circuit breaker does not trip, reconnect the loads, one by one, up to a total load that does not overload the genset or cause the circuit breaker to trip. If a circuit breaker trips right away when an appliance is connected, the load equipment probably has a short.

Electrical equipment and tools must be used and maintained properly and be properly grounded to cause the line circuit breakers to trip when short circuits occur.

**⚠WARNING** *Short circuits in electrical equipment and tools can cause fire and electrical shock*

*leading to severe personal injury or death. Read and follow the equipment and tool manufacturer's instructions and warnings regarding use, maintenance and proper grounding.*



**FIGURE 5. LINE CIRCUIT BREAKERS**

## **OPERATING IN COLD WEATHER**

Make sure the engine oil viscosity is appropriate for the cold weather temperatures. See ENGINE OIL RECOMMENDATIONS (Page 10). Be sure to change the oil if a sudden drop in temperature occurs.

## **OPERATING IN HOT WEATHER**

Pay particular attention to the following items when operating the genset in hot weather:

1. Make sure nothing blocks airflow to and from the genset.
2. Make sure engine oil viscosity is appropriate for the ambient temperatures. See ENGINE OIL RECOMMENDATIONS (Page 9).
3. Keep the genset clean.
4. Perform maintenance due. See PERIODIC MAINTENANCE SCHEDULE (Page 20).

## **OPERATING AT HIGH ALTITUDE**

For the effect of altitude on maximum power, see LOADING THE GENSET (Page 15).

## **OPERATING IN DUSTY ENVIRONMENTS**

Pay particular attention to the following items when operating the genset in dusty environments:

1. Do not let dirt and debris accumulate inside the genset compartment. Keep the genset clean.
2. Perform air cleaner maintenance more often. See PERIODIC MAINTENANCE SCHEDULE (Page 20).

3. Change engine oil more often. See PERIODIC MAINTENANCE SCHEDULE (Page 20).
4. Keep containers of engine oil that have been opened tightly closed to keep out dust.

## **BREAKING IN A NEW ENGINE**

Proper engine break-in on a new genset or on one with a rebuilt engine is essential for top engine performance and acceptable oil consumption. Run the genset at approximately 1/2 rated power for the first 2 hours and then at 3/4 rated power for 2 more hours.

Proper engine oil and oil level are especially critical during break-in because of the higher engine temperatures that can be expected. Change the oil if not appropriate for the ambient temperatures during break-in. See ENGINE OIL RECOMMENDATIONS (Page 9). Check oil level twice a day or every 4 hours during the first 24 hours of operation and change the oil and oil filter after the first 50 hours of operation.

## **EXERCISING THE GENSET**

Exercise the genset at least 2 hours each month if use is infrequent. Run the genset at approximately 1/2 rated power. A single two hour exercise period is better than several shorter periods.

Exercising a genset drives off moisture, re-lubricates the engine, replaces stale fuel and removes oxides from electrical contacts. The result is better starting, more reliable operation and longer engine life.



## STORING THE GENSET

Proper storage is essential for preserving top genset performance and reliability when the genset cannot be exercised regularly and will be idle for more than 120 days.

### Storing the Genset

1. Push the genset line circuit breaker OFF (Page 16).
2. Change the engine oil and attach a tag indicating oil viscosity. See ENGINE OIL RECOMMENDATIONS (Page 9).
3. Disconnect the battery cables (negative [-] cable first) from the starting battery and store the battery according to the battery manufacturer's recommendations. See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24).
4. Plug the exhaust tail pipe to keep out dirt, moisture, bugs, etc.
5. Close the fuel supply valve (if so equipped).

## Returning the Genset to Service

1. Check the oil tag on the genset and change the oil if the viscosity indicated is not appropriate for the temperatures expected. See ENGINE OIL RECOMMENDATIONS (Page 9).
2. Reconnect the starting battery (negative [-] cable last). See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24).
3. Remove the plug from the exhaust tailpipe.
4. Change the air filter element if it is dirty (Page 24).
5. Open the fuel supply valve (if so equipped).
6. Inspect the genset. See CONDUCTING GENERAL INSPECTIONS (Page 14).
7. Push the genset line circuit breaker ON (Page 16) when the genset is ready to power appliances.





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# 3.Periodic Maintenance

Periodic maintenance is essential for top performance and long genset life. Use Table 3 as a guide for normal periodic maintenance. In hot and dusty environments some maintenance procedures should be performed more frequently, as indicated by the footnotes in the table. Keeping a log of maintenance performed and hours run (Page 42) will help you keep

genset maintenance regular and provide a basis for supporting warranty claims.

Maintenance, replacement or repair of emission control devices and systems may be performed by any engine repair establishment or individual. However, warranty work must be completed by an authorized Cummins Onan dealer.

**TABLE 3. PERIODIC MAINTENANCE SCHEDULE**

MAINTENANCE OPERATION	MAINTENANCE FREQUENCY						
	Every Day	After First 50 Hours	Every Month	Every 150 Hours	Every 500 Hours	Every 1000 Hours	Page
General Inspection	•						21
Check Engine Oil Level	•						22
Check Engine Coolant Level	•						28
Clean and Check Battery			• <sup>2</sup>				24
Clean Spark Arrestor				• <sup>3, 7</sup>			–
Change Engine Oil and Oil Filter		•		• <sup>1, 2, 3, 4</sup>			23
Replace Engine Air Filter					• <sup>1, 3</sup>		24
Replace Fuel Filter					• <sup>3</sup>		25
Check Coolant Anti-Freeze Protection					• <sup>3</sup>		21
Flush Coolant System						• <sup>5</sup>	21
Replace Coolant Pressure Cap						• <sup>5</sup>	21
Replace Engine V-belt (Coolant Pump)						• <sup>6, 7</sup>	–
Replace Coolant Hoses and Thermostat						• <sup>6, 7</sup>	–
Adjust Engine Valve Lash						• <sup>6, 7</sup>	–
Service Fuel Injectors						• <sup>6, 7</sup>	–
Check Generator Bearings, Drive Belt, Belt Tensioner & Drive Coupling						• <sup>6, 7</sup>	–

- 1 – Perform more often when operating in dusty conditions.
- 2 – Perform more often when operating in hot weather.
- 3 – Perform at least once a year.
- 4 – Perform every 75 hours when using high sulfur fuel. See ENGINE OIL RECOMMENDATIONS (Page 9).
- 5 – Perform at least once every two years.
- 6 – Perform at least once every five years.
- 7 – Must be performed by a qualified mechanic (authorized Cummins Onan dealer).

## CONDUCTING GENERAL INSPECTIONS

Inspect the genset before the first start of the day and after every eight hours of operation.

### Oil Level

Check engine oil level (Page 22).

### Engine Coolant System

**⚠ CAUTION** *Operating the genset when coolant level is low can cause serious engine damage.*

Check the coolant level and look for coolant leaks around the bottom of the genset and on the ground below. Minor leaks that can be replenished by daily additions of coolant to the recovery tank should be repaired by a qualified service technician as soon as possible. Larger leaks are cause for shutting down the genset until it can be repaired.

### Exhaust System

**⚠ WARNING** *EXHAUST GAS IS DEADLY! Do not operate the genset if there is an exhaust leak or any danger of exhaust gases entering or being drawn into the vehicle.*

Look and listen for exhaust system leaks while the genset is running. Shut down the genset if a leak is found and have it repaired before operating the genset again.

Look for openings or holes between the genset compartment and vehicle cab or living space if the genset engine sounds louder than usual. Have all such openings or holes closed off or sealed to prevent exhaust gases from entering the vehicle.

Replace dented, bent or severely rusted sections of the tailpipe and make sure the tailpipe extends at least 1 inch (25.4 mm) beyond the perimeter of the vehicle.

Check all CO monitors to assure proper operation.

**⚠ WARNING** *Do not park the vehicle in high grass or brush. Contact with the exhaust system can cause a fire.*

Park the vehicle so that the genset exhaust gases can disperse away from the vehicle. Barriers such as walls, snow banks, high grass and brush and other vehicles can cause exhaust gases to accumulate in and around the vehicle.

Do not operate power ventilators or exhaust fans while the vehicle is standing with the genset running. The ventilator or fan can draw exhaust gases into the vehicle.

### Fuel System

Check for leaks at hose, tube and pipe fittings in the fuel supply system while the genset is running and while it is stopped. Check flexible fuel hose sections for cuts, cracks, and abrasions. Make sure the fuel line is not rubbing against other parts. Replace worn or damaged fuel line parts before leaks occur.

**⚠ WARNING** *Diesel fuel leaks can lead to fire. Do not operate the genset if operation causes fuel to leak.*

Prime the fuel system if the genset ran out of fuel.

### Battery Connections

Check the battery terminals for clean, tight connections. Loose or corroded connections have high electrical resistance which makes starting harder. See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 24).

### Mechanical

Visually inspect genset for mechanical damage. For generator sets with a sound shield, install service doors before running the generator set to listen for unusual noises. Check the genset mounting bolts. Check to see that the generator set air inlet and outlet openings are not clogged with debris or blocked. Keep the generator set compartment clean.

To prevent overheating and to reduce fouling with dust and debris, make sure the genset's normal ground clearance is not being reduced by sloping ground, curbs, logs or other objects. Repark the vehicle if necessary and/or remove any objects blocking the air inlet or air outlet.

## CHECKING ENGINE OIL LEVEL

Park the vehicle on level ground and shut off the genset before checking engine oil level.

**⚠️WARNING** *State and federal agencies have determined that contact with used engine oil can cause cancer or reproduce toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.*

**⚠️WARNING** *Crankcase pressure can blow hot engine oil out the fill opening causing severe burns. Always stop the genset before removing the oil fill plug or drain.*

**⚠️CAUTION** *Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the high and low beads on the dipstick.*

1. Pull the plug and dipstick out of the oil fill neck (Figure 6). The plug may be difficult to pull straight out. It is easier if you tilt the plug in its socket while pulling out. Wipe off the dipstick and thread it back into the fill neck and seat the plug, which snaps into its socket. Remove the plug and dipstick again and check the oil level on the dipstick.
2. Add or drain oil as necessary. See ENGINE OIL RECOMMENDATIONS (Page 9). Keep the oil level between the high and low beads on the end of the dipstick, as shown. It is not necessary to add oil between oil changes if the oil has not dropped more than 1/3 of the way between the high and low beads. Approximately 1 pint (0.4 liter) can be added if the oil level is at the lower bead.

3. Secure the oil fill plug, which snaps into its socket.

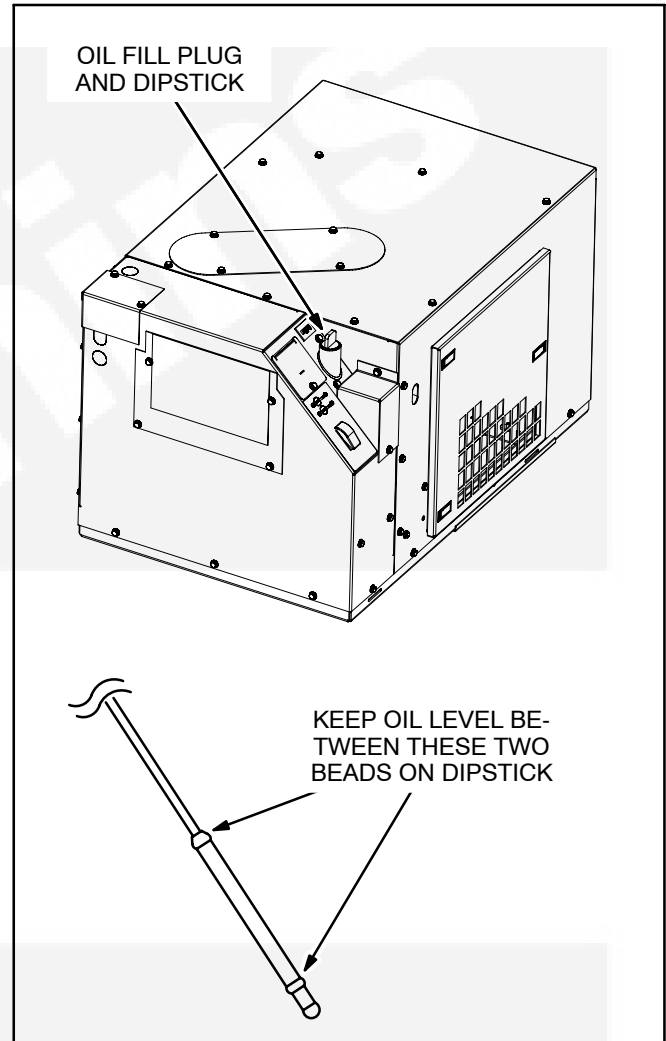


FIGURE 6. CHECKING ENGINE OIL LEVEL



## CHANGING ENGINE OIL AND FILTER

Refer to Table 3 for scheduled engine oil change. Change oil more often in hot and dusty environments.

**⚠WARNING** State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.

**⚠WARNING** To prevent accidental or remote starting while working on the genset, disconnect the negative (-) battery cable at the battery.

**⚠WARNING** Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.

**⚠WARNING** Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.

1. Run the genset until warm and shut it off.
2. Pull the oil dipstick (Page 22) out a couple of inches (50 mm) so that the oil will drain faster.
3. Remove the front and bottom access covers (Figures 7 and 8) and direct the end of the drain hose into a container.
4. Open the drain valve to drain all of the old oil.
5. **Close the drain valve.**
6. Spin off the oil filter and clean the filter mounting surface on the engine block. Remove the old gasket if it remains. (The oil filter is easier to remove through the front access opening.)
7. Make sure the gasket is in place on the new filter and apply a thin film of clean oil to the gasket. Spin the new filter on until the gasket just touches the block. Turn it an additional 1/2 to 3/4 turn. Do not over tighten.
8. Refill with 2 quarts (1.9 liters) of oil and check the level (Page 22).
9. Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.

10. Dispose of the used oil and oil filter according to local environmental regulations.

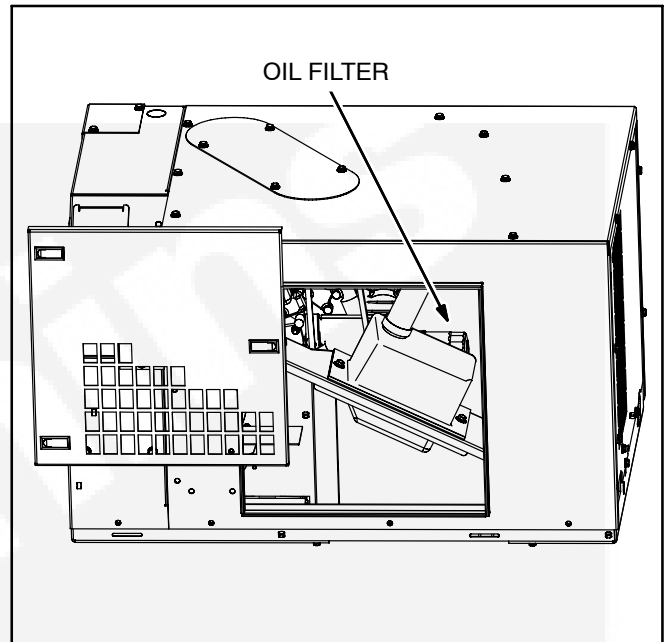


FIGURE 7. OIL FILTER ACCESS THROUGH FRONT

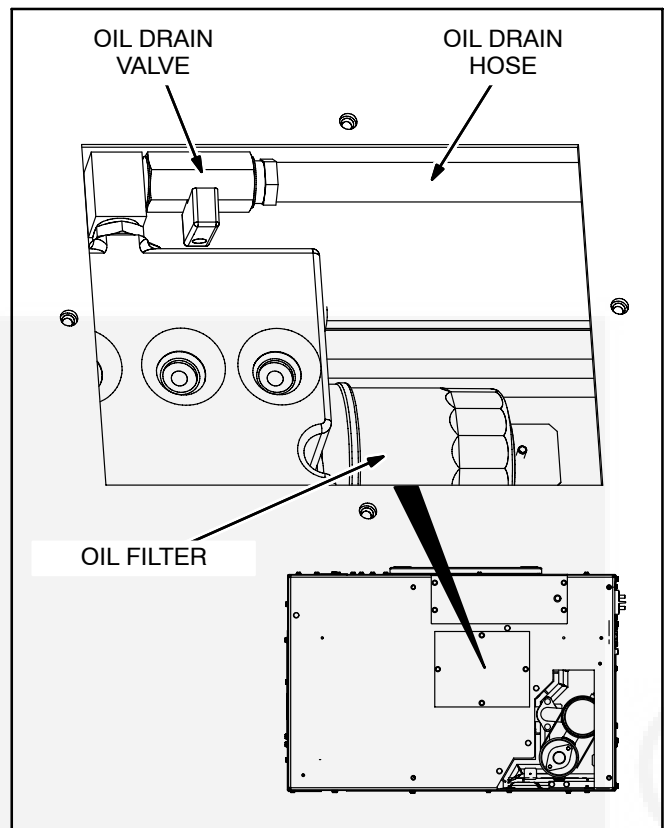


FIGURE 8. OIL DRAIN VALVE, DRAIN HOSE AND FILTER ACCESS THROUGH BOTTOM

## MAINTAINING BATTERY AND BATTERY CONNECTIONS

Refer to Table 3 for scheduled battery maintenance, and follow the battery manufacturer's instructions. Have the battery charging system serviced if DC system voltage is consistently low or high. Always:

**⚠WARNING** *Arcing at battery terminals or in light switches or other equipment, and flames or sparks, can ignite battery gas causing severe personal injury. To prevent injury:*

- *Ventilate battery area before working on or near battery*
- *Wear safety glasses*
- *Do not smoke*
- *Switch work light ON or OFF away from battery*
- *Stop genset and disconnect charger before disconnecting battery cables*
- *Disconnect negative (-) cable first and reconnect it last.*

1. Keep the battery case and terminals clean and dry and the terminals tight.
2. Remove battery cables with a battery terminal puller.
3. Make sure which terminal is positive (+) and which is negative (-) before making battery con-

nections, always removing the negative (-) cable first and reconnecting it last to reduce arcing.

## REPLACING AIR FILTER ELEMENT

Refer to Table 3 for scheduled air filter element replacement. In dusty environments the filter element should be inspected and changed more frequently.

**⚠WARNING** *To prevent accidental or remote starting while working on the genset, disconnect the negative (-) battery cable at the battery.*

**⚠WARNING** *Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.*

Remove the front access door, unscrew the 2 wing-nuts on the filter housing and pull away the filter housing and filter element (Figure 9).

When installing the new filter element, turn the wing-nuts hand tight.

Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.

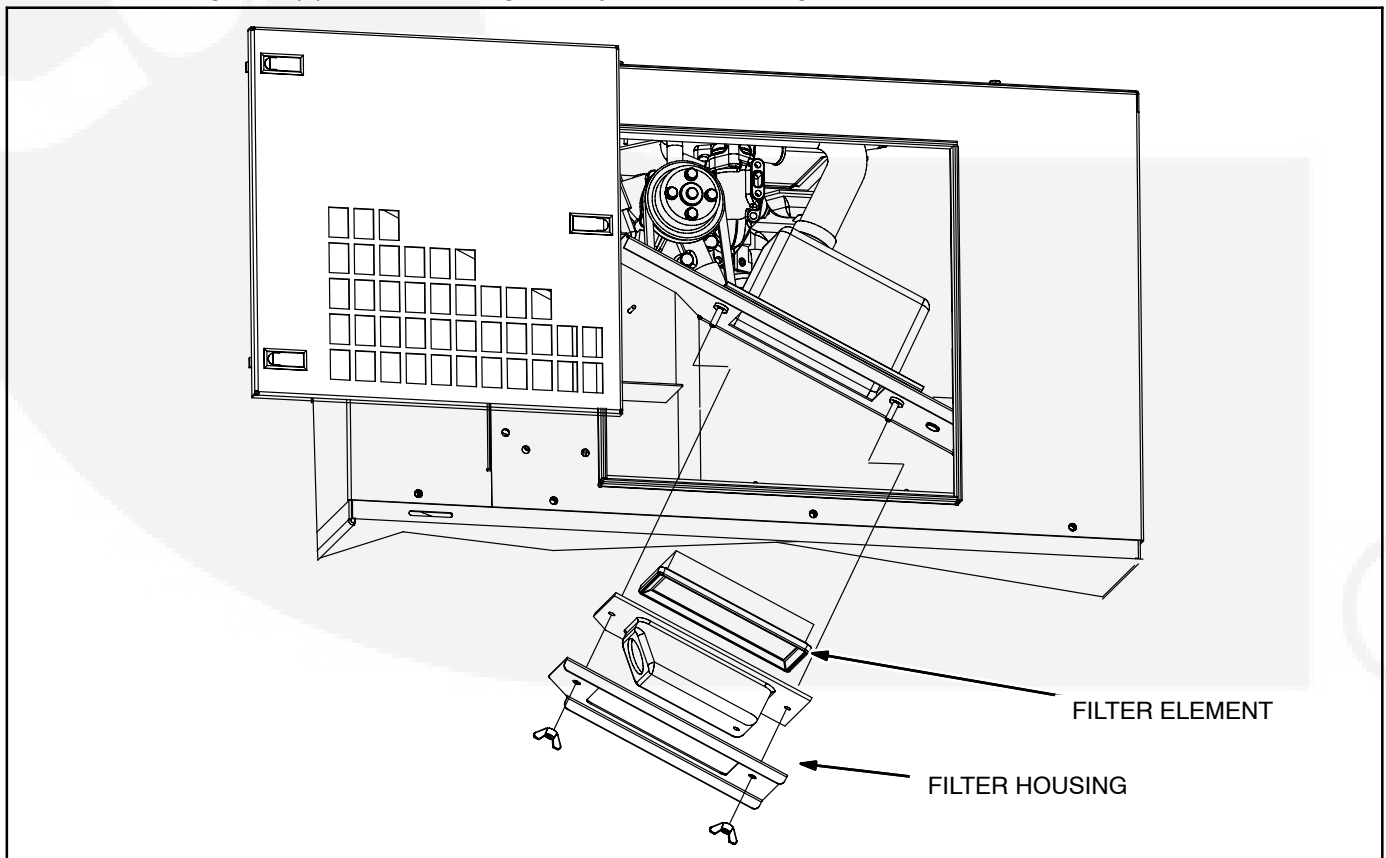


FIGURE 9. REPLACING THE AIR FILTER ELEMENT

## REPLACING FUEL FILTER

See Table 3 for scheduled fuel filter replacement. A dirty fuel filter may be the cause of a failure to start. The fuel filter is accessible through the bottom access opening (Figure 10).

**⚠WARNING** *Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near diesel fuel tanks or equipment. Keep flames, sparks, pilot lights, electrical switches, arc-producing equipment and all other sources of ignition well away. Keep a type ABC fire extinguisher in the vehicle.*

**⚠WARNING** *To prevent accidental or remote starting while working on the genset, disconnect the negative (-) battery cable at the battery.*

**⚠WARNING** *Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.*

**⚠WARNING** *Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.*

## Removing the Fuel Filter

Take care to spill as little fuel as possible when disconnecting the filter from the fuel line. Close any shut off valve in the fuel line. Use paper towels to clean the two fuel line fittings and absorb any fuel that spills.

To remove the filter, disconnect the two fittings at the filter. *Use two flarenut wrenches on each fitting so as not to round the corners or stress the fittings.* Then remove the filter mounting nut and two (2) bracket mounting screws. Dispose of the fuel filter and paper towels according to local regulations.

## Installing the Fuel Filter

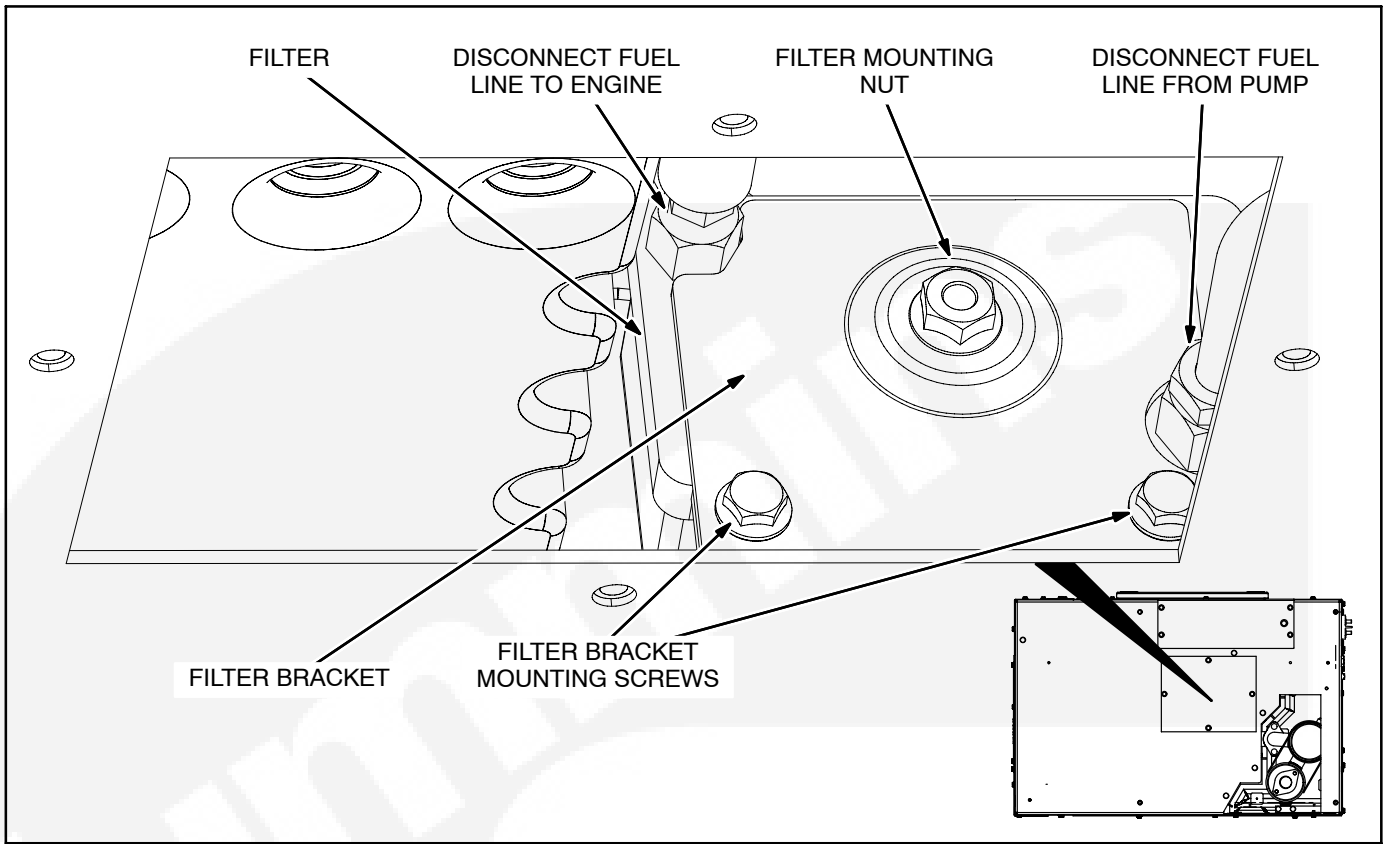
Secure the bracket loosely to the new filter. The filter and its bracket fit properly only one way.

Loosely secure the filter and bracket to the base with the two mounting screws and re-connect the fuel fittings. Take care not to cross thread the fuel fittings. Thread them in by hand and tighten one flat past seating. Finally, tighten the bracket and bracket mounting screws.

Prime the fuel system by holding the control switch down in its **Stop** position for at least 1 minute. Priming is necessary to fill the new filter with fuel.

Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.





**FIGURE 10. FUEL FILTER**

## CHANGING COOLANT

Refer to Table 3 for scheduled maintenance. The engine cooling system is filled with a 50/50 mixture of ethylene glycol and water at the factory, which is suitable for temperatures down to  $-34^{\circ}\text{F}$  ( $-37^{\circ}\text{C}$ ).

### Recommended Coolant Mixture

Use the best quality ethylene glycol antifreeze solution available. It should be fully formulated with rust inhibitors and coolant stabilizers. Use fresh water that is low in minerals and corrosive chemicals. Distilled water is best.

**⚠WARNING** *Hot coolant spray can cause severe burns. Let the engine cool before releasing the pressure cap or opening the drain cock.*

### Replacing the Pressure Cap

Replace the pressure cap (Figure 12) every two years (seals deteriorate and leak). Proper cooling system pressure (14 psi) is essential for optimal engine cooling and minimal coolant loss.

### Draining the Cooling System

**⚠WARNING** *To prevent accidental or remote starting while working on the genset, disconnect the negative (-) battery cable at the battery.*

**⚠WARNING** *Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.*

Let the engine cool before removing the pressure cap. Relieve any remaining pressure by turning the pressure cap slowly, without pushing down. To remove the cap, push down and turn it the rest of the way. Then remove the bottom access cover (Figure 11), open the radiator drain cock and drain the coolant into a suitable container. Approximately 1.6 quarts (1.5 L) will drain.

**⚠WARNING** *Ethylene glycol antifreeze is considered toxic. Dispose of it according to local regulations for hazardous substances.*

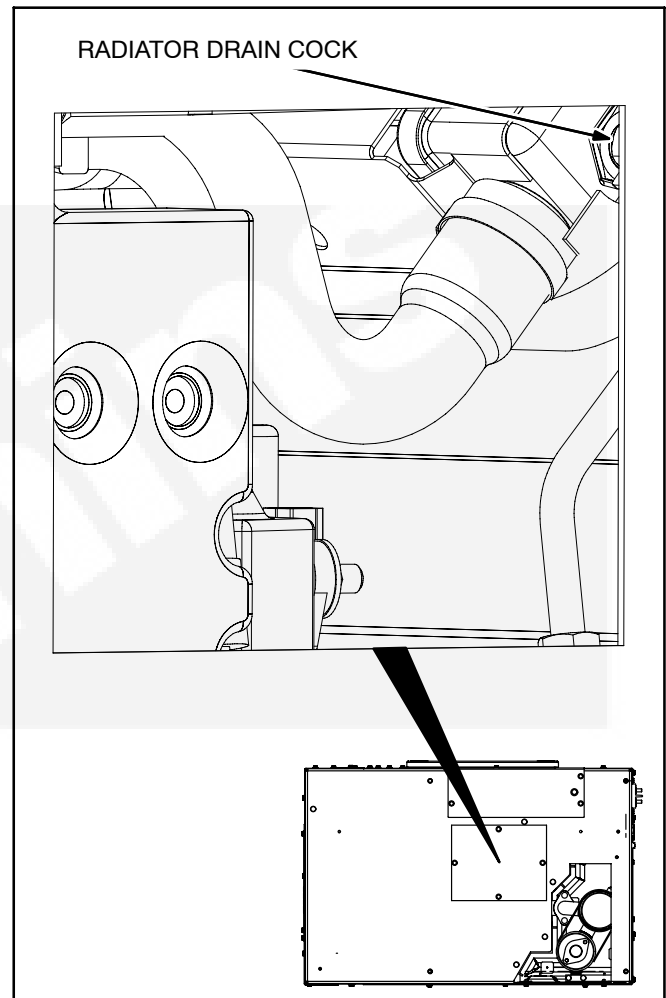


FIGURE 11. LOWER RADIATOR HOSE

## Cleaning the Cooling System

Clean and flush the cooling system with radiator cleaning chemicals available at auto parts stores. Follow the instructions for cleaning and flushing that come with the cleaning solution.

## Refilling the Cooling System

Close the radiator drain cock. Pull the hose connected to the pressure cap assembly out as far and as high as it will go (Figure 12). Remove the pressure cap and fill the system using a funnel inserted into the fill hose to prevent coolant from entering the vent hose and blocking the escape of air as the system fills. The system *will seem full when it actually is not* if the air cannot escape through the vent hose. If the vent hose does get blocked, pinch the overflow hose and blow the vent hose clear. Start and operate the genset for a few minutes while keeping the fill opening elevated to promote venting of air from the coolant. Shut down the genset and add coolant as neces-

sary. Secure the pressure cap and fill the recovery tank to the COLD mark.

**CAUTION** *Coolant trapped in the vent hose will prevent the system from filling to its capacity, which can lead to serious engine damage.*

Secure the maintenance access covers for proper engine cooling and for protection from hazardous moving parts and hot exhaust manifolds.

**WARNING** *Do not run the genset with the maintenance access covers off. Contact with hazardous moving parts and hot exhaust manifolds can cause severe personal injury.*

Fill the recovery tank with coolant mixture to the COLD mark.

## Checking Coolant Level

Check coolant level in the recovery tank (Figure 12) before the first startup of each day and fill to the COLD mark if necessary.

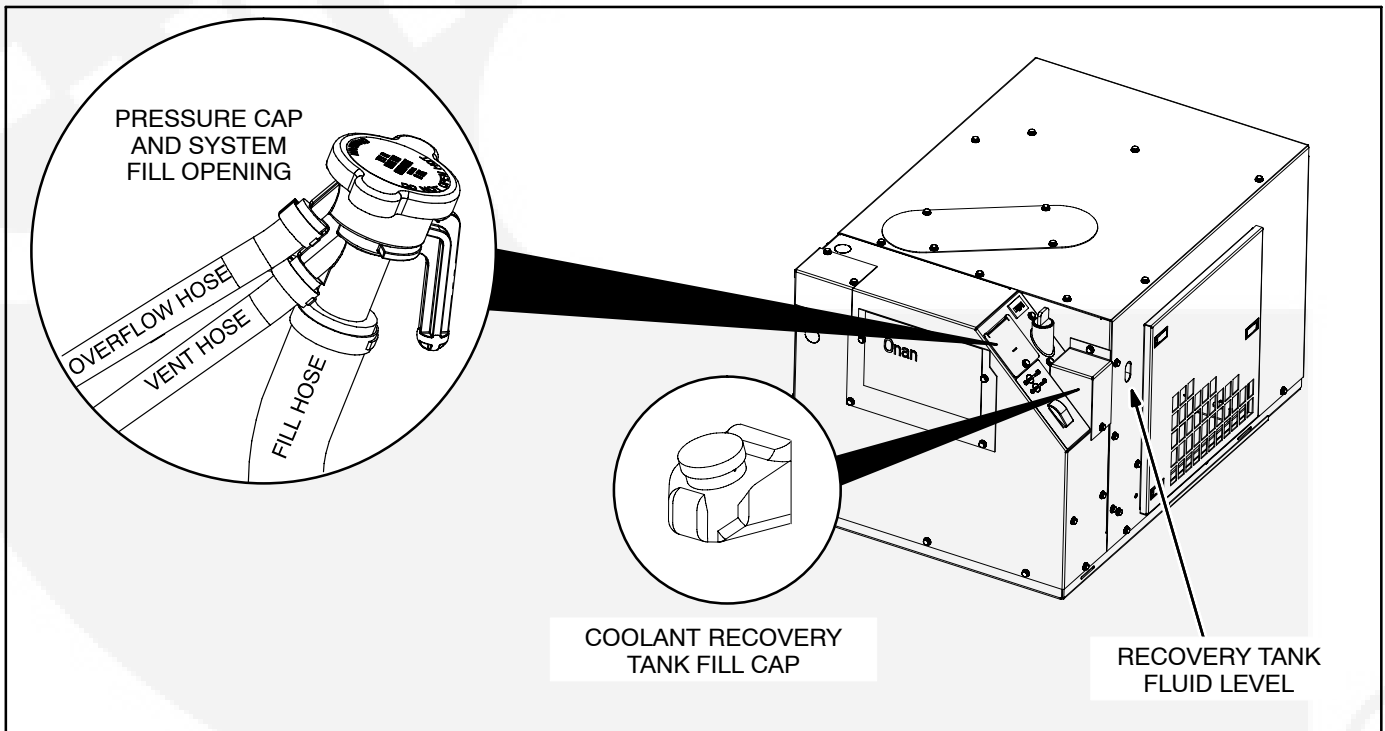


FIGURE 12. ENGINE COOLING SYSTEM PRESSURE CAP AND RECOVERY TANK



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# 4. Troubleshooting

TABLE 4. TROUBLESHOOTING lists the shutdown codes in numerical order along with step-by-step corrective actions. If you are unable to resolve the problem after taking the corrective actions suggested, contact an authorized Cummins Onan dealer. See *How to Obtain Service* (Page 40).

First note the following:

- Maintaining engine oil and coolant levels, keeping battery connections clean and tight, watching the fuel gauge, not overloading the genset, keeping the air inlet and outlet openings clear, etc. will prevent most shutdowns.
- When the genset and vehicle engine share a common fuel tank the fuel dip tubes are usually arranged so that the genset will run out of fuel first. Marking the genset empty point on the fuel gauge will make it easier to tell when to stop the genset before running it out of fuel.

## SHUTDOWN CODES

The genset controller provides extensive diagnostics by causing the status indicator light on the Control Switch to blink in a coded fashion. Following a fault shutdown, the indicator light will repeatedly blink 1, 2, 3 or 4 blinks at a time.

- **One blink** indicates shut down due to high temperature.

- **Two blinks** indicate shutdown due to a loss of engine oil pressure.

- **Three blinks** indicate a service fault. Press **Stop** once to cause the two-digit, second-level shutdown code to blink. (Pressing **Stop** again will stop the blinking.) The two-digit code consists of 1, 2, 3, 4 or 5 blinks, a brief pause, and then 1 to 9 blinks. The first set of blinks represents the tens digit and the second set of blinks the units digit of the shutdown code number. For example, **shutdown code No. 36** appears as:

blink-blink-blink—*pause*—blink-blink-blink-blink-blink-blink—*long pause*—repeat

- **Four blinks** indicate that cranking exceeded a preset time (20 seconds if ambient temperature is above 32° F[0° C], 30 seconds if below) without starting.
- **Note: shutdown code Nos. 3 and 4 are first level faults. Avoid interpreting them as second-level shutdown code Nos. 33 and 44, which have not been assigned as shutdown codes.**

**Restoring Shutdown Code Blinking** – The shutdown code stops blinking after five minutes. Press **Stop** three times within three seconds to restore blinking. **Note that the last fault logged will blink, even after the condition that caused the shutdown has been corrected.**





TABLE 4. TROUBLESHOOTING

**⚠ WARNING** *Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

**NO RESPONSE—DEAD STATUS INDICATOR LIGHT**

(Poor connections, faulty wiring or dead battery)

**Corrective Action:**

1. Try starting the genset at the operator's console if it does not start at the remote panel.
2. Clean and tighten the battery cable connections at the battery and at the genset.
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

**THE STARTING BATTERIES DO NOT MAINTAIN A CHARGE**

(The battery, battery connections or charging system are in marginal condition)

**Corrective Action:**

1. Clean and tighten the battery cable connections at the battery and at the genset.
2. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

**THE STARTER ENGAGES AND DISENGAGES**

(Cranking voltage dips below 6 volts because of low battery charge or poor connections)

**Corrective Action:**

1. Have the vehicle propulsion engine running while trying to start the genset. (The battery charging alternator may be able to maintain starting voltage high enough to get the genset started.)
2. Clean and tighten the battery cable connections at the battery and at the genset.
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

**THERE IS NO POWER WHEN THE GENSET IS RUNNING**

(A line circuit breaker is OFF, tripped or malfunctioning)

**Corrective Action:**

1. Reset or turn ON the line circuit breaker on the genset (Page 16).
2. Reset or turn ON any other circuit breaker in the power supply system.

**THE GENSET WILL NOT STOP RUNNING (THE RUN LIGHT IS OFF)**

(The governor mechanism is stuck or binding)

**Corrective Action:** Close the fuel supply valve, if provided, or squeeze off the fuel supply line and see an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

**⚠ WARNING** *Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

**HIGH TEMPERATURE FAULT—CODE NO. 1**

(First-level fault code—engine coolant temperature exceeded 230° F [110° C])

**Corrective Action:**

1. Check the engine coolant level and add coolant as necessary (Page 28).
2. Check for and remove any objects blocking the air inlet or outlet openings in the bottom and sides of the genset.
3. Flush the coolant system to remove coolant passage fouling (Page 27).

**LOW OIL PRESSURE FAULT—CODE NO. 2**

(First-level fault code—the low oil pressure cutoff switch is open)

**Corrective Action:**

1. Check the engine oil level and add oil as necessary (Page 22).
2. Drain the excess oil if the oil level is above the Full mark on the dipstick. (The oil will foam if the level is too high and result in possible loss of oil pressure.)

**SERVICE CHECK—CODE NO. 3**

(First-level fault code—a second-level fault occurred)

**Corrective Action:** Check the second-level fault code by momentarily pressing Stop. The second-level fault will be one of the following in this table.

**OVERCRANK FAULT—CODE NO. 4**

(First-level fault code—Cranking without starting exceeded 20 to 30 seconds, depending on ambient)

**Corrective Action:**

1. Check the fuel level and refill as necessary. (Note: The genset fuel pickup is probably higher than the vehicle engine fuel pickup.)
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute.
3. Check the engine air filter (Page 24) and remove any blockage.
4. Check for mechanical damage.
5. Replace the fuel filter (Page 26).

**OVERVOLTAGE FAULT—CODE NO. 12**

(The controller is not able to regulate to rated voltage)

**Corrective Action:** See an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

**⚠ WARNING** *Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

**UNDERVOLTAGE FAULT—CODE NO. 13**

(The controller is not able to regulate to rated voltage)

**Corrective Action:** Turn OFF the line circuit breaker on the operator's console. If the genset now runs, run it with fewer connected loads.

**OVERFREQUENCY FAULT—CODE NO. 14**

(The controller is not able to regulate to rated frequency)

**Corrective Action:**

1. Check for a tripped genset circuit breaker, reset it if necessary, and run with fewer connected loads. (A breaker tripping under load can cause frequency to overshoot.)
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute. (Air bubbles can disrupt frequency.)

**UNDERFREQUENCY FAULT—CODE NO. 15**

(The controller is not able to regulate to rated frequency)

**Corrective Action:**

1. Turn OFF the line circuit breaker. If the genset now runs, run it with fewer connected loads, especially those with high motor starting loads such as air conditioners.
2. Check the fuel level and refill as necessary. (Note: The genset fuel pickup is probably higher than the vehicle engine fuel pickup.)
3. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute. (Air bubbles can disrupt frequency.)
4. Check the engine air filter (Page 24) and remove any blockage.
5. Check for mechanical damage.
6. Replace the fuel filter (Page 26).

**GOVERNOR ACTUATOR FAULT—CODE NO. 19**

(The controller sensed that the actuator circuit is either open or shorted)

**Corrective Action:** See an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

**⚠ WARNING** *Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

**GOVERNOR OVERLOAD FAULT—CODE NO. 22**

(The duration of operation at or near full-duty cycle was beyond the design limit)

**Corrective Action:**

1. Reduce the number of appliances running at the same time, especially those with high motor starting loads such as air conditioners.
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute.
3. Replace the engine air filter (Page 24) .
4. Replace the fuel filter (Page 26).

**TEMPERATURE SENDER FAULT—CODE NO. 24**

(The controller sensed that the sender circuit is either open or shorted)

**Corrective Action:** See an authorized Cummins Onan dealer.

**AC VOLTAGE SENSE FAULT—CODE NO. 27**

(The controller was unable to sense output voltage)

**Corrective Action:** See an authorized Cummins Onan dealer.

**HIGH BATTERY VOLTAGE FAULT—CODE NO. 29**

(The controller sensed battery system voltage greater than 19 volts)

**Corrective Action:**

1. Check battery bank connections and reconnect, if necessary, so that the 12 volt batteries serving the genset are connected in parallel (12 volt) rather than in series (24 volt).
2. Select a lower battery booster charge rate.

**LOW CRANKING SPEED FAULT—CODE NO. 32**

(Cranking speed less than 100 rpm [2.5 Hz, generator] for more than 12 seconds)

**Corrective Action:**

1. Have the vehicle propulsion engine running while trying to start the genset. (The battery charging alternator may be able to maintain starting voltage high enough to get the genset started.)
2. Clean and tighten the battery cable connections at the battery and at the genset.
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.
4. Replace engine oil with oil of proper viscosity for ambient temperatures. (High oil viscosity can slow down cranking speed.)

TABLE 4. TROUBLESHOOTING (CONT.)

**⚠ WARNING** *Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

**CONTROL CARD FAULT—CODE NO. 35**  
(Microprocessor EEPROM error during self-test)

**Corrective Action:** See an authorized Cummins Onan dealer.

**ENGINE STOPPED FAULT—CODE NO. 36**  
(The genset stopped without a command from the controller)

**Corrective Action:**

1. Check the fuel level and refill as necessary. (Note: The genset fuel pickup is probably higher than the vehicle engine fuel pickup.)
2. Check for fuel (air) leaks at all fuel fittings and tighten as necessary. Prime the engine fuel system by holding the control switch at **Stop** for one minute.
3. Check the engine air filter (Page 24) and remove any blockage.
4. Check for mechanical damage.
5. Replace the fuel filter (Page 26).

**FIELD OVERLOAD FAULT—CODE NO. 38**  
(Field voltage exceeded 150 VDC)

**Corrective Action:**

1. Reduce the number of air conditioners running at the same time (and other appliances that cause low power factor).
2. Have the air conditioners and other appliances checked for proper operation. (A locked compressor rotor can cause very low power factor.)

**SHORTED ROTOR FAULT—CODE NO. 41**  
(The rotor circuit is shorted to ground)

**Corrective Action:** See an authorized Cummins Onan dealer.

**PROCESSOR FAULT—CODE NO. 42**  
(Microprocessor ROM error during self-test)

**Corrective Action:** See an authorized Cummins Onan dealer.

**PROCESSOR FAULT—CODE NO. 43**  
(Microprocessor RAM error during self-test)

**Corrective Action:** See an authorized Cummins Onan dealer.

TABLE 4. TROUBLESHOOTING (CONT.)

**⚠ WARNING** *Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

**SPEED SENSE FAULT—CODE NO. 45**  
(Controller unable to sense quadrature frequency)

**Corrective Action:** Check the fuel level and fill as necessary. Then prime the engine fuel system by holding the control switch at **Stop** for one minute and try restarting.

**OVERPRIME FAULT—CODE NO. 57**  
(Prime mode exceeded 3 minutes)

**Corrective Action:** Check for and remove any object that may be holding either control switch (remote or local) in the prime (stop) position.



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# 5. Specifications

	HDKBB	HDKBC
<b>GENSET CONTROLLER:</b> Integrated Microprocessor Based Engine and Generator Controller		
<b>GENERATOR:</b> Two-Bearing, Two-Pole Rotating Field, "Poly-Vee" Belt Drive		
Power (@1.0 PF)	4800 W	5000 W
RPM	3000	3600
Frequency	50 Hz	60 Hz
Voltage	230V 1-Ph	120V 1-Ph, 120/240V 1-Ph, or 120/240V 3-Ph
Current	21 A	41.7/20.8 A or 12 A (3-Ph)
Circuit Breakers	2-pole 25 A (1 pole used)	2-pole 25 A (1-Ph) or 3-pole 15 A (3-Ph)
<b>FUEL CONSUMPTION:</b>		
No-load	0.20 gph (0.74 lph)	0.25 gph (0.95 lph)
Half-load	0.32 gph (1.23 lph)	0.39 gph (1.47 lph)
Full-load	0.54 gph (2.04 lph)	0.60 gph (2.27 lph)
<b>ENGINE:</b> 2-Cylinder In-Line, Water-Cooled, Indirect-Injection, 4-Stroke Cycle Diesel		
RPM	2880	2880
Bore	2.64 in (67 mm)	2.64 in (67 mm)
Stroke	2.68 in (68 mm)	2.68 in (68 mm)
Displacement	29.23 in <sup>3</sup> (479 cc)	29.23 in <sup>3</sup> (479 cc)
Compression Ratio	23 : 1	23 : 1
Injection Order	1-2	1-2
Engine Timing	18.25° to 19.75° BTDC	18.25° to 19.75° BTDC
Fuel Nozzle Injection Pressure	1991 psi (13.73 mPa)	1991 psi (13.73 mPa)
Valve Lash: Intake & Exhaust (cold)	0.0057 – 0.0073 inch (0.145 – 0.185 mm)	0.0057 – 0.0073 inch (0.145 – 0.185 mm)
Oil Capacity (with filter)	2 quart (1.9 liter)	2 quart (1.9 liter)
Cooling System Capacity	3.0 quart (2.8 liter)	3.0 quart (2.8 liter)
<b>DC SYSTEM:</b>		
Nominal Battery Voltage	12 volts	12 volts
Minimum Battery Capacity CCA (Cold Cranking Amps)	475 amps down to 0° F (-17° C) 650 amps down to -20° F (-29° C)	475 amps down to 0° F (-17° C) 650 amps down to -20° F (-29° C)
Fuse F1 (control, start and glow plug circuits)	30 amp mini-bayonet	30 amp mini-bayonet
<b>WEIGHT:</b> 400 lbs (181 kg)		
<b>SIZE (L x W x H):</b> 34.5 x 22.9 x 20.3 in (876 x 581.2 x 514.4 mm)		
<b>SOUND LEVEL:</b> 68 dB(A) @ 10 ft (3m) before installation and @ 1/2-load		





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# 6. How to Obtain Service

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When you call for service, parts, or product literature (such as the Service Manual or Parts Catalog) for your genset, contact the nearest authorized Cummins Onan distributor. Cummins Onan has factory-trained representatives to handle your requests for genset parts and service. For information for contacting our distributors worldwide, go to internet site [www.cumminsonan.com](http://www.cumminsonan.com).

## In North America

Call 1-800-888-6626 to contact the nearest Cummins Onan distributor in the United States or Canada. (This automated service utilizes touch-tone phones only). Select OPTION 1 (press 1) to be automatically connected to the distributor nearest to you.

If you are unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS – ELECTRIC,  
ENGINES – GASOLINE OR DIESEL, or

RECREATIONAL VEHICLES – EQUIPMENT,  
PARTS AND SERVICE.

If you have difficulty in arranging service or resolving a problem, please contact the Service Manager at the nearest Cummins Onan distributor for assistance.

## Outside North America

If you are outside North America, call Cummins Onan at 1-763-574-5000 from 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday, or fax 1-763-528-7229.

## Information to Have Ready

Before calling for service, have the following information available:

1. *The complete genset model number and serial number. See Model Identification (Page 4).*
2. *The date of purchase*
3. *The nature of the problem. See Troubleshooting (Page 30).*





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# Cummins **Onan**

## **Cummins Power Generation**

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# GRUNDFOS MAGNA

## Series 2000

MAGNA 25-40, 25-60, 25-100, 32-40, 32-60, 32-100, 40-100(D), 50-100

### Installation and operating instructions

GB D F I E P GR NL S FIN DK PL RU





## **GB** Declaration of Conformity

We **Grundfos** declare under our sole responsibility that the products **MAGNA Series 2000**, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to

- Machinery (98/37/EC).
- Electrical equipment designed for use within certain voltage limits (2006/95/EC).
- Standards used: EN 60335-1: 2002 and EN 60335-2-51: 2003.
- Electromagnetic compatibility (2004/108/EC).
- Standard used: EN 61800-3.

## **D** Konformitätserklärung

Wir **Grundfos** erklären in alleiniger Verantwortung, dass die Produkte **MAGNA Series 2000**, auf die sich diese Erklärung bezieht, mit den folgenden Richtlinien des Rates zur Angleichung der Rechtsvorschriften der EG-Mitgliedstaaten übereinstimmen

- Maschinen (98/37/EG).
- Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen (2006/95/EG).
- Normen, die verwendet wurden: EN 60335-1: 2002 und EN 60335-2-51: 2003.
- Elektromagnetische Verträglichkeit (2004/108/EG).
- Norm, die verwendet wurde: EN 61800-3.

## **F** Déclaration de Conformité

Nous **Grundfos** déclarons sous notre seule responsabilité que les produits **MAGNA Series 2000** auxquels se réfère cette déclaration sont conformes aux Directives du Conseil concernant le rapprochement des législations des Etats membres CE relatives à

- Machines (98/37/CE).
- Matériel électrique destiné à employer dans certaines limites de tension (2006/95/CE).
- Standards utilisés: EN 60335-1: 2002 et EN 60335-2-51: 2003.
- Compatibilité électromagnétique (2004/108/CE).
- Standard utilisé: EN 61800-3.

## **I** Dichiarazione di Conformità

Noi **Grundfos** dichiariamo sotto la nostra esclusiva responsabilità che i prodotti **MAGNA Series 2000** ai quali questa dichiarazione si riferisce sono conformi alle Direttive del Consiglio concernente il ravvicinamento delle legislazioni degli Stati membri CE relative a

- Macchine (98/37/CE).
- Materiale elettrico destinato ad essere utilizzato entro certi limiti di tensione (2006/95/CE).
- Standard usati: EN 60335-1: 2002 e EN 60335-2-51: 2003.
- Compatibilità elettromagnetica (2004/108/CE).
- Standard usato: EN 61800-3.

## **E** Declaración de Conformidad

Nosotros **Grundfos** declaramos bajo nuestra única responsabilidad que los productos **MAGNA Series 2000** a los cuales se refiere esta declaración son conformes con las Directivas del Consejo relativas a la aproximación de las legislaciones de los Estados Miembros de la CE sobre

- Máquinas (98/37/CE).
- Material eléctrico destinado a utilizarse con determinadas límites de tensión (2006/95/CE).
- Normas aplicadas: EN 60335-1: 2002 y EN 60335-2-51: 2003.
- Compatibilidad electromagnética (2004/108/CE).
- Norma aplicada: EN 61800-3.

## **P** Declaração de Conformidade

Nós **Grundfos** declaramos sob nossa única responsabilidade que os produtos **MAGNA Series 2000** aos quais se refere esta declaração estão em conformidade com as Directivas do Conselho das Comunidades Europeias relativas à aproximação das legislações dos Estados Membros respeitantes a

- Máquinas (98/37/CE).
- Material eléctrico destinado a ser utilizado dentro de certos limites de tensão (2006/95/CE).
- Normas utilizadas: EN 60335-1: 2002 e EN 60335-2-51: 2003.
- Compatibilidade electromagnética (2004/108/CE).
- Norma utilizada: EN 61800-3.

## **GR** Δήλωση Συμμόρφωσης

Εμείς η **Grundfos** δηλώνουμε με αποκλειστικά δική μας ευθύνη ότι τα προϊόντα **MAGNA Series 2000** συμμορφώνονται με την Οδηγία του Συμβουλίου επί της σύγκλισης των νόμων των Κρατών Μελών της Ευρωπαϊκής Ένωσης σε σχέση με τα

- Μηχανήματα (98/37/ΕΚ).
- Ηλεκτρικές συσκευές σχεδιασμένες για χρήση εντός ορισμένων ορίων ηλεκτρικής τάσης (2006/95/ΕΚ).
- Πρότυπα που χρησιμοποιήθηκαν: EN 60335-1: 2002 και EN 60335-2-51: 2003.
- Ηλεκτρομαγνητική συμβατότητα (2004/108/ΕΚ).
- Πρότυπο που χρησιμοποιήθηκε: EN 61800-3.

## **NL** Overeenkomstigheidsverklaring

Wij **Grundfos** verklaren geheel onder eigen verantwoordelijkheid dat de producten **MAGNA Series 2000** waarop deze verklaring betrekking heeft in overeenstemming zijn met de Richtlijnen van de Raad inzake de onderlinge aanpassing van de wetgevingen van de Lid-Staten betreffende

- Machines (98/37/EG).
- Elektrisch materiaal bestemd voor gebruik binnen bepaalde spanningsgrenzen (2006/95/EG).
- Normen: EN 60335-1: 2002 en EN 60335-2-51: 2003.
- Elektromagnetische compatibiliteit (2004/108/EG).
- Norm: EN 61800-3.

## **S** Försäkran om överensstämmelse

Vi **Grundfos** försäkrar under ansvar, att produkterna **MAGNA Series 2000**, som omfattas av denna försäkran, är i överensstämmelse med Rådets Direktiv om inbördes närmande till EU-medlemsstaternas lagstiftning, avseende

- Maskinell utrustning (98/37/EC).
- Elektrisk utrustning avsedd för användning inom vissa spänningsgränser (2006/95/EC).
- Använda standarder: EN 60335-1: 2002 och EN 60335-2-51: 2003.
- Elektromagnetisk kompatibilitet (2004/108/EC).
- Använd standard: EN 61800-3.

## **FIN** Vastavuusvakuutus

Me **Grundfos** vakuutamme yksin vastuullisesti, että tuotteet **MAGNA Series 2000**, jota tämä vakuutus koskee, noudattavat direktiivejä jotka käsittelevät EY:n jäsenvaltioiden koneellisia laitteita koskevien lakien yhdenmukaisuutta seur:

- Koneet (98/37/EY).
- Määrättyjen jänniterajoitusten puitteissa käytettävät sähköiset laitteet (2006/95/EY).
- Käytetyt standardit: EN 60335-1: 2002 ja EN 60335-2-51: 2003.
- Elektromagneettinen vastavuus (2004/108/EY).
- Käytetyt standardit: EN 61800-3.

## **DK** Overensstemmelseserklæring

Vi **Grundfos** erklærer under ansvar, at produkterne **MAGNA Series 2000**, som denne erklæring omhandler, er i overensstemmelse med Rådets direktiver om indbyrdes tilnærmelse til EF medlemsstaternes lovgivning om

- Maskiner (98/37/EF).
- Elektrisk materiel bestemt til anvendelse inden for visse spændingsgrænser (2006/95/EF).
- Anvendte standarder: EN 60335-1: 2002 og EN 60335-2-51: 2003.
- Elektromagnetisk kompatibilitet (2004/108/EF).
- Anvendt standard: EN 61800-3.

## **PL** Deklaracja zgodności

My, **Grundfos**, oświadczamy z pełną odpowiedzialnością, że nasze wyroby **MAGNA Series 2000**, których deklaracja niniejsza dotyczy, są zgodne z następującymi wytycznymi Rady d/s ujednolicenia przepisów prawnych krajów członkowskich EG:

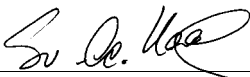
- maszyny (98/37/EG).
- wyposażenie elektryczne do stosowania w określonym zakresie napięć (2006/95/EG).
- zastosowane normy: EN 60335-1: 2002 i EN 60335-2-51: 2003.
- zgodność elektromagnetyczna (2004/108/EG).
- zastosowana norma: EN 61800-3.

**RU Декларация о соответствии**

Мы, компания **Grundfos**, со всей ответственностью заявляем, что изделия **MAGNA Series 2000**, к которым и относится данная декларация, отвечают требованиям следующих указаний Совета ЕС об унификации законодательных предписаний стран-членов ЕС:

- Машиностроение (98/37/ЕС).
  - Электрические машины для эксплуатации в пределах определенного диапазона значений напряжения (2006/95/ЕС).  
Применяющиеся стандарты: Евростандарт EN 60335-1: 2002 и EN 60335-2-51: 2003.
  - Электромагнитная совместимость (2004/108/ЕС).  
Применяющиеся стандарты: Евростандарт EN 61800-3.
- 

Bjerringbro, 1st December 2008

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Svend Aage Kaas  
Technical Director



# GRUNDFOS MAGNA

## Series 2000

MAGNA 25-40, 25-60, 25-100, 32-40, 32-60, 32-100, 40-100(D), 50-100

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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.**

## 1. Symbols used in this document



### Warning

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



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



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

## 2. General description

The GRUNDFOS MAGNA Series 2000 is a complete range of circulator pumps with integrated differential pressure control enabling adjustment of pump performance to the actual system requirements. In many systems, this will reduce the power consumption considerably, reduce noise from thermostatic valves and similar fittings, and improve the control of the system.

The desired head can be set on the pump control panel.

## 3. Applications

The GRUNDFOS MAGNA is designed for circulating liquids in heating and air-conditioning systems. The pump can also be used in domestic hot-water systems.

The pump range is primarily used in

- systems with a **variable flow**.
- The pump range can also be used in
- systems with a **constant flow** where it is desirable to optimise the setting of the pump duty point,
  - systems with **variable flow-pipe temperature**.

### 3.1 Pumped liquids

Thin, clean, non-aggressive and non-explosive liquids, not containing solid particles, fibres or mineral oil.

In **heating systems**, the water should meet the requirements of accepted standards on water quality in heating systems, e.g. the German standard VDI 2035.

In **domestic hot-water systems**, it is advisable to use GRUNDFOS MAGNA pumps only for water with a degree of hardness lower than approx. 14 °dH.



### Warning

**The pump must not be used for the transfer of inflammable liquids such as diesel oil, petrol or similar liquids.**

## 4. Installation

Arrows on the pump housing indicate the liquid flow direction through the pump.

### 4.1 Positioning

GRUNDFOS MAGNA must be installed with the pump head in horizontal position. See page 285.


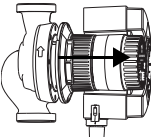
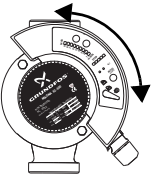
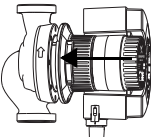
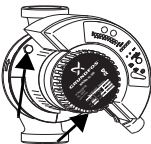
### 4.2 Changing the control box position



#### Warning

**Before any dismantling of the pump, the system must be drained or the isolating valves on both sides of the pump must be closed as the pumped liquid may be scalding hot and under high pressure.**

Procedure:

Step	Action	Illustration
1	Remove the two screws.	
2	Pull the stator and the pump head approx. 5 mm out.	
3	Turn the stator and the pump head to the desired position.	
4	Push the stator and the pump head into place.	
5	Refit the two screws.	

#### 4.2.1 Control box position

For permissible control box positions, see the Quick Guide.

### 4.3 Insulation shells

**Note** *It is recommended to fit insulation shells to the pump.*

- Insulation shells for pumps in heating systems are supplied with the pump.
- Insulation shells for pumps in air-conditioning systems are accessories and must be ordered separately. Please contact Grundfos.

The fitting of insulation shells will increase the pump dimensions. See the dotted line on the dimensional sketches on pages 280 and 281.

The insulation shells are only available for single-head pumps.

### 4.4 Twin-head pumps

Twin-head pumps are supplied fitted with a GENI module on each control box. The modules are connected via a cable. The modules determine the operating mode of the pump, see section 7.9.1 *Control of twin-head pumps.*

**Caution** *Twin-head pumps mounted in horizontal pipes must be fitted with an automatic air vent (Rp 1/4) in the upper part of the pump housing, see fig. 1.*

The automatic air vent is not supplied with the pump.

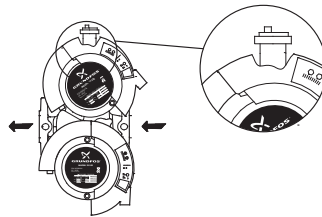


Fig. 1 Automatic air vent

### 4.5 Non-return valve

If a non-return valve is fitted in the pipe system, see fig. 2, it must be ensured that the set minimum discharge pressure of the pump is always higher than the closing pressure of the valve. This is especially important in proportional-pressure control mode (reduced head at low flow).

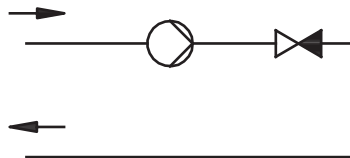


Fig. 2 Non-return valve

## 4.6 Frost protection

If the pump is not used during periods of frost, necessary steps must be taken to prevent frost bursts.

Note

*Additives with a density and/or kinematic viscosity higher than those of water will reduce the hydraulic performance.*

## 5. Electrical connection

The electrical connection and protection must be carried out in accordance with local regulations.

### Warning

*The pump must be connected to an external mains switch with a contact separation of at least 3 mm in each pole.*

*Earthing or neutralisation can be used for protection against indirect contact.*

*Megging must be carried out as described in section 10. Megging.*



*If the pump is connected to an electric installation where an earth leakage circuit breaker (ELCB) is used as additional protection, this circuit breaker must trip out when earth fault currents with DC content (pulsating DC) occur.*

*The earth leakage circuit breaker must be marked with this symbol:*



- The pump requires no external motor protection.
- Check that the supply voltage and frequency correspond to the values stated on the pump nameplate.

### 5.1 Supply voltage

1 x 230-240 V – 10 %/+ 6 %, 50/60 Hz.

### 5.2 Connection to the supply

Step	Action
1	

TM03 0898 0705

Step	Action
2	
3	
4	
5	
6	

TM03 0899 0705

TM03 0900 0705

TM03 0901 0705

TM03 0902 0705

TM03 0520 0105

## 6. Start-up

Do not start the pump until the system has been filled with liquid and vented. Furthermore, the required minimum inlet pressure must be available at the pump inlet, see section 11. *Technical data*. The system cannot be vented through the pump.

## 7. Functions

Most functions can be selected on the pump control panel. However, some functions can only be selected with the R100 or via expansion modules.

---

**On the pump control panel, see fig. 11, page 15:**

- **AUTO<sub>ADAPT</sub>** (factory setting)  
Recommended for most heating installations. During operation, the pump automatically makes the necessary adjustment to the actual system characteristic. This setting ensures minimum energy consumption and noise level which reduces operating costs and increases comfort.
- **Proportional-pressure control**  
The pump head is changed continuously in accordance with the water demand in the system. The desired setpoint can be set on the pump control panel.
- **Constant-pressure control**  
A constant head is maintained, irrespective of water demand. The desired setpoint can be set on the pump control panel.
- **Automatic night-time duty**  
The pump changes automatically between normal duty and night-time duty depending on the flow-pipe temperature. Automatic night-time duty can be combined with the above-mentioned control modes.

---

**Further functions:**

**With the R100 remote control:**

- **Constant-curve duty**  
The pump runs at a constant speed, on or between the max. and min. curves.
- **Temperature influence**  
The pump head varies depending on the liquid temperature.

---

**Via expansion modules:**

### GENI module

- **External analog control** of head or speed via a signal from an external 0-10 V signal transmitter.
- **External forced control** via inputs for:
  - Max. curve
  - Min. curve.
- **Bus communication via GENIbus**  
The pump can be controlled and monitored by a Grundfos Control MPC Series 2000, a building management system or another type of external control system.
- **Control of twin-head pumps**  
The control of twin-head pumps is described in section 7.9.1.
- **External start/stop**  
The pump can be started and stopped via the digital input.
- **Fault, ready and operating indication via signal relay**  
The pump controls an external fault, ready and operating signal relay via a potential-free output. The function of the signal relay is set with the R100.

### Relay module

- **External start/stop**  
The pump can be started and stopped via the digital input.
  - **Fault, ready and operating indication via signal relay**  
The pump controls an external fault, ready and operating signal relay via a potential-free output. The function of the signal relay is set with the R100.
-



### 7.1 Control modes

A GRUNDFOS MAGNA pump can be set to the control mode which is most suitable for the individual system.

Possible control modes:

- AUTO<sub>ADAPT</sub> (factory setting)
- Proportional pressure
- Constant pressure.

Each of the control modes can be combined with automatic night-time duty, see section 7.3 *Automatic night-time duty*.

#### AUTO<sub>ADAPT</sub>

To be set on the control panel or with the R100, see section 8. *Setting the pump*.

The control mode AUTO<sub>ADAPT</sub> continuously adapts the pump performance.

The setpoint of the pump has been factory-set as follows and cannot be changed manually:

- MAGNA 25-100, 32-100, 40-100(D), 50-100 to 5.5 metres.
- MAGNA 25-60, 32-60 to 3.5 metres.
- MAGNA 25-40, 32-40 to 2.5 metres.

When the pump registers a lower pressure on the max. curve, A<sub>2</sub>, the AUTO<sub>ADAPT</sub> function automatically selects a correspondingly lower control curve, H<sub>set2</sub>, thus reducing the energy consumption.

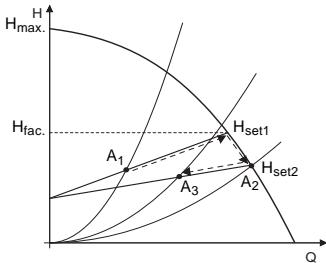



Fig. 3 AUTO<sub>ADAPT</sub>

- A<sub>1</sub>: Original duty point.
- A<sub>2</sub>: Lower registered pressure on the max. curve.
- A<sub>3</sub>: New duty point after AUTO<sub>ADAPT</sub> control.
- H<sub>set1</sub>: Original setpoint.
- H<sub>set2</sub>: New setpoint after AUTO<sub>ADAPT</sub> control.
- H<sub>fac</sub>: Factory-set setpoint.

The AUTO<sub>ADAPT</sub> function can be reset by pressing the button  for approx. 10 seconds until the control mode is back to the starting point (AUTO<sub>ADAPT</sub> or AUTO<sub>ADAPT</sub> with automatic night-time duty).

#### Proportional-pressure control

To be set on the control panel or with the R100, see section 8. *Setting the pump*.

The pump head is reduced at decreasing water demand and increased at rising water demand, see fig. 4.

#### Constant-pressure control

To be set on the control panel or with the R100, see section 8. *Setting the pump*.

The pump maintains a constant pressure, irrespective of water demand, see fig. 4.

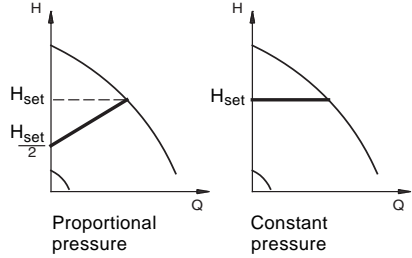




Fig. 4 Pressure control

TM02 0251 4800



TM00 5546 4596

## 7.2 Selection of control mode

System type	Description	Select this control mode
Typical heating systems	Grundfos recommends to let the pump remain in AUTO <sub>ADAPT</sub> mode. This ensures optimum performance at the lowest possible energy consumption.	AUTO <sub>ADAPT</sub>
Relatively great head losses in the distribution pipes and air-conditioning systems	<ol style="list-style-type: none"> <li>Two-pipe heating systems with thermostatic valves and: <ul style="list-style-type: none"> <li>with a dimensioned pump head higher than 3 metres,</li> <li>very long distribution pipes,</li> <li>strongly throttled pipe balancing valves,</li> <li>differential pressure regulators,</li> <li>great head losses in those parts of the system through which the total quantity of water flows (e.g. boiler, heat exchanger and distribution pipe up to the first branching).</li> </ul> </li> <li>Primary circuit pumps in systems with great head losses in the primary circuit.</li> <li>Air-conditioning systems with <ul style="list-style-type: none"> <li>heat exchangers (fan coils),</li> <li>cooling ceilings,</li> <li>cooling surfaces.</li> </ul> </li> </ol>	Proportional pressure 
Relatively small head losses in the distribution pipes	<ol style="list-style-type: none"> <li>Two-pipe heating systems with thermostatic valves and: <ul style="list-style-type: none"> <li>with a dimensioned pump head lower than 2 metres,</li> <li>dimensioned for natural circulation,</li> <li>with small head losses in those parts of the system through which the total quantity of water flows (e.g. boiler, heat exchanger and distribution pipe up to the first branching) or</li> <li>modified to a high differential temperature between flow pipe and return pipe (e.g. district heating).</li> </ul> </li> <li>Underfloor heating systems with thermostatic valves.</li> <li>One-pipe heating systems with thermostatic valves or pipe balancing valves.</li> <li>Primary circuit pumps in systems with small head losses in the primary circuit.</li> </ol>	Constant pressure 

### 7.2.1 Setpoint setting

If AUTO<sub>ADAPT</sub> is selected, the setpoint cannot be set.

The setpoint can be set by pressing  or  when the pump is in control mode:

- proportional pressure,
- constant pressure or
- constant-curve duty.

Set the setpoint so that it matches the system.

A too high setting may result in noise in the system whereas a too low setting may result in insufficient heating or cooling in the system.

### 7.3 Automatic night-time duty

To be set on the control panel or with the R100, see section 8. *Setting the pump.*

Once automatic night-time duty has been activated, the pump automatically changes between normal duty and night-time duty (duty at low performance).

Changeover between normal duty and night-time duty is dependent on the flow-pipe temperature.

The pump automatically changes over to night-time duty when the built-in sensor registers a flow-pipe temperature drop of more than 10-15 °C within approx. 2 hours. The temperature drop must be at least 0.1 °C/min.

Changeover to normal duty takes place without a time lag when the temperature has increased by approx. 10 °C.

**Note**

**Automatic night-time duty cannot be used in air-conditioning systems.**

## 7.4 Constant-curve duty

To be set with the R100, see section 8. *Setting the pump.*

The pump can be set to operate according to a constant curve, like an uncontrolled pump, see fig. 6.

When the pump has been set to constant-curve mode with the R100, the setting can be changed on the control panel or with the R100.

### MAGNA 25-100, 32-100, 40-100(D), 50-100

Select one of 9 curves (81 curves with the R100) between the max. and min. curves, see fig. 5.

### MAGNA 25-60, 32-60

Select one of 5 curves (41 curves with the R100) between the max. and min. curves, see fig. 5.

### MAGNA 25-40, 32-40

Select one of 3 curves (21 curves with the R100) between the max. and min. curves, see fig. 5.

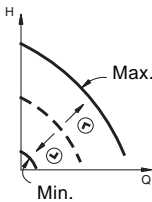


Fig. 5 Operating curves

## 7.5 Max. or min. curve duty

To be set on the control panel, with the R100 or via GENI module, see section 8. *Setting the pump.*

The pump can be set to operate according to the max. or min. curve, like an uncontrolled pump, see fig. 6.

This operating mode is available, irrespective of the control mode.

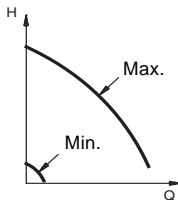


Fig. 6 Max. and min. curves

The **max. curve** mode can be selected if an uncontrolled pump is required.

The **min. curve** mode can be used in periods in which a minimum flow is required. This operating mode is for instance suitable for manual night-time duty if automatic night-time duty is not desired.

## 7.6 Temperature influence

To be set with the R100, see section 8. *Setting the pump.*

When this function is activated in proportional- or constant-pressure control mode, the setpoint for head will be reduced according to the liquid temperature.

It is possible to set temperature influence to function at liquid temperatures below 80 °C or below 50 °C. These temperature limits are called  $T_{max}$ . The setpoint is reduced in relation to the head set (= 100 %) according to the characteristics below.

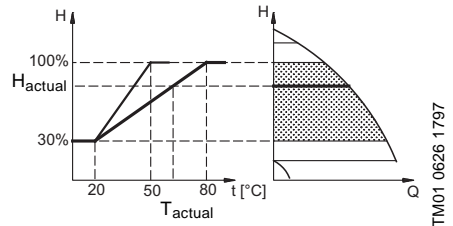


Fig. 7 Temperature influence

In the above example,  $T_{max} = 80$  °C has been selected. The actual liquid temperature  $T_{actual}$  causes the setpoint for head to be reduced from 100 % to  $H_{actual}$ .

The temperature influence function requires:

- Proportional- or constant-pressure control mode.
- The pump must be installed in the flow pipe.
- System with flow-pipe temperature control.

Temperature influence is suitable in:

- systems with variable flows (e.g. two-pipe heating systems), in which the activation of the temperature influence function will ensure a further reduction of the pump performance in periods with small heating demands and consequently a reduced flow-pipe temperature.
- systems with almost constant flows (e.g. one-pipe heating systems and underfloor heating systems), in which variable heating demands cannot be registered as changes in the head as is the case with two-pipe heating systems. In such systems, the pump performance can only be adjusted by activating the temperature influence function.

### Selection of $T_{max}$ .

In systems with a dimensioned flow-pipe temperature of:

- up to and including 55 °C, select  $T_{max} = 50$  °C,
- above 55 °C, select  $T_{max} = 80$  °C.

Note

**The temperature influence function cannot be used in air-conditioning systems.**

## 7.7 Expansion modules

The pump can be fitted with an expansion module enabling communication with external signals (signal transmitters).

Two types of expansion modules are available:

- Relay module
- GENI module.

Twin-head pumps are always fitted with GENI modules.

Connection examples (GENI module) can be found on pages 283 and 284.

## 7.8 Relay module

For mounting and operation, see separate installation and operating instructions for the relay module.

### Functions

- External start/stop
- Fault, ready and operating indication via signal relay.

## 7.9 GENI module

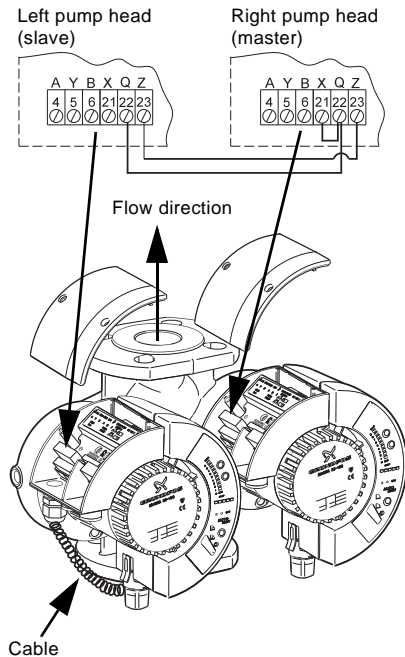
For mounting and operation, see separate installation and operating instructions for the GENI module.

### Functions

- External start/stop
- External forced control
- External analog 0-10 V control
- Bus communication via GENIbus
- Control of twin-head pumps
- Fault, ready and operating indication via signal relay.

## 7.9.1 Control of twin-head pumps

Twin-head pumps are supplied fitted with a GENI module on each control box. The modules are connected via a cable.



**Fig. 8** Twin-head pump with GENI modules

For connection of the communication cable between the GENI modules, see pages 283 and 284.

The communication between the control box and the GENI module is wireless.

Twin-head pumps are factory-set to the control mode *AUTO<sub>ADAPT</sub>* and the operating mode "alternating operation", which is described below.

Operating modes:

- **Alternating operation**

Pump operation alternates every 24 hours. If the duty pump stops due to a fault, the other pump will start.

- **Standby operation**

One pump is operating continuously. In order to prevent seizing-up, the other pump will start at a fixed frequency and run for a short period. If the duty pump stops due to a fault, the other pump will start.

**Note**

*In air-conditioning systems, standby operation is recommended to avoid critical condensation inside the pump.*

TM03 06/42 0405

### 7.9.2 Selection of operating mode

Select the operating mode by means of the mechanical contact in each module.

Operating mode	Left pump head	Right pump head
Alternating	Alternating	Alternating
Standby	Alternating	Standby
Standby	Standby	Alternating
Standby	Standby	Standby

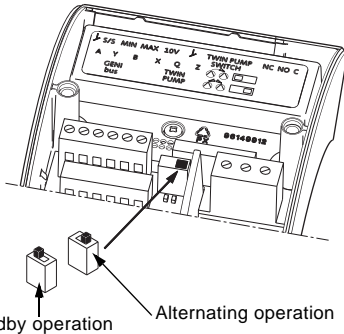


Fig. 9 Mechanical contact

### Operating the pump

Twin-head pumps can be set and operated in the same way as single-head pumps. The duty pump uses its setpoint setting, whether it is made on the control panel, with the R100 or via bus.

**Both pumps should be set to the same setpoint and control mode. Different settings will result in different operation when changing between the two pumps.**

Note

### 7.10 Connection to LON network

The pump can be connected to a LON network via a GENI module and an external Grundfos G10 LON interface. Product number: 605726.

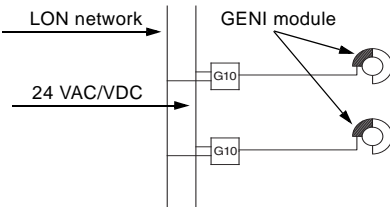


Fig. 10 Connection to LON network

## 8. Setting the pump

For the setting of the pump, use:

- control panel.
- R100 remote control.
- bus communication (not described in detail in these instructions, contact Grundfos).

The table shows the application of the individual operating units and in which section the function has been described.

Possible settings	Control panel	R100
AUTO <sub>ADAPT</sub>	8.2.1	8.7.1
Automatic night-time duty	8.2.1	8.7.2
Proportional-pressure control	8.2.1	8.7.1
Constant-pressure control	8.2.1	8.7.1
Setpoint setting	8.2.2	8.5.1
Max. curve duty	8.2.3	8.5.2
Min. curve duty	8.2.4	8.5.2
Constant-curve duty	–	8.5.2
Temperature influence	–	8.7.3
Activation/deactivation of pump buttons	–	8.7.4
Allocation of pump number	–	8.7.6
Start/stop	8.2.5	8.5.2
<b>Resetting of fault indications</b>	8.2.6	8.5.3
<b>Reading of various data</b>	–	8.6.1 - 8.6.7

"–" = not available with this operating unit.

### 8.1 Factory setting

The pump is factory-set to AUTO<sub>ADAPT</sub> without automatic night-time duty.

## 8.2 Control panel



### Warning

**At high liquid temperatures, the pump may be so hot that only the buttons should be touched to avoid burns.**

The control panel, fig. 11, incorporates:

Pos.	Description
1	Buttons for setting
2	<ul style="list-style-type: none"> <li>Indicator lights for operating and fault indication and</li> <li>symbol for indication of external control</li> </ul>
3	Button for change of control mode
4	Light symbols for indication of control mode and night-time duty
5	Light fields for indication of head, flow and operating mode

For further information, see section 9. *Fault finding chart.*

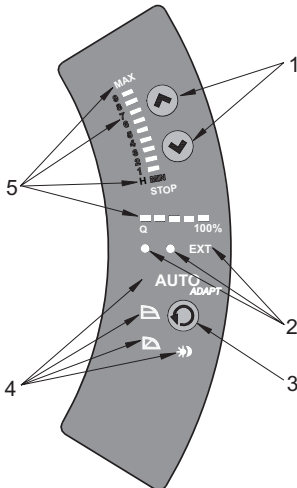



Fig. 11 Control panel

### 8.2.1 Control mode setting

Description of function, see section 7.1 *Control modes.*

To change the control mode, press , pos. 3, according to this cycle:

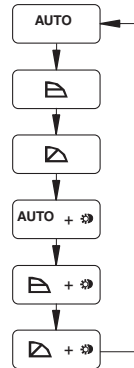










Fig. 12 Cycle of control modes

Automatic night-time duty can be activated together with each of the control modes.

The light symbols in pos. 4, see fig. 11, indicate the pump settings:

Light in	Control mode	Automatic night-time duty
AUTO <sub>ADAPT</sub>	AUTO <sub>ADAPT</sub>	NO
	Proportional pressure	NO
	Constant pressure	NO
-	Constant curve	NO
AUTO <sub>ADAPT</sub> 	AUTO <sub>ADAPT</sub>	YES
 	Proportional pressure	YES
 	Constant pressure	YES
- 	Constant curve	YES

"-" = no light.

### 8.2.2 Setpoint setting

Set the setpoint of the pump by pressing  $\odot$  or  $\ominus$  when the pump has been set to proportional-pressure control, constant-pressure control or constant-curve duty.

The light fields, pos. 5, on the control panel indicate the setpoint set.

#### MAGNA 25-100, 32-100, 40-100(D), 50-100

The light fields can indicate a maximum setpoint of 9 metres.

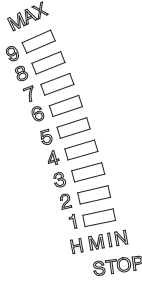


Fig. 13 Light fields MAGNA xx-100

#### MAGNA 25-40, 32-40, 25-60, 32-60

The light fields can indicate a maximum setpoint of:

- MAGNA 25-40, 32-40 = 3 metres.
- MAGNA 25-60, 32-60 = 5 metres.



Fig. 14 Light fields MAGNA xx-40, xx-60

### 8.2.3 Setting to max. curve duty

Description of function, see section 7.5 *Max. or min. curve duty*.

To change over to the max. curve, press  $\odot$  continuously until "MAX" illuminates, see fig. 15. To change back, press  $\ominus$  continuously until the desired setpoint is indicated.

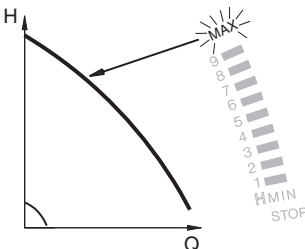


Fig. 15 Max. curve

### 8.2.4 Setting to min. curve duty

Description of function, see section 7.5 *Max. or min. curve duty*.

To change over to the min. curve, press  $\ominus$  continuously until "MIN" illuminates, see fig. 16. To change back, press  $\odot$  continuously until the desired setpoint is indicated.

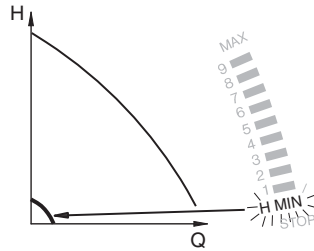


Fig. 16 Min. curve

### 8.2.5 Start/stop of pump

To stop the pump, press  $\ominus$  continuously until "STOP" illuminates. When the pump is stopped, the green indicator light will be flashing.

To start the pump, press  $\odot$  continuously.

***If the pump is to be stopped, it is recommended to use the start/stop input, the R100 or to switch off the electricity supply. In this way, the setpoint will remain unchanged when the pump is started again.***

Note

### 8.2.6 Resetting of fault indications

The fault indications are reset by briefly pressing any button. The settings remain unchanged. If the fault has not disappeared, the fault indication will reappear. The time until the fault reappears may vary from 0 to 255 seconds.

### 8.3 R100 remote control

The pump is designed for wireless communication with the Grundfos R100 remote control. The R100 communicates with the pump via infra-red light.

During communication, the R100 must be pointed at the pump control panel. When the R100 is communicating with the pump, the red indicator light will flash rapidly.

The R100 offers additional possibilities of setting and status displays for the pump.

### 8.4 R100 display overview

The R100 displays are divided into four parallel menus, see fig. 17:

- 0. GENERAL, see operating instructions for R100
- 1. OPERATION
- 2. STATUS
- 3. INSTALLATION

The number stated at each individual display in fig. 17 refers to the section in which the display is described.

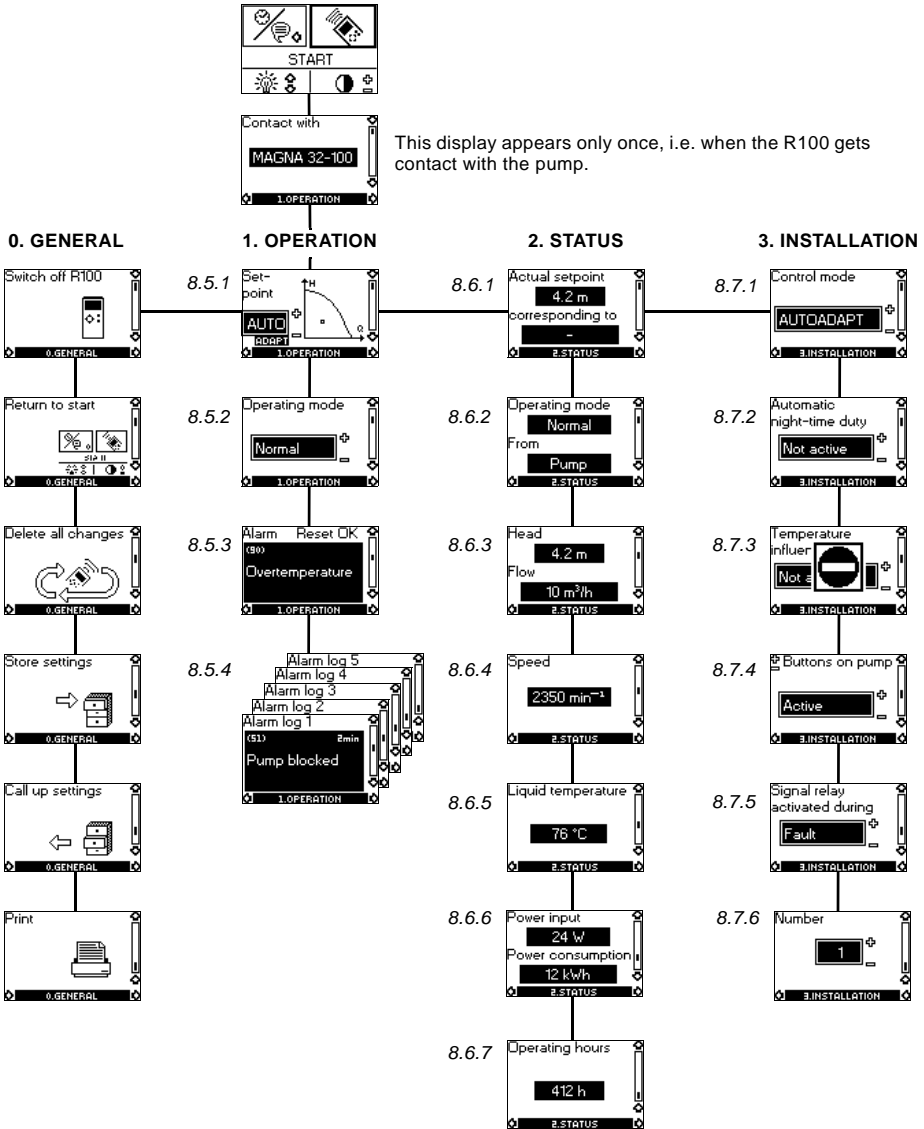


Fig. 17 Menu overview



## 8.5 Menu OPERATION

When the communication between the R100 and the pump has been established, "Contact with" appears in the display. When the "arrow down" on the R100 is pressed, menu OPERATION appears.

**The display "Contact with" appears only once, i.e. when the R100 gets contact with the pump.**

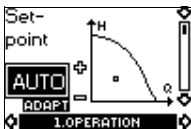
Note

### 8.5.1 Setpoint

This display depends on the control mode selected in the display "Control mode" in menu INSTALLATION.

If the pump is forced-controlled via external signals, the number of possible settings will be reduced, see section 8.8 *Priority of settings*. Attempts to change the settings will result in an indication in the display saying that the pump is forced-controlled and changes therefore cannot be made.

This display will appear when the pump is in AUTO<sub>ADAPT</sub> mode.



Set the desired setpoint by pressing the buttons "+" and "-" on the R100 (not possible when the pump is in AUTO<sub>ADAPT</sub> mode).

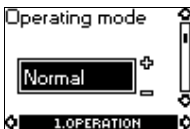
Furthermore, it is possible to select one of these operating modes:

- Stop
- Min. (min. curve)
- Max. (max. curve).

The display is different if proportional pressure, constant pressure or constant curve has been selected.

The actual duty point of the pump is indicated by a square in the Q/H field. No indication at low flow.

### 8.5.2 Operating mode



Select an operating mode:

- Stop
- Min. (min. curve)
- Normal (AUTO<sub>ADAPT</sub>, proportional pressure, constant pressure or constant curve)
- Max. (max. curve).

### 8.5.3 Fault indications



If the pump is faulty, the cause will appear in this display.

Possible causes:

- Pump blocked
- Internal fault
- Overvoltage
- Undervoltage
- Overtemperature
- Module fault
- Fault in module communication.

The fault indication can be reset in this display. If the fault has not disappeared when resetting is attempted, the fault indication will reappear in the display when communicating with the pump.

### 8.5.4 Alarm log



The alarm code with text appears in this display. The display also shows the number of minutes the pump has been connected to the electricity supply after the fault occurred.

The last five fault indications will appear in the alarm log.

## 8.6 Menu STATUS

The displays appearing in this menu are status displays only. It is not possible to change or set values.

The actual values in the display are indicative and based on estimation.

### 8.6.1 Actual setpoint



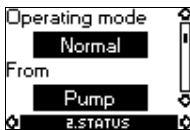
#### Field "Actual setpoint":

Actual setpoint of pump.

#### Field "corresponding to":

Actual setpoint in % of the setpoint set if the pump is connected to an external analog 0-10 V signal transmitter or if temperature influence or proportional-pressure control is activated.

### 8.6.2 Operating mode



This display shows the actual operating mode (*Stop*, *Min.*, *Normal* or *Max.*) and where it was selected (*Pump*, *R100*, *BUS* or *External*).

### 8.6.3 Head and flow



The actual head and flow of the pump.

If "<" is indicated in front of the flow, the flow is less than the displayed value.

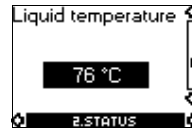
If the pump is unable to determine head and flow, this is indicated by "-".

### 8.6.4 Speed



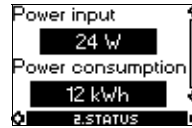
The actual pump speed.

### 8.6.5 Liquid temperature



The actual temperature of the pumped liquid.

### 8.6.6 Power input and power consumption



Actual power input and power consumption of the pump.

The value of power consumption is an accumulated value and cannot be set to zero.

### 8.6.7 Operating hours



Operating hours of the pump.

The value of operating hours is an accumulated value and cannot be set to zero.

## 8.7 Menu INSTALLATION

This menu shows the settings that should be considered when installing the pump.

### 8.7.1 Control mode

Description of function, see section 7.1 *Control modes* or 7.4 *Constant-curve duty*.



Select one of the control modes:

- *AUTOADAPT*
- *Prop. pressure* (proportional pressure)
- *Const. pressure* (constant pressure)
- *Const. curve* (constant curve).

Setting of setpoint and curve is carried out in display 8.5.1 *Setpoint* in menu OPERATION (not possible when the pump is in *AUTOADAPT* mode).

### 8.7.2 Automatic night-time duty



In this display, automatic night-time duty can be activated or deactivated.

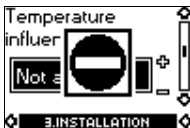
Automatic night-time duty can be set to:

- *Active*
- *Not active*,

irrespective of the control mode selected.

### 8.7.3 Temperature influence

Description of function, see section 7.6 *Temperature influence*.

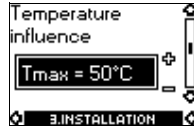


**If the pump is in control mode *AUTOADAPT* or constant curve, the temperature influence cannot be set with the R100.**

Note

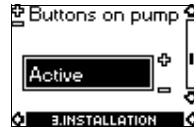
The temperature influence function can be activated in this display when the control mode is proportional pressure or constant pressure, see section 8.7.1 *Control mode*.

In the case of temperature influence, the pump must be installed in the flow pipe. It is possible to choose between maximum temperatures of 50 °C and 80 °C.



When the temperature influence is active, a small thermometer is shown in the display "Setpoint" in menu OPERATION, see section 8.5.1 *Setpoint*.

### 8.7.4 Buttons on pump



To prevent unauthorised persons from operating the pump, the function of the buttons ⏻, ⏹ and ⏸ can be deactivated in this display. The buttons can be reactivated only with the R100.

The buttons can be set to:

- *Active*
- *Not active*.

### 8.7.5 Signal relay



If an expansion module has been fitted, the signal relay function can be set in this display.

- *Fault* (functions as a fault signal relay)
- *Ready* (functions as a ready signal relay)
- *Operation* (functions as an operating signal relay).

### 8.7.6 Pump number



A number from 1 up to and including 64 can be allocated to a pump or can be changed so that the R100, Grundfos Control MPC Series 2000 or other systems can distinguish between two or more pumps.

### 8.8 Priority of settings

The external forced-control signals will influence the settings available on the pump control panel and with the R100. However, the pump can always be set to max. curve duty or to stop on the pump control panel or with the R100.

If two or more functions are activated at the same time, the pump will operate according to the setting with the highest priority.

The priority of the settings is as shown in the table.

**Example:** If the pump has been forced to stop via an external signal, the pump control panel or the R100 can only set the pump to max. curve.

#### With expansion module

Priority	Possible settings		
	Pump control panel or R100	External signals	Bus signal
1	Stop		
2	Max. curve		
3		Stop	Stop
4		Max. curve	Max. curve
5	Min. curve	Min. curve	Min. curve
6	Setpoint setting		Setpoint setting

	Not active when the pump is controlled via bus.
	Only active when the pump is controlled via bus.

As illustrated in the table, the pump does not react to external signals (max. curve and min. curve) when the pump is controlled via bus.

If the pump is to react to external signals (max. curve and min. curve), the system must be configured for that function.

For further details, please contact Grundfos.

## 9. Fault finding chart



### Warning

The pumped liquid may be scalding hot and under high pressure. Before any removal or dismantling of the pump, the system must therefore be drained or the isolating valves on either side of the pump must be closed.

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Indicator light is off.








Indicator light is on.



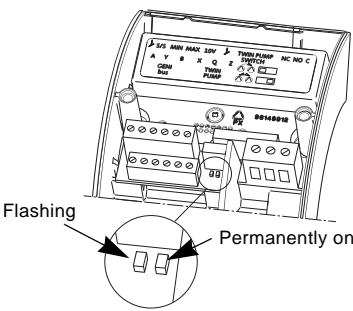
Indicator light is flashing.

Indicator lights		Fault	Cause	Remedy
Green	Red			
		The pump is not running.	One fuse in the installation is blown/tripped out.	Replace/cut in the fuse. Check that the electricity supply falls within the specified range.
			The current-operated or voltage-operated circuit breaker has tripped out.	Cut in the circuit breaker. Check that the electricity supply falls within the specified range.
			The pump may be defective.	Replace the pump or call GRUNDFOS SERVICE for assistance.
		The pump is not running.	The pump has been stopped in one of the following ways: 1. With the button . 2. With the R100. 3. External on/off switch in position off. 4. Via bus signal.	1. Start the pump by pressing . 2. Start the pump with the R100 or by pressing . 3. Switch on the on/off switch. 4. Start the pump via bus signal.
			Electricity supply failure.	Check that the electricity supply falls within the specified range.
			The pump has stopped due to a fault.	Pump blocked and/or impurities in the pump. Dismantle and clean the pump.
			The pump may be defective.	Use the R100 for fault finding, see section 8.5.3 <i>Fault indications</i> . Replace the pump or call GRUNDFOS SERVICE for assistance.
		The pump is running but is faulty.	The pump is faulty, but is able to operate.	Try to reset the fault indication by briefly switching off the electricity supply or by pressing the button ,  or .
		The pump has been set to stop and is faulty.	The pump is faulty, but is able to operate (has been set to STOP).	Use the R100 for fault finding, see section 8.5.3 <i>Fault indications</i> . In case of repeated faults, contact GRUNDFOS SERVICE.
			Air in the system.	Vent the system.
		Noise in the system.	The flow is too high.	Reduce the setpoint and possibly change over to AUTO <sub>ADAPT</sub> or constant pressure.
			The pressure is too high.	Reduce the setpoint and possibly change over to AUTO <sub>ADAPT</sub> or proportional pressure.

Indicator lights		Fault	Cause	Remedy
Green	Red			
		Noise in the pump.	The inlet pressure is too low.  Air in the pump.	Increase the inlet pressure and/or check air volume in the expansion tank (if installed).  Set the pump to "MAX" by continuously pressing the button  or with the R100. After venting, set the pump back to normal duty by pressing the buttons  ,  or with the R100. <b>Note:</b> The pump must not run dry.

**Note** *The R100 can also be used for fault finding.*

### 9.1 Checking the module

Illustration	Action
	<ol style="list-style-type: none"> <li>1. Remove the module cover.</li> <li>2. Check the LEDs. When the pump is switched on and the module is correctly mounted, the left LED must be flashing and the right LED must be permanently on.</li> <li>3. Refit the module cover.</li> </ol>

TM03 0892 0705

## 10. Megging



### Warning

Before removing the cables, the electricity must be switched off.

Procedure:

Megging of an installation incorporating a GRUNDFOS MAGNA pump is not allowed, as the built-in electronics may be damaged. If megging of the pump is necessary, the pump should be electrically separated from the installation.

GB

### Megging of the pump

Step	Illustration	Action
1		<ul style="list-style-type: none"> <li>Switch off the electricity supply.</li> <li>Open the connection box.</li> </ul>
2		<ul style="list-style-type: none"> <li>Remove the supply wires L and N and the earth wire (PE).</li> </ul>
3		<ul style="list-style-type: none"> <li>Short-circuit the wires L and N using a wire.</li> <li>Test between the wires L/N and earth (PE).</li> </ul> <p><b>Test voltage:</b> Max. 1000 VAC/1500 VDC. Maximum permissible leakage current &lt; 35 mA.</p> <p><b>Note:</b> Never test between the supply wires (L and N).</p>
4		<p>Test the cable to the pump.</p> <ul style="list-style-type: none"> <li>Pull the plug out of the pump and test again.</li> <li>Refit the supply wires L and N and the earth wire (PE).</li> <li>Switch on the electricity supply.</li> </ul>

## 11. Technical data

### Supply voltage

1 x 230-240 V – 10 %/+ 6 %, 50/60 Hz.

### Motor protection

The pump requires no external motor protection.

### Enclosure class

IP44.

### Insulation class

F.

### Relative air humidity

Maximum 95 %.

### Ambient temperature

0 °C to +40 °C.

### Temperature class

TF110 to EN 60335-2-51.

### Liquid temperature

Maximum +110 °C.

Continuously: +2 °C to +95 °C.

Pumps in domestic hot-water systems:

Continuously: +2 °C to +60 °C.

Ambient temperature [°C]	Liquid temperature	
	Min. [°C]	Max. [°C]
0	2	95/110
30	2	95/110
35	2	90/90
40	2	70/70

### Maximum system pressure

The maximum system pressure is indicated on the pump flanges: PN 6 / PN 10: 10 bar.

Number of bolt holes in the pump flange: 4.

### Inlet pressure

Recommended inlet pressures:

- Min. 0.10 bar at +75 °C.
- Min. 0.35 bar at +95 °C.

### EMC (electromagnetic compatibility)

EN 61800-3.

### Sound pressure level

The sound pressure level of the pump is lower than 38 dB(A).

### Leakage current

The pump mains filter will cause a discharge current to earth during operation.  $I_{\text{leakage}} < 3.5 \text{ mA}$ .

### Standby loss

Single-head pumps: Lower than 3 W.

Twin-head pumps: Lower than 7 W.

## Inputs and outputs of a pump with relay module

Signal output	Internal potential-free change-over contact. Maximum load: 250 V, 2 A, AC1. Minimum load: 5 V, 100 mA. Screened cable depending on signal level.
Input for external start/stop	External potential-free contact. Contact load: 5 V, 10 mA. Screened cable. Loop resistance: Maximum 130 Ω.

## Inputs and outputs of a pump with GENI module

Inputs for max. and min. curves	External potential-free contact. Contact load: 5 V, 1 mA. Screened cable. Loop resistance: Maximum 130 Ω.
Input for analog 0-10 V signal	External signal: 0-10 VDC. Maximum load: 1 mA. Screened cable.
Bus input	Grundfos bus protocol, GENIbus protocol, RS-485. Screened cable. Wire cross section: 0.25 - 1 mm <sup>2</sup> . Cable length: Maximum 1200 m.
Signal output	Internal potential-free change-over contact. Maximum load: 250 V, 2 A AC1. Minimum load: 5 V, 100 mA. Screened cable depending on signal level.
Input for external start/stop	External potential-free contact. Contact load: 5 V, 10 mA. Screened cable. Loop resistance: Maximum 130 Ω.

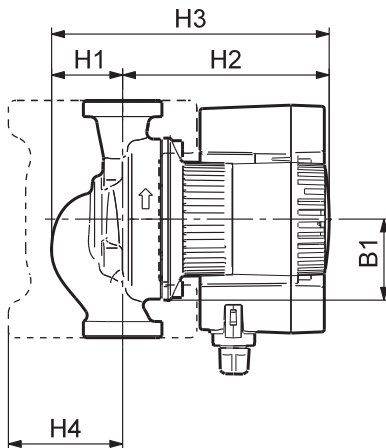
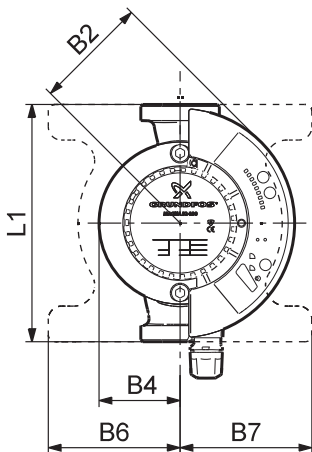
## 12. Disposal

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.

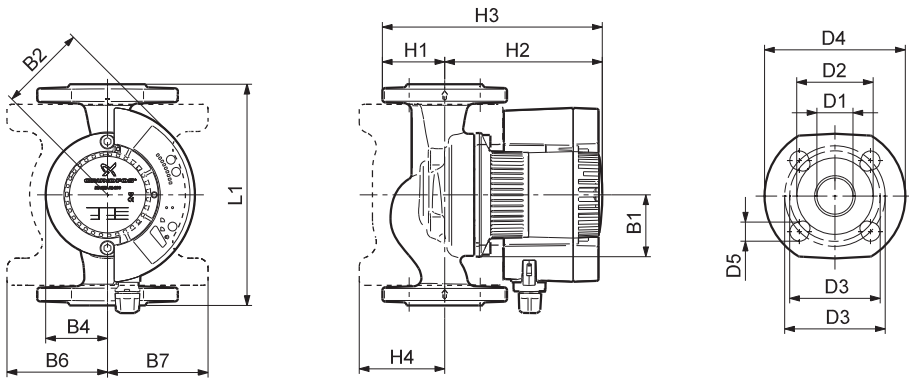
Subject to alterations.





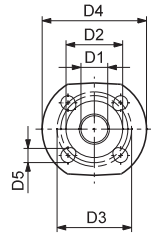
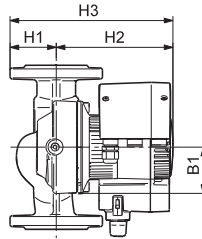
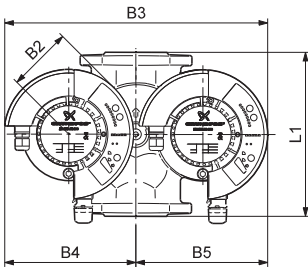
TM03 1234 1405

	MAGNA 25-40	MAGNA 25-60	MAGNA 25-100	MAGNA 32-40	MAGNA 32-60	MAGNA 32-100 (N)
	G 1½	G 1½	G 1½	G 2	G 2	G 2
L1	180	180	180	180	180	180
B1	62	62	62	62	62	62
B2	87	87	87	87	87	87
B4	62	62	62	62	62	62
B6	100	100	100	100	100	100
B7	100	100	100	100	100	100
H1	54	54	54	54	54	54
H2	157	157	157	157	157	157
H3	211	211	211	211	211	211
H4	85	85	85	85	85	85
D1	25	25	25	32	32	32



TM03 1233 1405

	MAGNA 32-100	MAGNA 40-100	MAGNA 50-100
	PN 6 / PN 10	PN 6 / PN 10	PN 6 / PN10
<b>L1</b>	220	220	240
<b>B1</b>	62	62	62
<b>B2</b>	87	87	87
<b>B4</b>	62	62	62
<b>B6</b>	100	100	104
<b>B7</b>	100	100	104
<b>H1</b>	54	62	73
<b>H2</b>	157	157	167
<b>H3</b>	211	219	240
<b>H4</b>	85	85	88
<b>D1</b>	32	40	50
<b>D2</b>	76	84	99
<b>D3</b>	90 / 100	100 / 110	110 / 125
<b>D4</b>	140	150	165
<b>D5</b>	19	19	19



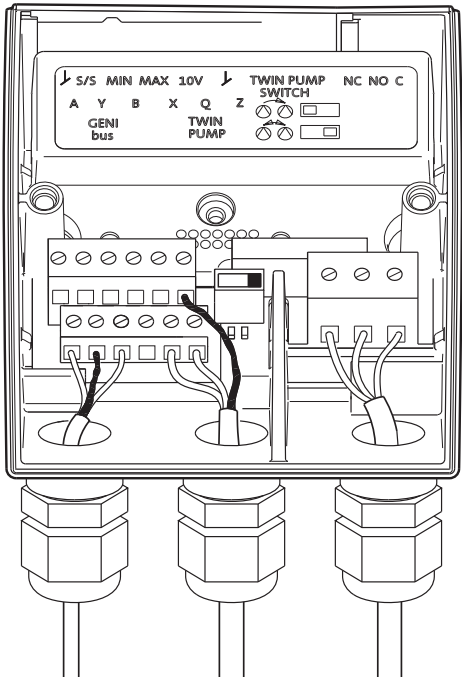
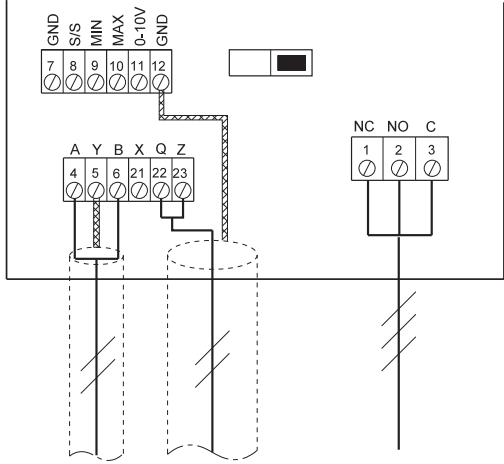
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**MAGNA D 40-100**

**PN 6 / PN 10**

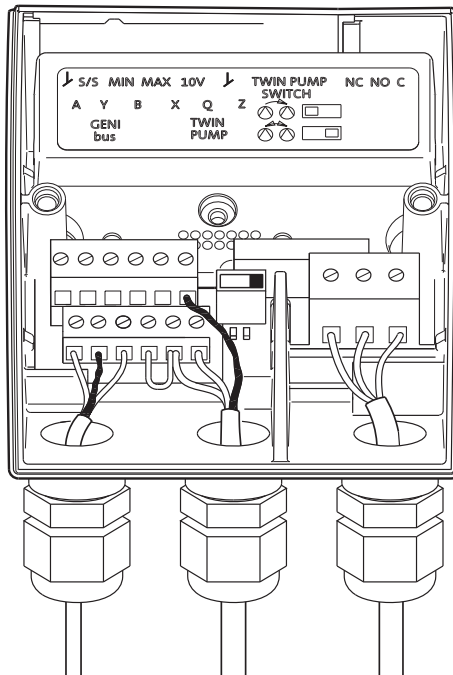
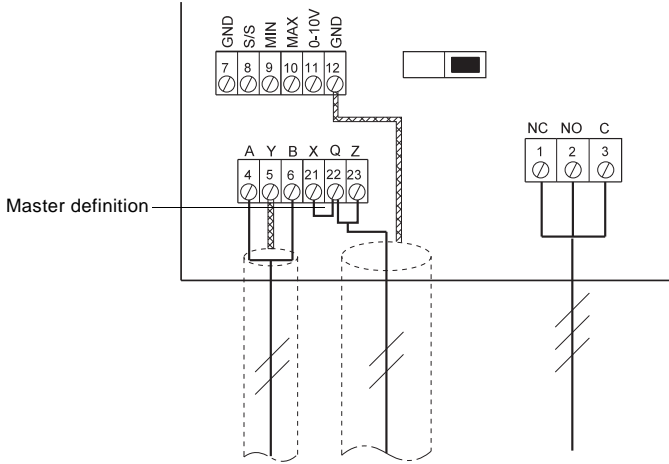
<b>L1</b>	220
<b>B1</b>	62
<b>B2</b>	87
<b>B4</b>	354
<b>B6</b>	177
<b>B7</b>	177
<b>H1</b>	62
<b>H2</b>	157
<b>H3</b>	219
<b>D1</b>	40
<b>D2</b>	84
<b>D3</b>	100 / 110
<b>D4</b>	150
<b>D5</b>	19

**MAGNA D 40-100 twin-head pump**  
**Slave**

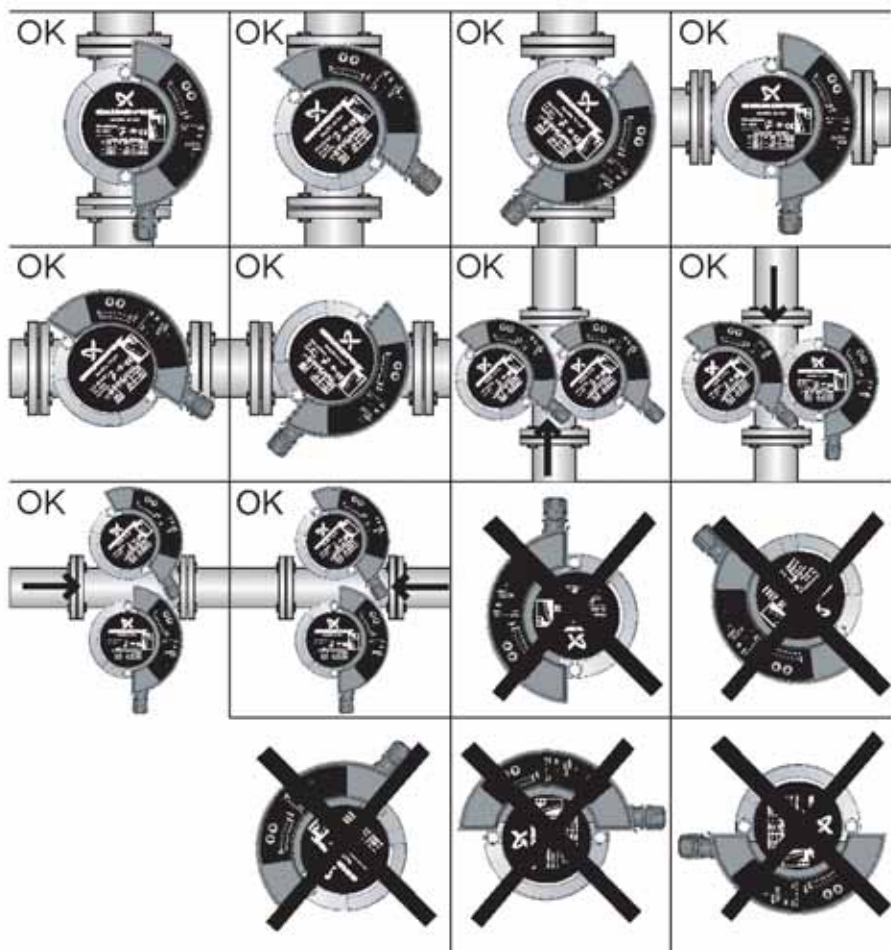


TM03 0856 0605

# MAGNA D 40-100 twin-head pump Master



## Positioning



TM04 3789 5008

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