

# VFC Fires

## Installation Instructions

Installatie-instructies • Instructions d'installation  
 Installationsanleitung • Istruzioni per l'installazione  
 Instrucciones de instalación • Installationanvisningar

FOR USE IN  
 VOOR HET GEBRUIK IN  
 POUR UNE UTILISATION EN  
 ZUR VERWENDUNG IN  
 DA UTILIZZARE IN  
 PARA UTILIZARSE EN  
 FÖR ANVÄNDNING I

	AT	BE	DK	FI	FR	DE	GR	IS	IE
Natural Gas	•	•	•	•	•				•
LPG		•	•	•	•			•	•

	IT	LU	NL	NO	PT	ES	SE	GB
Natural Gas	•	•	•		•	•	•	•
LPG	•		•	•	•	•	•	•

### IMPORTANT

Please read these instructions carefully and keep them in a safe place.  
 They will be needed when servicing the fire.

### BELANGRIJK

Lees deze instructies met aandacht en bewaar ze op een veilige plaats. U zult ze nodig hebben voor het onderhoud van de kachel.

### IMPORTANTE

Leggere attentamente le istruzioni e conservarle in un luogo sicuro. Saranno utili per l'assistenza e la manutenzione.

### IMPORTANT

Veillez lire ces instructions avec attention et les conserver dans un endroit sûr.  
 Elles seront nécessaires lors des révisions du poêle.

### IMPORTANTE

Lea estas instrucciones detenidamente y guárdelas en un lugar seguro. Estas instrucciones serán necesarias al realizar revisiones de la estufa.

### WICHTIG

Bitte lesen Sie diese Anleitung sorgfältig durch und bewahren Sie sie an einem sicheren Ort auf.  
 Sie wird zur Wartung des Ofens benötigt.

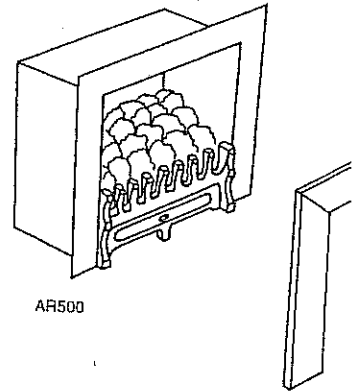
### VIKTIGT

Läs anvisningarna noggrant och förvara dem på säkert ställe.  
 De kommer att behövas vid service av kaminen.

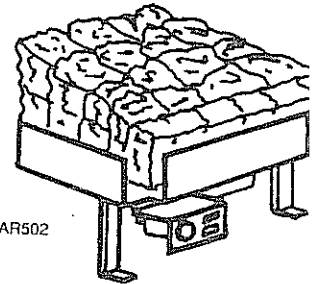


# TECHNICAL SPECIFICATION

GAS CAT. Cat. Gas Cat de gaz Gastegorie Cat gas Cat. de gas Gas-kat	GAS TYPE Soort Gas Type de gaz Gastyp Tipo di gas Tipo de gas Gastyp	PRESSURE Druk Pression Druck Pressione Presión Tryck	INPUT kW				COUNTRY Land Pays Land Paese Pais Land
			RD	16	18	22	
I2H	G20	20MB	6.8	9.1	10.6	12.3	AT, DK, ES, FI, GB, IE, IT, PT, SE.
I2L	G25	25MB		8.4	9.9	10.6	NL
I2E+	G20 G25	20MB 25MB	5.9	8.2	9.5	11.0	BE, FR
I3+	G30 G31	29MB 37MB	6.9	9.7	11.0	13.0	ES, IT, IE, GB, PT
I3+	G30 G31	29MB 37MB	6.1	8.7	9.9	11.7	BE, FR
I3B/P	G30 G31	29MB	6.8	9.7	11.0	13.0	DK, FI, IS, NL, NO, SE

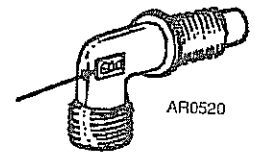


AR500

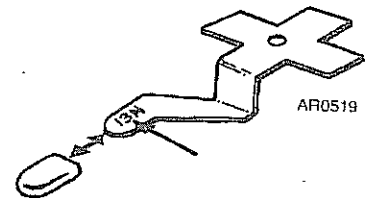


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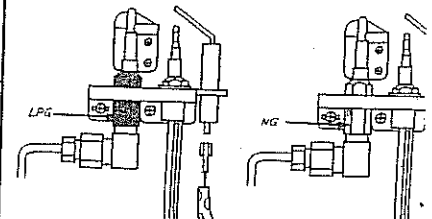
INJECTOR NG Injector Aardgas Injecteur GN Einspritzer Erdgas Inieftore GN Injector NG Injektor Naturgas		RD	16	18	22
		400	600	750	950
INJECTOR LPG Injector LPG Injecteur GPL Einspritzer Flüssiggas Inieftore GPL Injector GPL Injektor Gasol		180	260	300	360
AERATION NG Beluchting Aardgas Aeration GN Lüftung Erdgas Aerazione GN Aireación NG Luftinsläpp Naturgas	Others	13N	12N	11N	9N
	NL I <sub>2</sub> L		13N	13N	11N
AERATION LPG Beluchting LPG Aeration GPL Lüftung Flüssiggas Aerazione GPL Aireación GPL Luftinsläpp Gasol		RDL	9L	9L	0L
MINIMUM FLUE SIZE Minimale Afmeting van afvoer Taille minimum carneau Mindestrauchzuggrösse Dimensione minima del condotto Tamaño mínimo de conducto de humos Minimum avgaskanalanslutning		178mm (7")			
INLET CONNECTION SIZE Maat inlaatverbinding Taille connexion entree Einlassverbindungsgrösse Diametro collegamento d'ingresso Tamaño de conexión de punto de admisión Gasanslutning		8mm			



AR0520



AR0519



AR0521



# INSTALLATION

**IMPORTANT:** ENSURE THAT THE APPLIANCE IS CORRECTLY ADJUSTED FOR THE GAS TYPE AND CATEGORY APPLICABLE IN THE COUNTRY OF USE. REFER TO THE DATABADGE AND TECHNICAL SPECIFICATIONS AT THE FRONT OF THE BOOKLET.

FOR DETAILS OF CHANGING BETWEEN GAS TYPES REFER TO SECTION 18.

## 1. SAFETY PRECAUTIONS

- 1.1 This appliance must be installed in accordance with the rules in force, and used only in a sufficiently ventilated space. Please read these instructions before installation and use of this appliance.
- 1.2 These instructions, together with the user instructions, must be left intact with the user.
- 1.3 Do not attempt to burn rubbish on this appliance.
- 1.4 In your own interest, and those of safety, this appliance must be installed by competent persons in accordance with local and national codes of practice. Failure to install the appliance correctly could lead to prosecution.
- 1.5 Keep all plastic bags away from young children.

## 2. FLUE AND CHIMNEY REQUIREMENTS

- 2.1 The chimney or flue system must comply with the rules in force, and must be a minimum of 178mm (7") diameter. Conventional brick flues should be at least 230mm x 230mm (9"x 9").
- 2.2 The minimum effective height of the flue or chimney must be 3m (10ft).
- 2.3 The chimney or flue must be free from any obstruction. Any damper plates should be removed or secured in the fully open position, and no restrictor plates should be fitted.
- 2.4 The chimney should be swept prior to the installation of the appliance - unless it can be seen to be clean and unobstructed throughout its entire length.
- 2.5 Ensure that there is a smooth tapered transition from the fireplace opening into the chimney or flue.
- 2.6 The flue pull should be checked prior to installation of the appliance. Apply a smoke pellet to the flue or chimney opening and ensure that the smoke is drawn into the opening. If there is not a definite flow, pre-heat the chimney for a few minutes and re-test the flow.

**IF THERE IS STILL NO DEFINITE FLOW, THE CHIMNEY MAY REQUIRE ATTENTION - SEEK EXPERT ADVICE.**

## 3. VENTILATION

**It is important to ensure that any national ventilation requirements are taken into account during the installation of this appliance.**

- 3.1 Ventilation requirements differ according to the model. Minimum permanent effective free air requirements - if this is the sole gas appliance in the room - are as follows:

Model No.	Description	Min. vent cm <sup>2</sup>
8300, P8300 8305, P8305 8310, P8310	16" VFC Radiant 18" VFC Radiant 22" VFC Radiant	100 See note b.
8301, P8301	RD VFC Radiant	NONE
8421, P8421 8463, P8463	RD H/E VFC Convector	NONE See notes a & b.
8420, P8420 8461, P8461	16" H/E VFC Convector	15
8425, P8425 8466, P8466	18" H/E VFC Convector	20
8430, P8430 8471, P8471	22" H/E VFC Convector	30 See note b.
<b>Note a:</b> Gas input is less than 7kW and flue products clearance under 70m <sup>3</sup> /hr. Some countries call for 100cm <sup>2</sup> ventilation. Check local standards.		
<b>Note b:</b> It is essential to check for flue clearance (see diagrams 16/17) If spillage is detected, it may be necessary to provide additional ventilation.		

- 3.2 The above table is in addition to any openable window, and although it must communicate with the outside air, wherever possible, it can communicate with an adjacent room provided that the space has a similar vent to the outside.

**AIR VENTS MUST NOT BE RESTRICTED.**

## 4. INSTALLATION OF THE GAS SUPPLY

- 4.1 Before installation, ensure that the local distribution conditions (identification of the type of gas and pressure) and the adjustment of the appliance are compatible.
- 4.2 Ensure that the gas supply is capable of delivering the required amount of gas, and is in accordance with the rules in force.
- 4.3 Soft copper tubing and soft soldered joints can be used, but must not be closer than 50mm (2") to the base of the tray.
- 4.4 A means of isolating the gas supply to the appliance must be provided independent of any appliance control.
- 4.5 All supply gas pipes must be purged of any debris that may have entered, prior to connection to the appliance.



## 5. APPLIANCE LOCATION

- 5.1 This appliance must stand on a non-combustible hearth that is at least 12mm thick.
- 5.2 It must be fitted into a non-combustible opening.
- 5.3 These appliances must be hearth mounted into a fireplace opening conforming to National Standards. The minimum dimensions shall be as shown in diagram 1A for VFC Radiant fires or diagram 1B for VFC Convector fires. (The shaded area must be flat and square).
- 5.4 The appliance must be firmly fixed to the hearth. Fasteners are provided for this purpose.
- 5.5 Ensure that no naked flame or incandescent part of the fire bed projects beyond the vertical plane of the fireplace opening.
- 5.6 The appliance must not be installed in any room that contains a bath or shower.
- 5.7 Ensure clearances to combustible materials - see diagram 2.

## 6. UNPACKING

- 6.1 Remove the appliance from its packaging, and check that it is complete and undamaged.
- 6.2 Put the loose ceramic parts to one side so that they are not damaged during installation.

## 7. INSTALLATION - RADIANT

- 7.1 Fix the rear leg strap. See diagram 3.
- 7.2 Position the fire with the rear leg fully engaged under the rear leg strap. Fasten the front legs using the fixings supplied. See diagram 4B.
- 7.3 **"HAVE YOU PURGED THE GAS SUPPLY PIPES"**. This is essential to expel any foreign matter that might get blown into the valve assembly causing blockages.
- 7.4 Remove the control knob and fascia plate. See diagram 4A. Connect the 8mm gas supply pipe to the fire. See diagram 5.
- 7.5 If the isolation tap is to be fitted under the fire, the GAZCO GC0066 provides a neat and easy solution. See diagram 5A.
- 7.6 Check the gas connections to the fire are sound. Light the fire and check all joints on the appliance.
- 7.7 Check the appliance running pressure is correct. See data badge.
- 7.8 Refit the front fascia plate and the control knob. Fit the fret to the fire front using two screws. See diagram 6.

## 8. INSTALLATION - CONVECTOR FIRES

- 8.1 Make any necessary alterations to fireplace opening. Ensure that the lintel does not obstruct the flue outlet into the flue, and that there is a clear space for debris of at least 90mm. See diagram 7.

- 8.2 Gas pipe entry must be through one of the holes in the rear inspection panel. See diagram 8.

**Note:** Gas pipes passing through masonry must be protected.

- 8.3 If the isolation tap is to be fitted under the fire, the GAZCO GC0066 provides a neat and easy solution.
- 8.4 Remove the fire assembly (see diagram 9), and offer the convector box into the opening, checking that it fits squarely. Mark the fixing holes and the gas pipe entry positions. See diagram 10.
- 8.5 Fit the gas pipe into position, ready for passing into the convector box, ensuring enough remains to connect to the fire. For easier installation, the inspection panel in the rear of the convection box can be removed.
- 8.6 Carefully fit the convector box, feeding the piping through into the box. Secure the box to the wall, through the flange - ensuring that the box is square in the opening. Any undulations or gaps between the convector box and the wall should be filled with a non-combustible material. Do not use silicone as it makes future removal almost impossible.
- 8.7 Refit the fire assembly and front air guide back into the convector box. See diagram 9. Remove the control cover from the fire to allow the gas connection to be made.
- 8.8 Follow steps 7.3 to 7.8.
- 8.9 Fit the fire trim to the convector box. See diagram 11.
- 8.10 Fit the fret to the front using the two securing screws. See diagram 6.

## 9. FUELBED ARRANGEMENT

**NOTE: CERAMIC PARTS ARE FRAGILE.**

- 9.1 Position the flame baffle on the rear of the tray. See diagram 12B.
- 9.2 Position the front coal, make sure it sits flat onto the burner skin. See diagram 12C.
- 9.3 Place the coals following the appropriate diagrams and instructions.
- 9.4 Coal layout.
- 9.5 **RD & 16" Fires**
  - a) **Holyrood fret only** - Place 3 large coals in the centre resting against the fret as shown. Place 2 small coals at either end. See diagram 13A.
  - b) **All other frets** - Place 7 small coals resting against the fret. See diagram 13B.
  - c) Place 5 large coals onto the flame baffle. See diagram 13C.
  - d) Place 4 large coals between the other 2 rows, making sure that they do not fall down into the burner. Place 1 small coal at each end. Place 4 small coals at the back of the fire. See diagram 13D.
  - e) Place 4 small coals on top of the others. See diagram 13E.
- 9.6 **18" Fires**
  - a) **Holyrood fret only** - Place 2 large coals in the centre resting against the fret as shown.





- Place 3 small coals at either end. See diagram 14A.
  - b) **All other frets** - Place 8 small coals resting against the fret. See diagram 14B.
  - c) Place 6 large coals onto the flame baffle. See diagram 14C.
  - d) Place 5 large coals between the other 2 rows, making sure that they do not fall down into the burner. Place 1 small coal at each end. Place 5 small coals at the back of the fire. See diagram 14D.
  - e) Place 5 small coals on top of the others. See diagram 14E.
- 9.7 **22" Fires**
- a) **Holyrood fret only** - Place 4 large coals in the centre resting against the fret as shown. Place 3 small coals at either end. See diagram 15A.
  - b) **All other frets** - Place 10 small coals resting against the fret. See diagram 15B.
  - c) Place 8 large coals onto the flame baffle. See diagram 15C.
  - d) Place 7 large coals between the other 2 rows, making sure that they do not fall into the burner. Place 1 small coal at each end. Place 6 large coals at the back of the fire. See diagram 15D.
  - e) Place 6 small coals on top of the others. See diagram 15E.
- 9.8 Positioning of coals affects the flame picture and sooting.
- 9.9 Place coals so that there are gaps for flames to pass through. Coals should only touch at single points.
- 9.10 Do not use more coals than those shown.

## 10. LIGHTING

- 10.1 Full instructions are given in the Users' Handbook.

## 11. COMMISSIONING

- 11.1 Close all windows and doors to the room, check all controls, and allow fire to burn on maximum for 5 minutes. Test for spillage of flue products using a smoke match. For standard VFC fires, pass the lighted smoke match along the top front edge just inside the opening or canopy. For the RD VFC only, hold the lighted smoke match centrally inside the flue opening. See diagram 16 for Radiant fires and diagram 17 for VFC Convector fires.
- 11.2 If the fire spills, run for a further 10 minutes and re-check. If there is still spillage, disconnect the fire and seek expert advice.
- 11.3 If there are extractor fans in the room or adjacent rooms, the spillage test must be repeated with the extractors running on maximum.
- 11.4 For **RD VFC**: If spillage is detected and no air vent is fitted in the room, re-check for spillage with a window slightly open. If this cures the spillage, it will be necessary to fit a vent.

**IF SPILLAGE PERSISTS, DISCONNECT THE APPLIANCE AND SEEK EXPERT ADVICE.**

## SERVICING

This appliance must be serviced at least once a year by a competent person.

### (VFC Convectors only)

As part of the annual service, the space behind the convector must be inspected for any debris which may have fallen down the chimney.

Remove the gas fire (Section 13 a to c). Remove the six screws holding the inspection panel at the back of the convector. See diagram 18.

Inspect the space behind the box for debris with a torch. With the aid of a mirror, inspect the area up behind the convector box for any large objects that may have fallen down the chimney. If any are found, it will be necessary to completely remove the convector box to remove the blockage and carry out remedial work to the chimney if necessary.

**The following part can be serviced without removing the fire.**

## 12. IGNITION LEAD AND PIEZO

These components can only be changed together:

- 12.1 Turn off the gas supply at the isolation device.
- 12.2 Remove the fret. Remove the control knob and fascia panel. See diagram 4A.
- 12.3 Undo the two screws securing the piezo to the control valve. See diagram 19.
- 12.4 Pull the piezo body down and off the control valve and disconnect the ignition lead from the pilot assembly. See diagram 20A.
- 12.5 Replace the assembly with a new piezo and lead, refit the two screws securing the piezo to the control valve and connect the ignition lead to the pilot assembly. Check the spark gap. See diagram 21.
- 12.6 Check the operation of the new piezo and lead with the pilot running.

**Ensure the two halves of the control are secured correctly and leak tested after completion.**

- 12.7 Replace the fascia panel, control knob and fret.

## 13. The following parts require the removal of the fire from the fireplace.

- a) Turn the gas supply off at the isolation device.
- b) Pull off the control knob and remove the fascia panel by removing the two securing screws. See diagram 4A.
- c) Disconnect the gas supply pipe from the pressure test elbow on the appliance.
- d) Undo the screws securing the fire. See diagram 9 or 4B.
- e) Remove the fire for servicing.



## 14. ODS PILOT UNIT

Note: The pilot unit on the appliance is a non-servicable unit due to the complex nature of its manufacture. Replacement of the complete unit must be carried out when one of the following items becomes faulty:

Pilot injector  
Ignition electrode  
Thermocouple

- 14.1 Carry out operations (a) to (e).
- 14.2 Gently pull the ignition lead off the electrode. See diagram 20A.
- 14.3 Remove the two screws securing the pilot assembly. See diagram 20B.
- 14.4 Undo the thermocouple connection at the back of the gas tap. See diagram 22B.
- 14.5 Replace with a new pilot assembly, set the spark gap. See diagram 21.
- 14.6 After reassembly, check for gas soundness and carry out a flame failure functional check detailed in the flow chart, especially the mag drop out time.

## 15. GAS FILTER

- 15.1 Carry out operations (a) to (e).
- 15.2 The gas filter is found inside the gas inlet to the control valve. See diagram 23A.
- 15.3 Undo the inlet pipe connection at the valve, pull the pipe clear of the valve so that the filter can be seen.
- 15.4 Prize out the filter and fit replacement.
- 15.5 Re-install the appliance and check for gas leaks and replace the fascia panel and control knob. See diagram 4A.

## 16. MAG UNIT

- 16.1 Carry out operations (a) to (e).
- 16.2 Undo the mag unit retaining nut at the back of the control valve. See diagram 23B.
- 16.3 After removing the retaining nut, the mag unit can be tapped out and a replacement fitted.
- 16.4 Replace the mag unit retaining nut and tighten. Note - this is a gas-tight seal.
- 16.5 Replace the thermocouple and check for gas leaks.
- 16.6 After reassembly, carry out the flame failure functional check as detailed in the flow chart, especially the mag unit drop out time.

## 17. MAIN INJECTOR

- 17.1 Carry out operations (a) to (e).
- 17.2 With the fire removed, undo the injector compression nut (see diagram 22A) and the control valve lock ring, (see diagram 23C) pull the pipe clear of the injector body.
- 17.3 Rotate the injector until it is fully removed.

- 17.4 Replace with the correct replacement injector. When ordering, always state the model, gas type and serial number.
- 17.5 Reassemble and turn the gas supply on, check for any leaks.

## 18. CHANGING BETWEEN GAS TYPES

The following parts must be changed when converting an appliance from one gas type to another:

- Main injector
- Pilot assembly
- Aeration adjuster
- Control valve
- Data badge

Refer to Spare Parts List for part numbers.

Note: The control valve will be set for the particular Appliance. In addition a new data badge will need to be ordered. In all instances, when ordering new parts, be sure to quote the appliance type and serial number.

Use only genuine Gazco replacement parts. Non-standard components will invalidate the guarantee and may be dangerous.

## 19. SPARES PARTS LIST

MANUAL FIRES	RD	16	18	22
<b>CERAMIC PARTS</b>				
Front Coal LH	• CE0151	CE0152	CE0153	
Front Coal RH	N/A		CE0154	
Flame Baffle	CE0119	CE0120	CE0121	
Burner Skin	CE0155	CE0156	CE0157	
Coal Set	CE0128	CE0129	CE0130	
Side Check LH Std	CE0158			
Side Check LH L/lintel	CE0160			
Side Check RH Std	CE0159			
Side Check RH L/lintel	CE0161			
Back Panel Std	CE0165	CE0166	CE0167	
Back Panel L/lintel	CE0168	CE0169	CE0170	
<b>NATURAL GAS PARTS</b>				
Main Injector	IN0007	IN0005	IN0008	IN0024
Pilot Assembly	PI0036		PI0044	
Aeration Adjuster	GZ1201	GZ1248	GZ1247	GZ1200
Aeration Adjuster IzL	N/A	GZ1201		GZ1247
Gas Valve	CONSULT GAZCO			
<b>LPG GAS PARTS</b>				
Main Injector	IN0025	IN0001	IN0002	IN0023
Pilot Assembly	PI0037		PI0045	
Aeration Adjuster	GZ1210	GZ1203		GZ1204
Gas Valve	CONSULT GAZCO			
<b>MISCELLANEOUS</b>				
Piezo with Lead	GC0062			
Mag Unit	GC0016			
Knob	GC0058			



## 20. FAULT FINDING

**This is for use only by qualified Installers and Service Engineers.**

Note: Many problems can be attributed to poor pilot flame length caused by blocked pilot jets as the orifice is very small. If the flame length is much shorter than that shown in the diagram, the pilot may have to be changed. See diagram 21.

It is always worth using the nozzle of a vacuum cleaner over the end of the pilot to ensure that it has no debris within it. In addition, many ignition problems are caused by incorrect spark gap, ensure it is set as in diagram 21A.



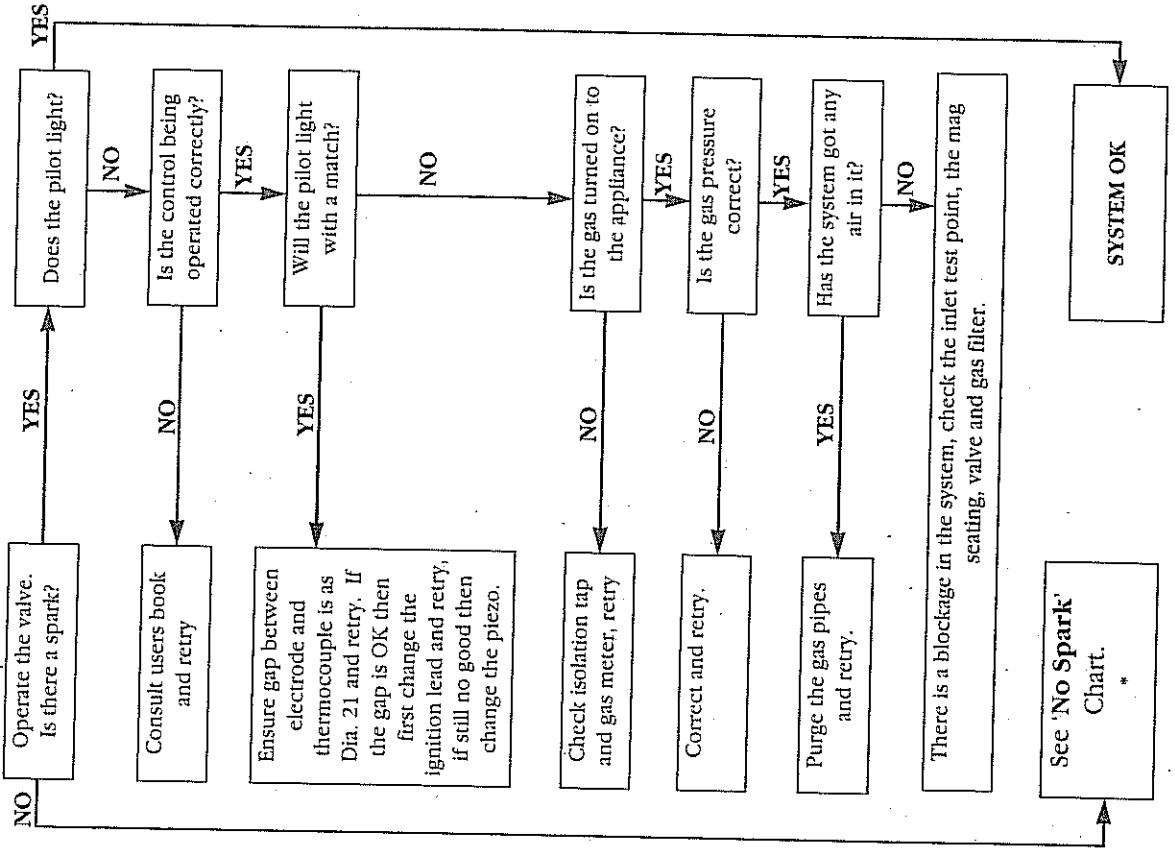
# FAULT FINDING

FAULT	CAUSE/POSSIBLE REMEDY
a) Pilot will not light	See Ignition Functional Check 1
b) No spark	See Ignition Functional Check 2
c) Pilot will not stay lit or fire goes out in use	See Flame Failure Functional Check
d) Uneven flame pattern, for example to one side only.	<ol style="list-style-type: none"> <li>1. Check that the front coal is correctly seated. See dia 12C.</li> <li>2. Check that the flame baffle is located on the burner top squarely. See dia 12B.</li> <li>3. The coals may need adjusting to even the flame pattern. See Section 9.4.</li> </ol>
e) Blue flame	<ol style="list-style-type: none"> <li>1. The fire will burn blue on initial lighting, until the heat generated allows the gas to burn yellow, typically within 20 mins.</li> <li>2. Insufficient gas pressure, check pressure setting.</li> <li>3. The aeration adjuster is set on coke effect, see Users Instructions, Section 2.6.</li> </ol>
f) Low flame height	<ol style="list-style-type: none"> <li>1. This may be caused by low gas pressure, therefore: Check gas pressure</li> <li>2. The visual effect of these fires is controlled by the placing of the coals, try slight adjustments. See coal layout sheet, Section 9.4.</li> </ol>

## IGNITION FUNCTIONAL CHECK 1

### PILOT WILL NOT LIGHT

Ensure there is no debris around the pilot assembly, eg coal, soot, etc, which could short the spark, clean the area. Check for fluff in the pilot aeration hole. See diagram 21A.

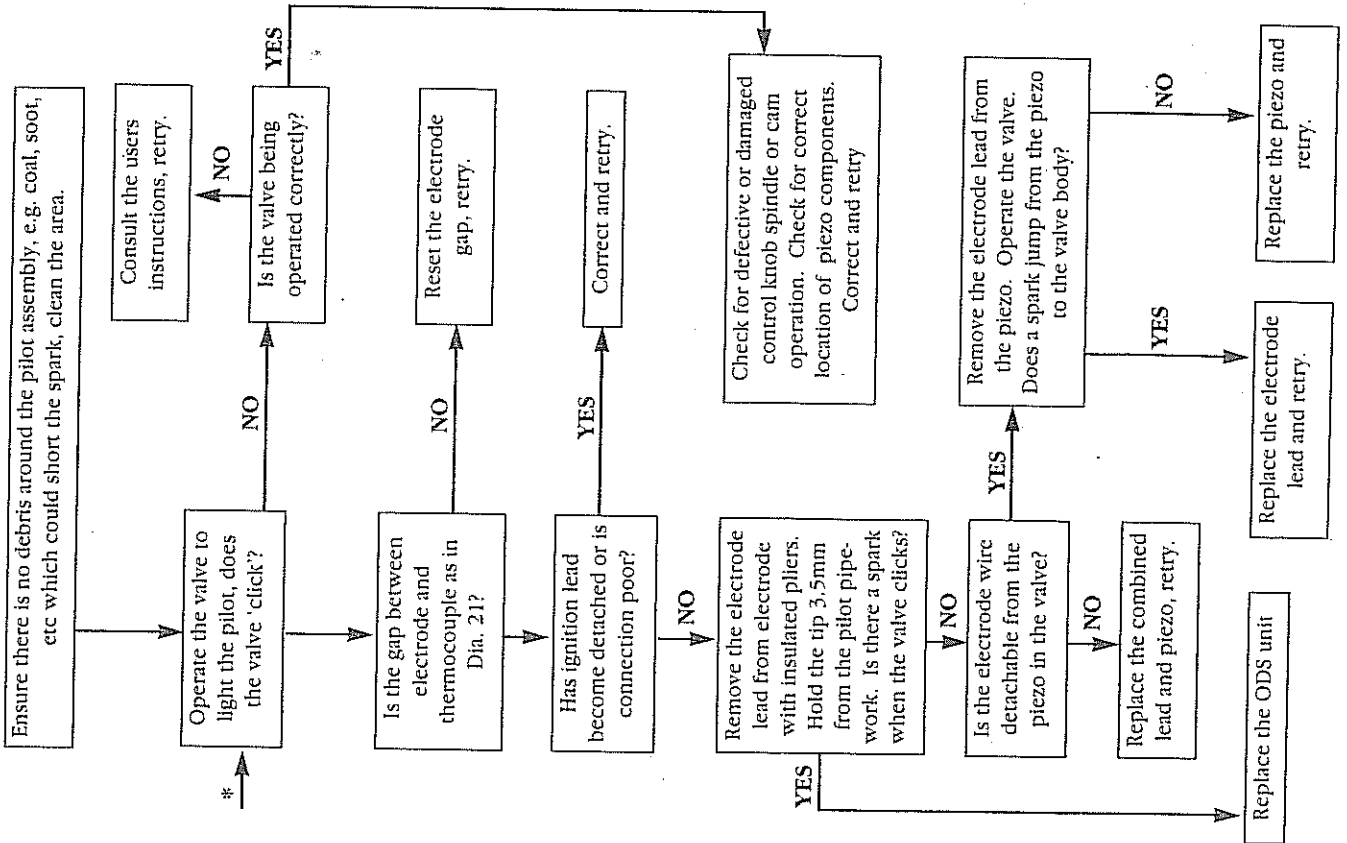






**IGNITION FUNCTIONAL CHECK 2**

**NO SPARK**



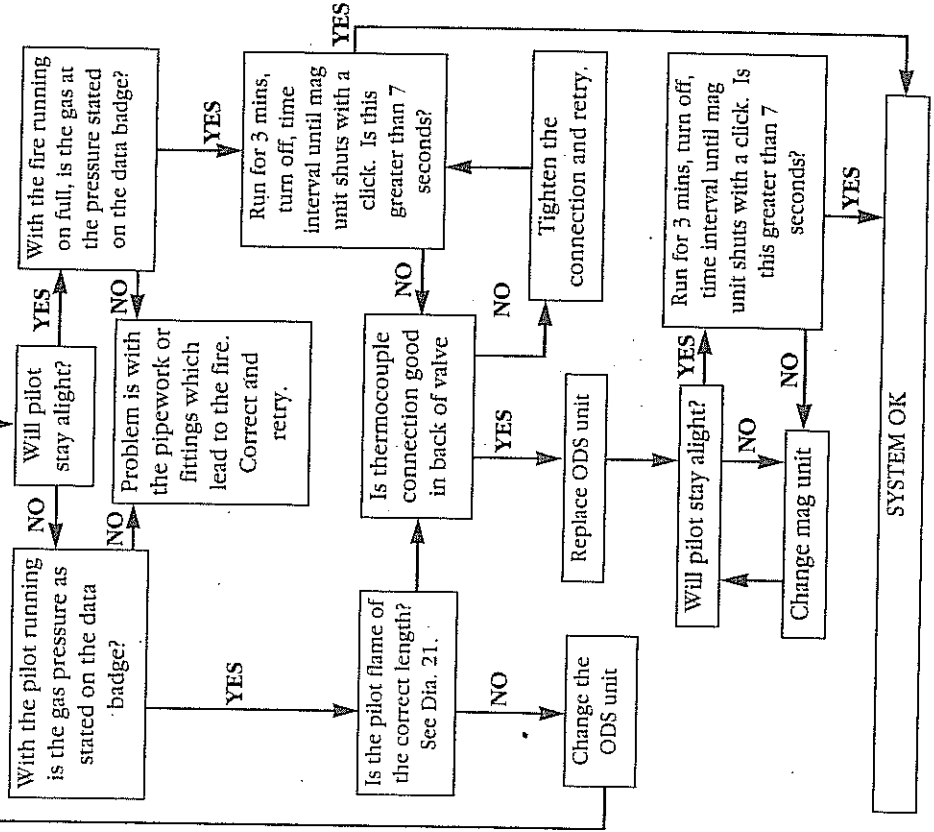
**FLAME FAILURE FUNCTIONAL CHECK**

**PILOT WON'T STAY LIT OR FIRE GOES OUT**

If the appliance goes out in use continually, this may mean that the oxygen depletion sensor has been activated. The appliance should not be used until the cause has been found and rectified.

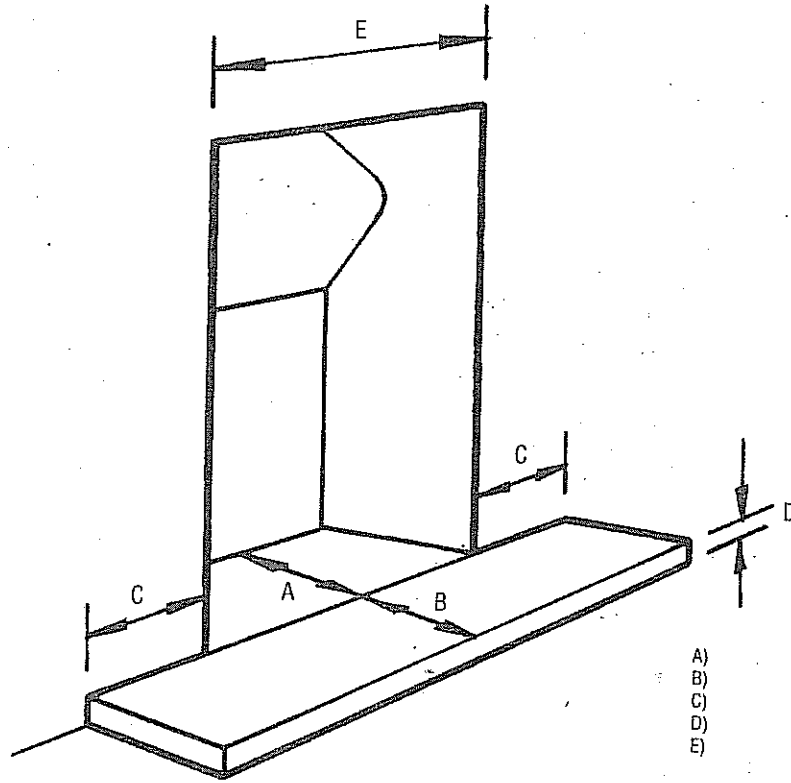
Ensure that there is no debris around the pilot assembly, eg coals, soot etc. Check for fluff in the pilot aeration hole. See diagram 21A.

Light the pilot and keep the control knob pushed in at least 10 seconds before letting go.



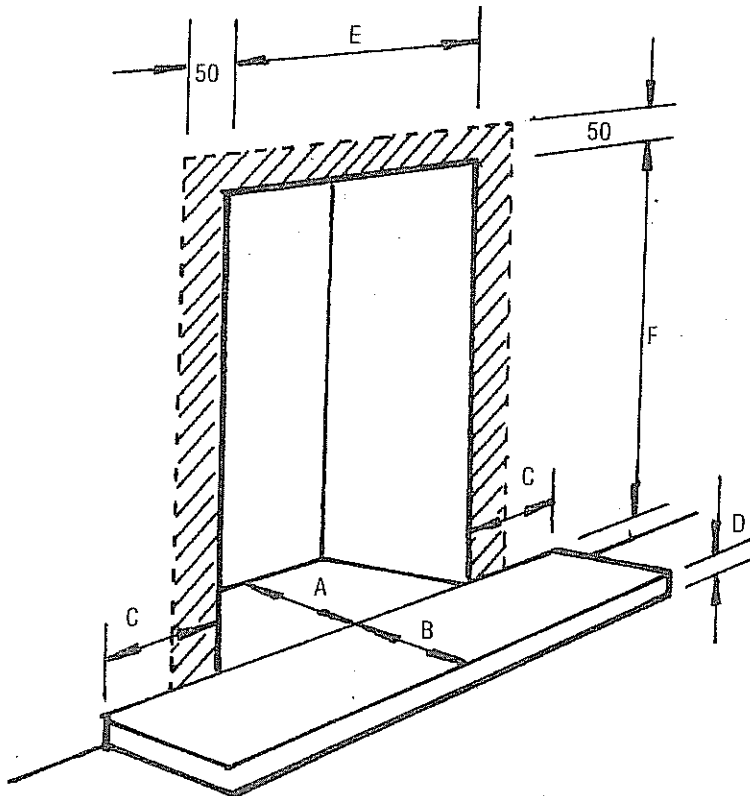


1A



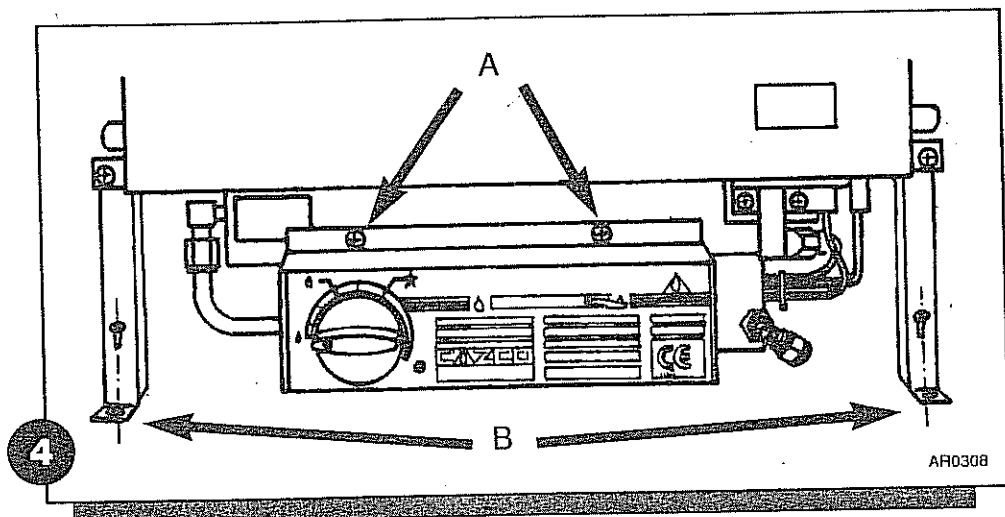
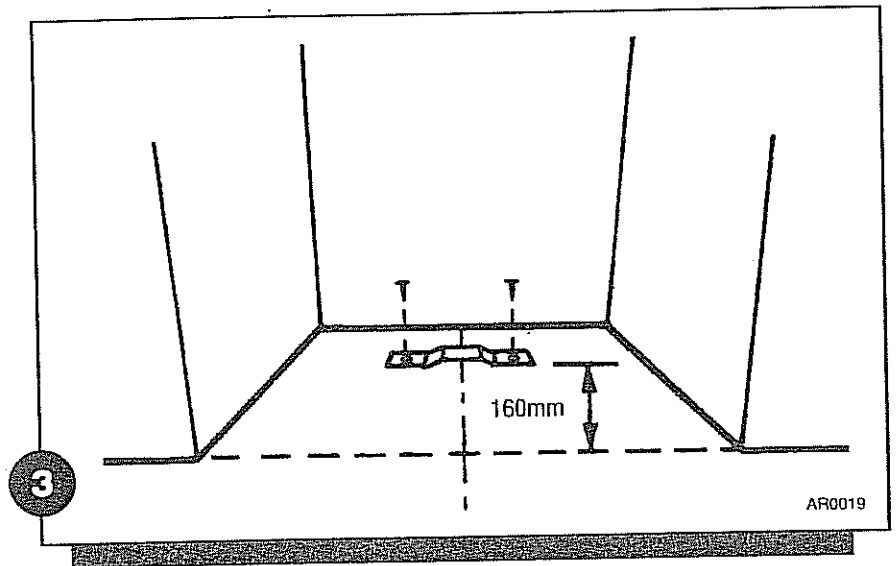
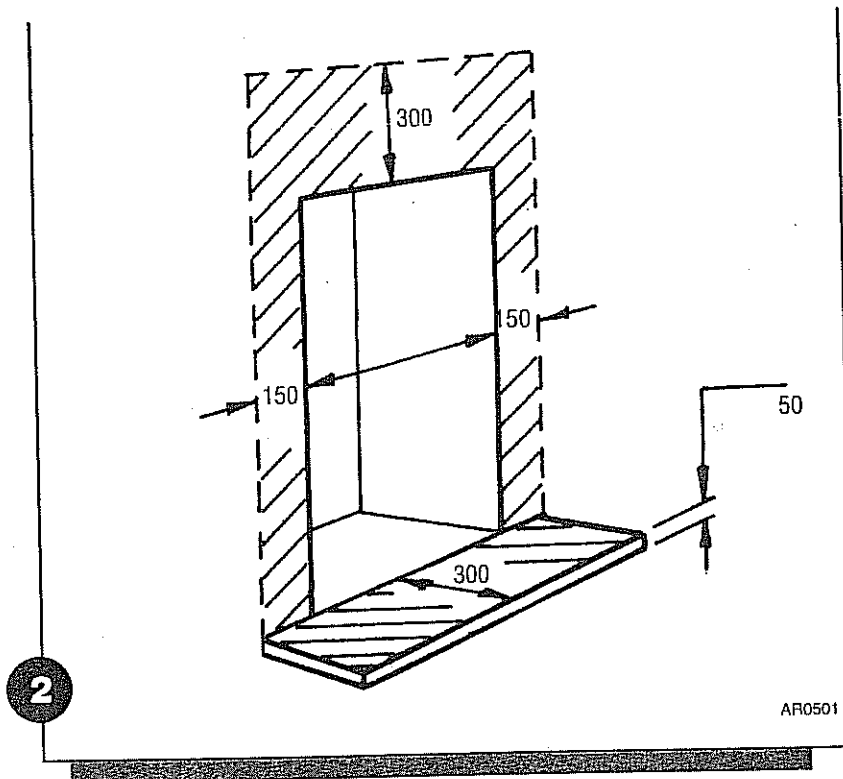
- A) 195mm
- B) 300mm
- C) 150mm
- D) 50mm
- E) RD&16" - 410mm  
18" - 460mm  
22" - 535mm

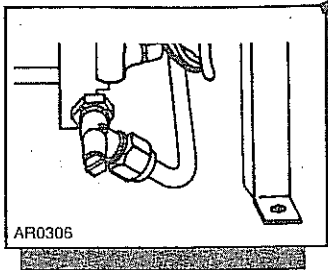
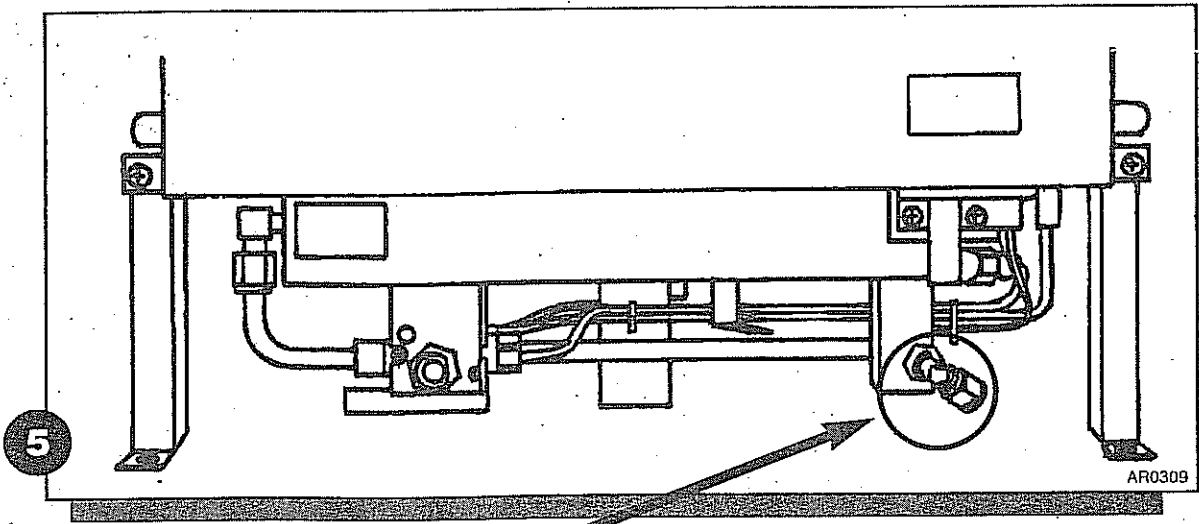
1B



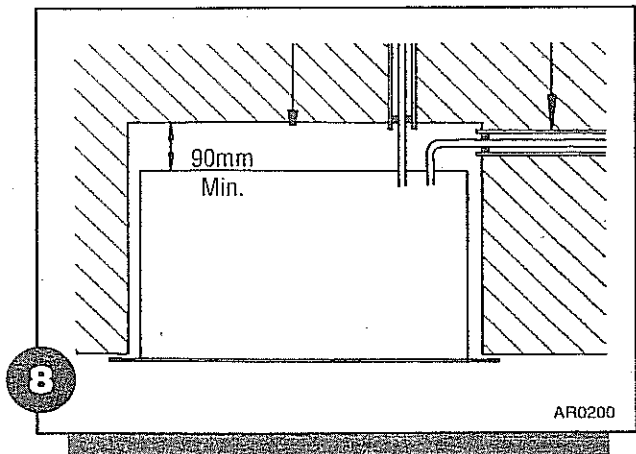
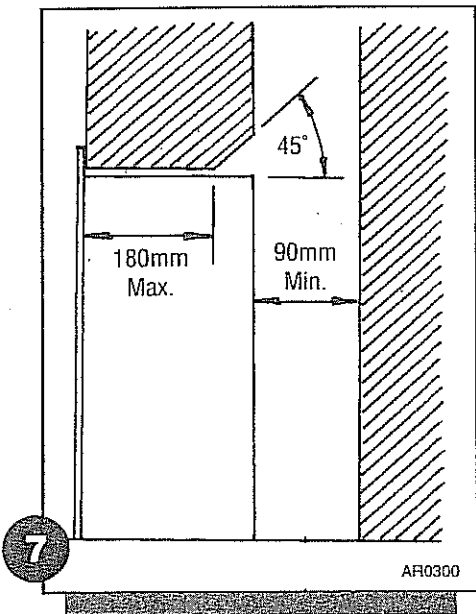
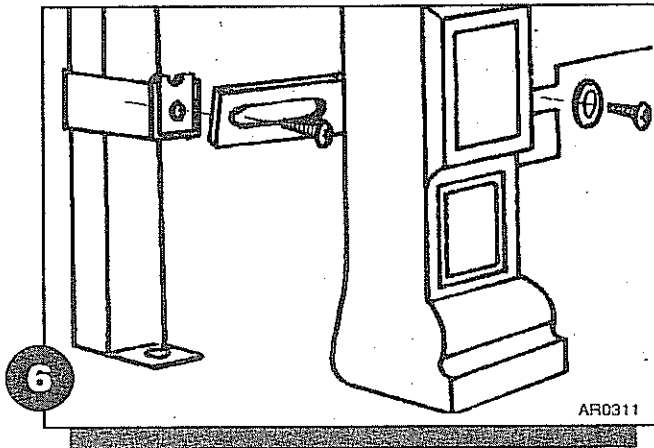
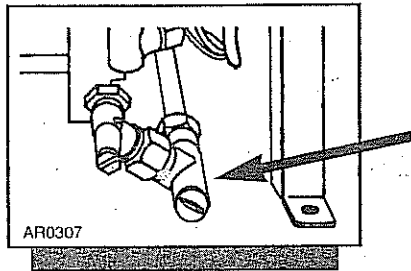
- A) 310mm
- B) 300mm
- C) 150mm
- D) 50mm
- E) RD&16" - 410mm  
18" - 460mm  
22" - 560mm
- F) Standard - 558mm  
Low Lintel - 510mm

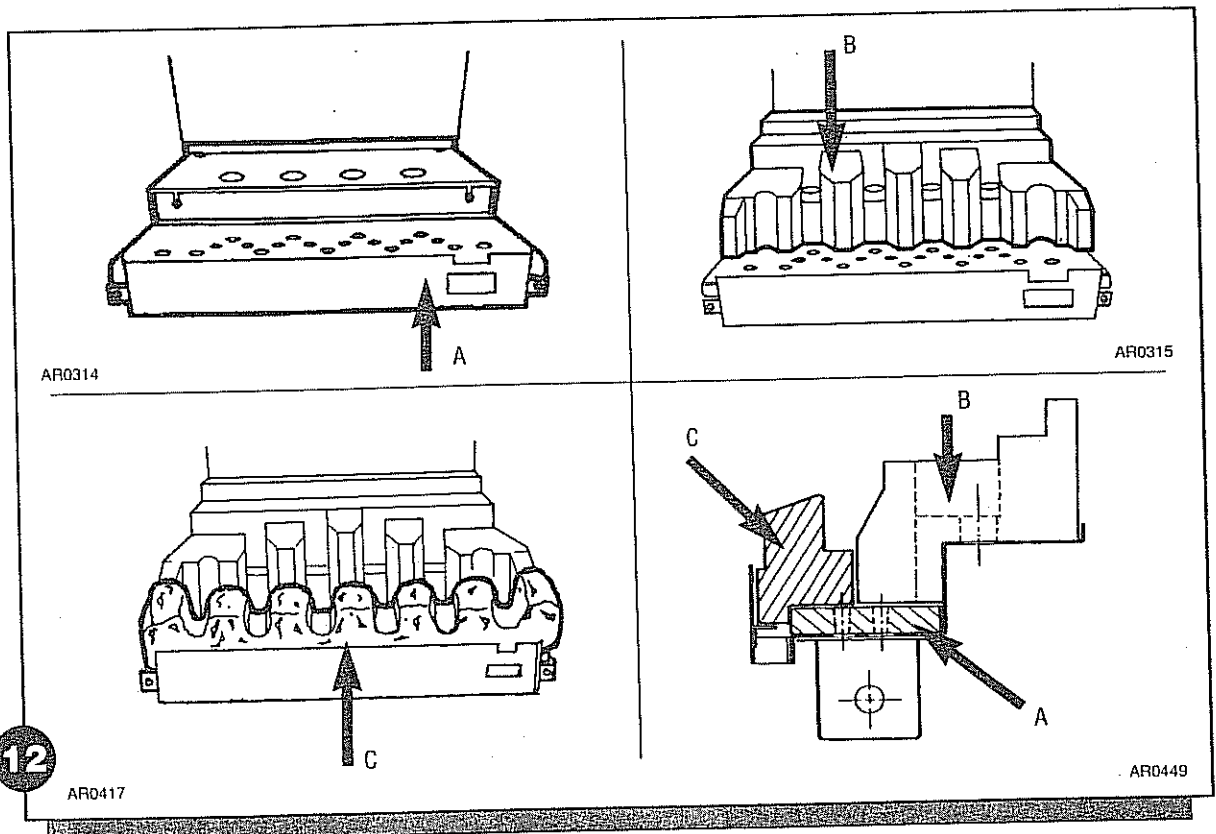
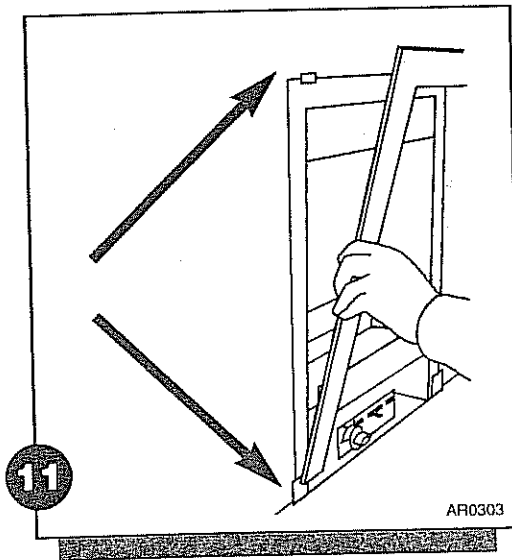
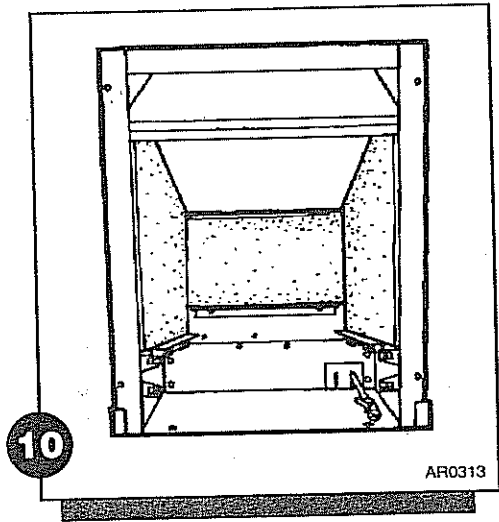
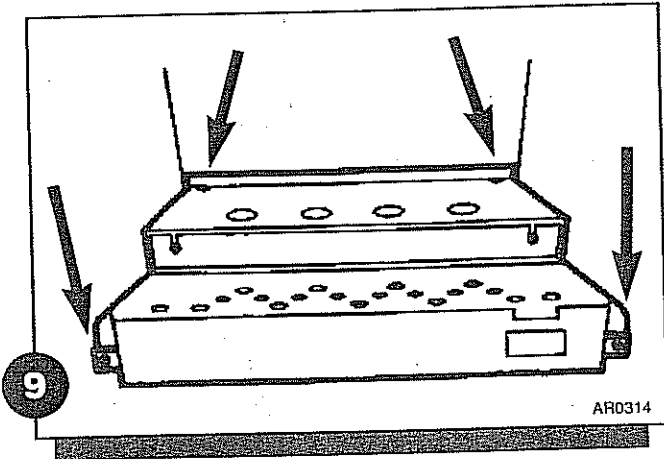
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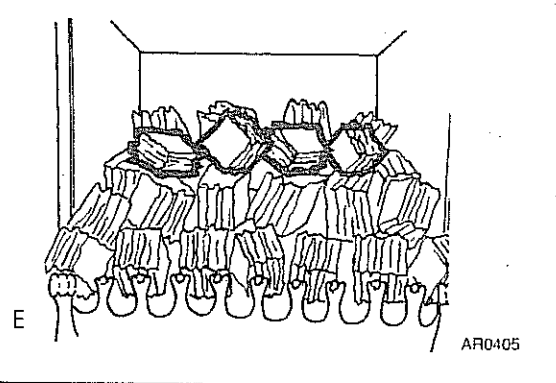
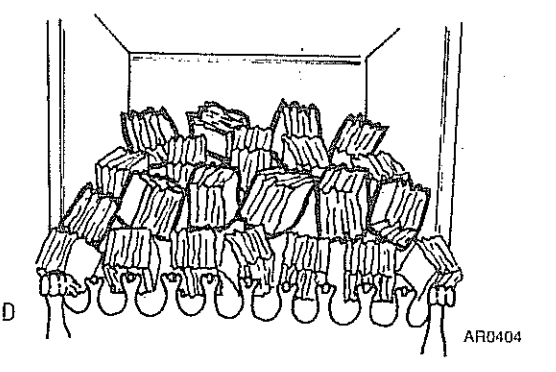
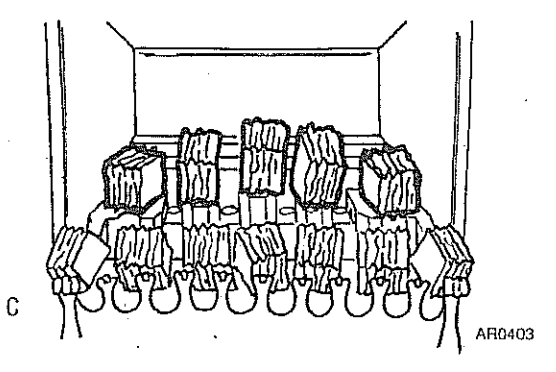
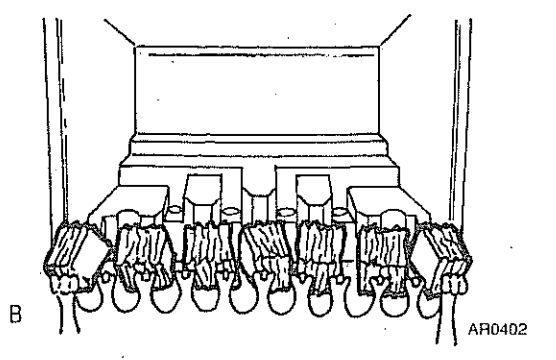
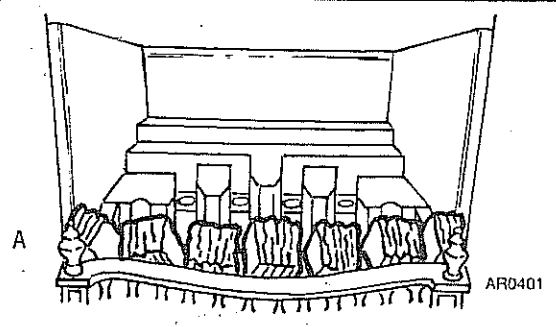


5A

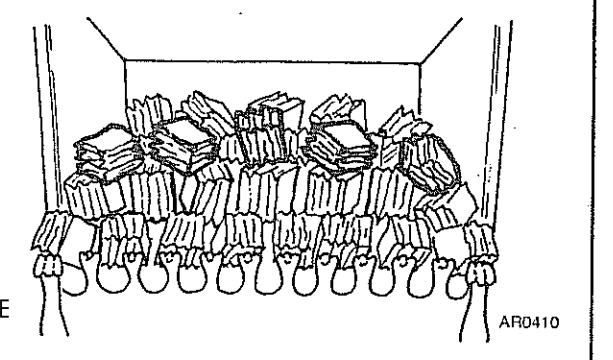
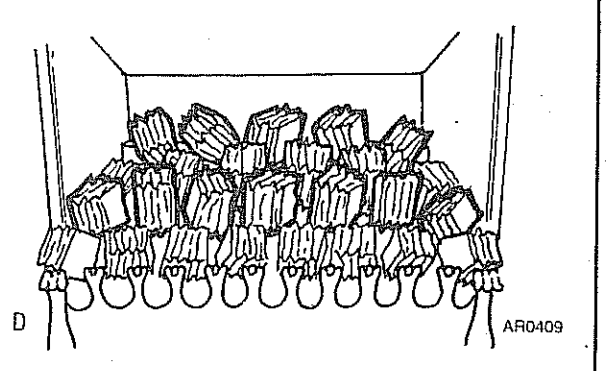
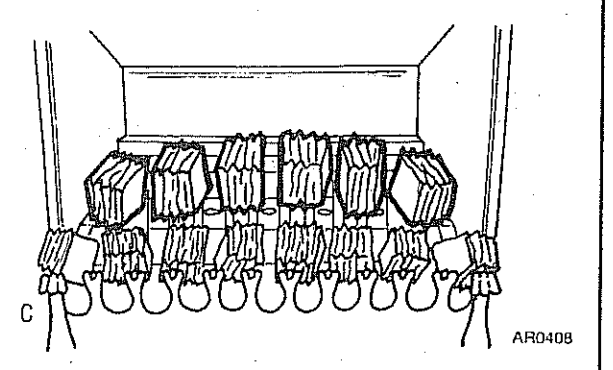
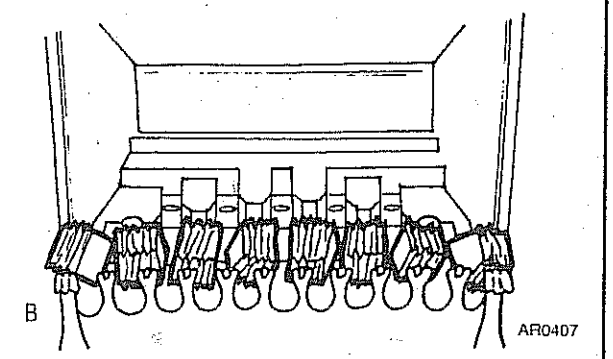
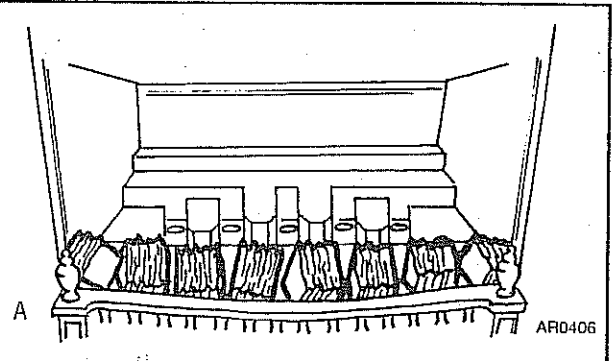




13

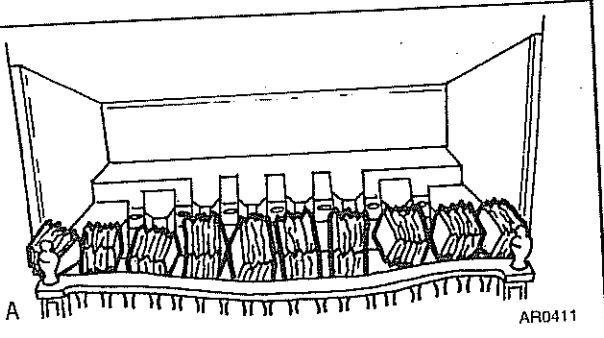


14

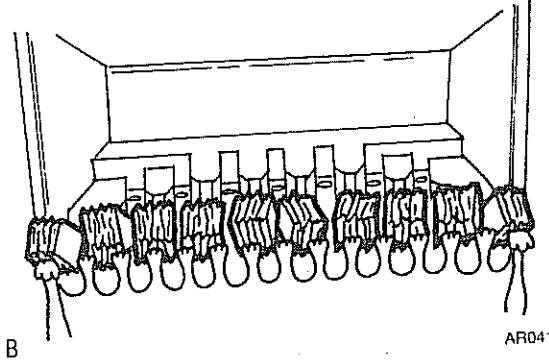


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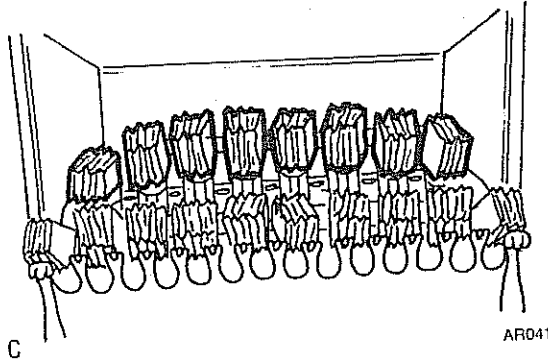
15



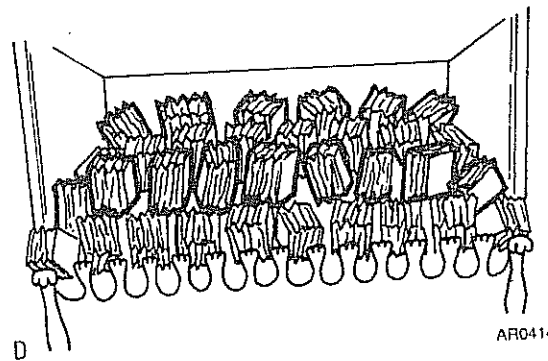
AR0411



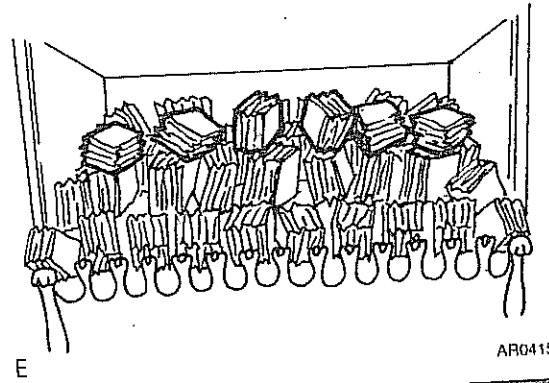
AR0412



AR0413

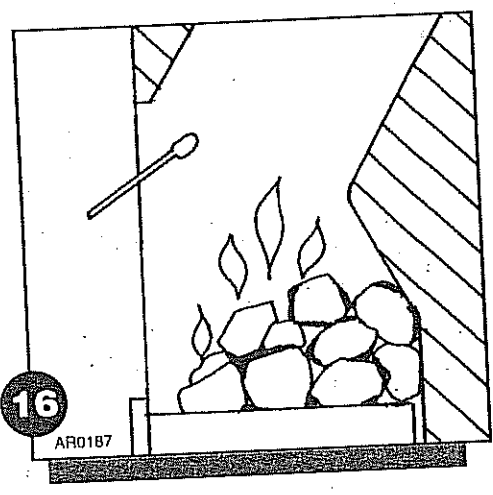


AR0414

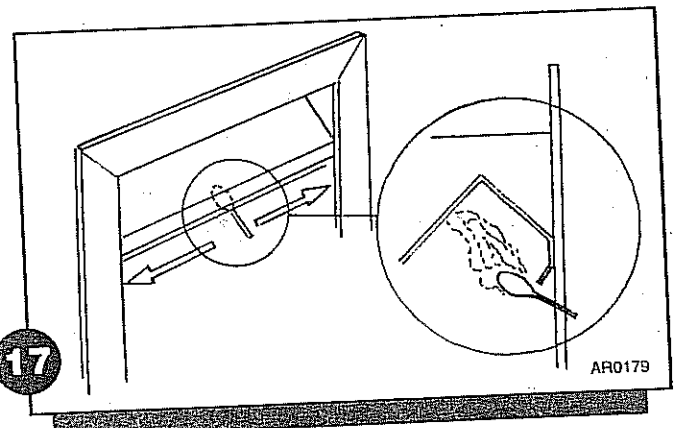


AR0415

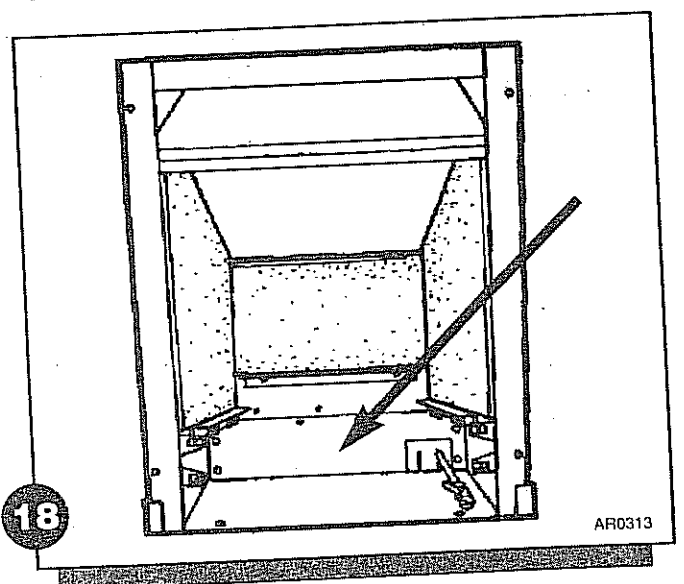
16



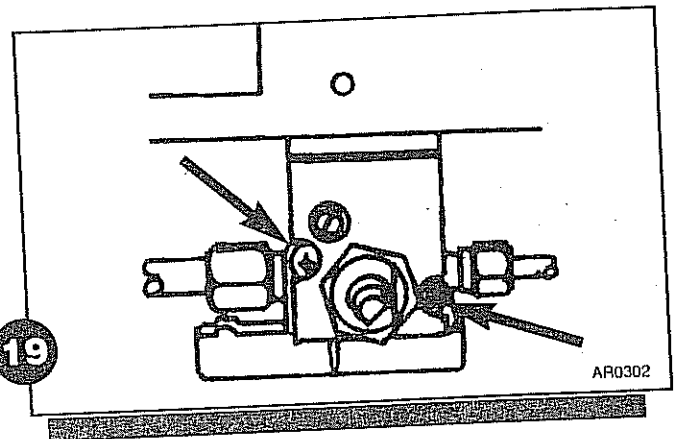
17



18

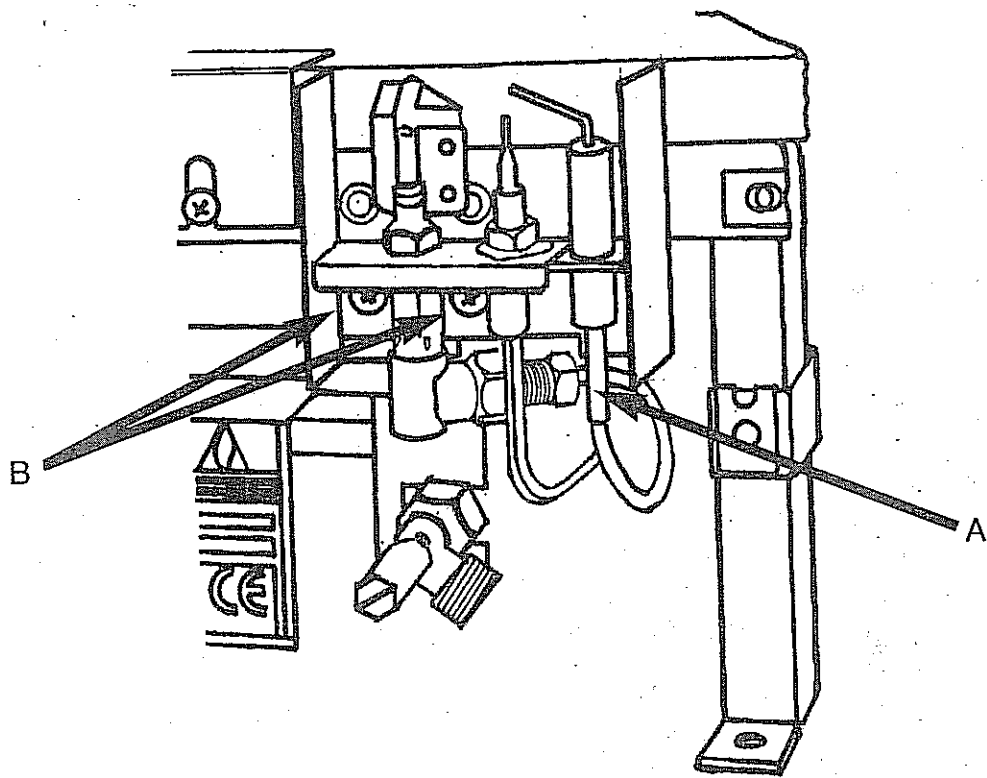


19



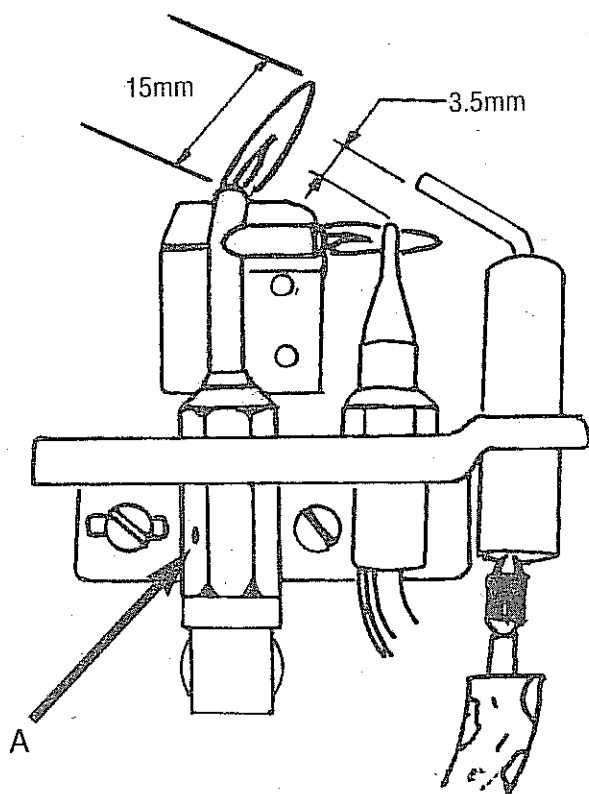


20



AR0305

21



AR0097

DIAGRAMS

