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Introduction

The aquamatic ARP is a continuous run radiant panel heating system designed primarily for overhead heating in factories and warehouses.

Heating medium can be either hot water or steam. The system will direct its radiant output downward to warm the people in the environment, the floors, walls and equipment. The latter in turn re-radiate this heat to further assist in providing a comfortable, evenly heated work space. The system is particularly ideal for areas that require low noise levels and the minimum air disturbance and also, due to the absence of any electrical items, hazardous areas.

Range

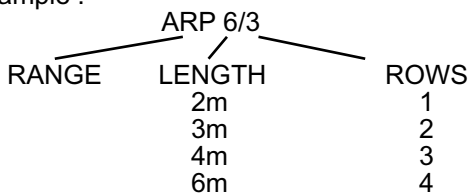
ARP radiant panels are supplied as standard in 2m, 3m, 4m and 6m lengths. All lengths are available in 1, 2, 3 and 4 tube configurations to provide for a range of heat outputs per linear metre run.

Construction

Heavy weight 32mm steel pipe to BS 1387 is used and can be provided with either plain ends for welding, or screwed connections. Reflectors are of rigid double skin construction having 0.8mm aluminium reflector surfaces, galvanised steel backing pieces and internal insulation. They are contoured to the curve of the pipes for maximum heat transfer and completed assemblies are mounted on purpose designed support channels at regular intervals. Closer units are available as separate components to maintain reflector continuity. Units are prime finished in matt black powder coat heat-resisting paint.

Ordering Details

aquatic ARP is identified as shown in the following example :-



Accessories

The following accessories are available:-

- Multi tube Headers
- Closer Units
- End Covers
- Hanger Link Sets
- Pipe Grade Adjuster

Design Guidelines

The output from radiant heating systems is similar to the light from a light bulb in that it travels in straight lines from the source, therefore to feel the effect one must be in the output path.

In designing the system the aim should be to ensure that all areas receive the same radiant intensity. Tables 2a, 2b and 2c detail the minimum radiant intensity, measured between parallel runs, as a percentage of the maximum intensity for various mounting heights and pitches. The pitch used will generally depend on the heat requirement of the building, the higher the requirement the closer the pitch. A more even distribution of output will be achieved if the ratio of pitch to height is below 1.5.

Table 3 details minimum mounting heights. Lower mounting heights will in general produce the best results but there is no limit to the maximum height.

Heat Loss Calculations

Heat loss calculations should be completed in the usual manner with regard to building construction, external temperatures etc.

A quick and effective method however is to calculate the floor area in m² and multiply by the loading or radiant intensity required. For example if we assume a building has a floor area of 400m² and from Table 1 below we determine a medium load radiant intensity of 200W/m² our total heat requirement will be 80,000Watts

Table 1 Radiant Intensity

Light Load	100W/m ²
Medium Load	200W/m ²
Heavy Load	300W/m ²

Table 2a Panel Pitch

ARP HORIZONTALLY MOUNTED					
Mounting height above floor level in metres.					
↓	Minimum intensity of radiation at 1.5m level (midway between runs) as a percentage of the maximum intensity (directly below runs)				
	PITCH				
m	1.5m	3.0m	4.6m	6.2m	7.7m
3.0	96%	66%	32%	-	-
4.6	100%	96%	86%	66%	47%
6.2	100%	100%	96%	90%	79%
7.7	100%	100%	99%	96%	92%
9.2	100%	100%	100%	98%	96%

Table 2b Panel Pitch

ARP INCLINED Double runs each @ 45° to the horizontal				
Mounting height above floor level in metres.				
↓	Minimum intensity of radiation at 1.5m level (midway between runs) as a percentage of the maximum intensity (directly below runs)			
	PITCH			
m	3.0m	4.6m	6.2m	7.7m
3.0	67%	44%	-	-
4.6	105%	84%	67%	55%
6.2	102%	105%	94%	79%
7.7	98%	104%	105%	98%
9.2	98%	102%	105%	105%

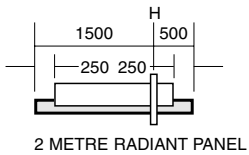
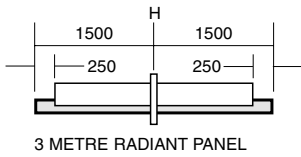
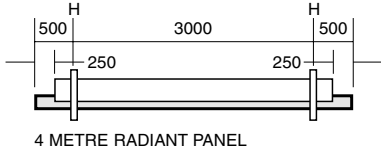
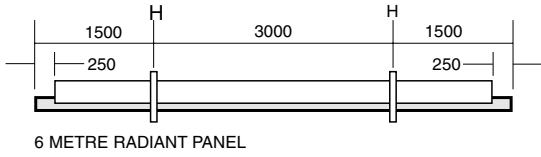
Table 2c Panel Pitch

ARP VERTICALLY MOUNTED				
Mounting height above floor level in metres.				
↓	Minimum intensity of radiation at 1.5m level (midway between runs) as a percentage of the maximum intensity (directly below runs)			
	PITCH			
m	3.0m	4.6m	6.2m	7.7m
3.0	40%	-	-	-
4.6	55%	55%	40%	-
6.2	72%	55%	45%	40%
7.7	84%	67%	55%	48%
9.2	89%	77%	63%	55%

Table 3 Minimum Mounting Heights

MINIMUM MOUNTING HEIGHTS ABOVE FLOOR LEVEL							
HEATING MEDIUM		ARP HORIZONTAL		ARP INCLINED			ARP VERT
M.W.T iC	STEAM bar	1 TUBE RUNS 3m+ PITCH m	MULTI-TUBE RUNS m	ANGLE FROM HORIZONTAL			m
				30° m	45° m	60° m	
70		2.50	2.60	2.50	2.29	2.06	1.83
80		2.60	2.74	2.60	2.36	2.13	1.98
90		2.67	2.90	2.67	2.44	2.29	2.13
105	0.2	2.74	3.00	2.74	2.60	2.44	2.29
115	0.7	2.90	3.28	2.90	2.74	2.60	2.44
125	1.3	3.00	3.50	3.00	2.90	2.74	2.60
140	2.6	3.20	3.80	3.20	3.00	2.90	2.74
150	3.8	3.35	4.20	3.35	3.20	2.97	2.74
160	5.2	3.43	4.57	3.43	3.28	3.00	2.90
170	6.9	3.50	4.88	3.52	3.35	3.12	2.90

Dimensions

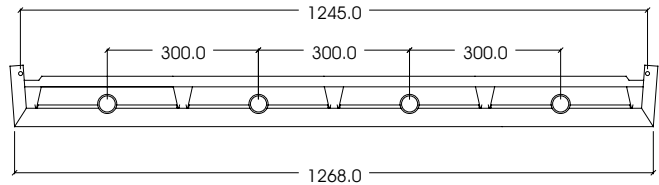
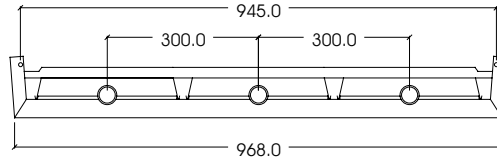
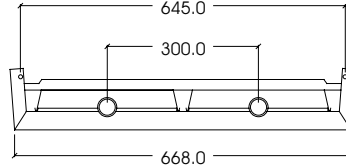
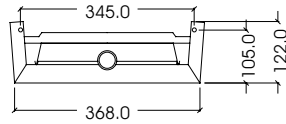


NOTES:

ALL DIMENSIONS
IN mm

NOT TO SCALE

'H' DENOTES HANGER
POSITION(S)



NOTES:

ALL DIMENSIONS IN mm

Hydraulic Resistances

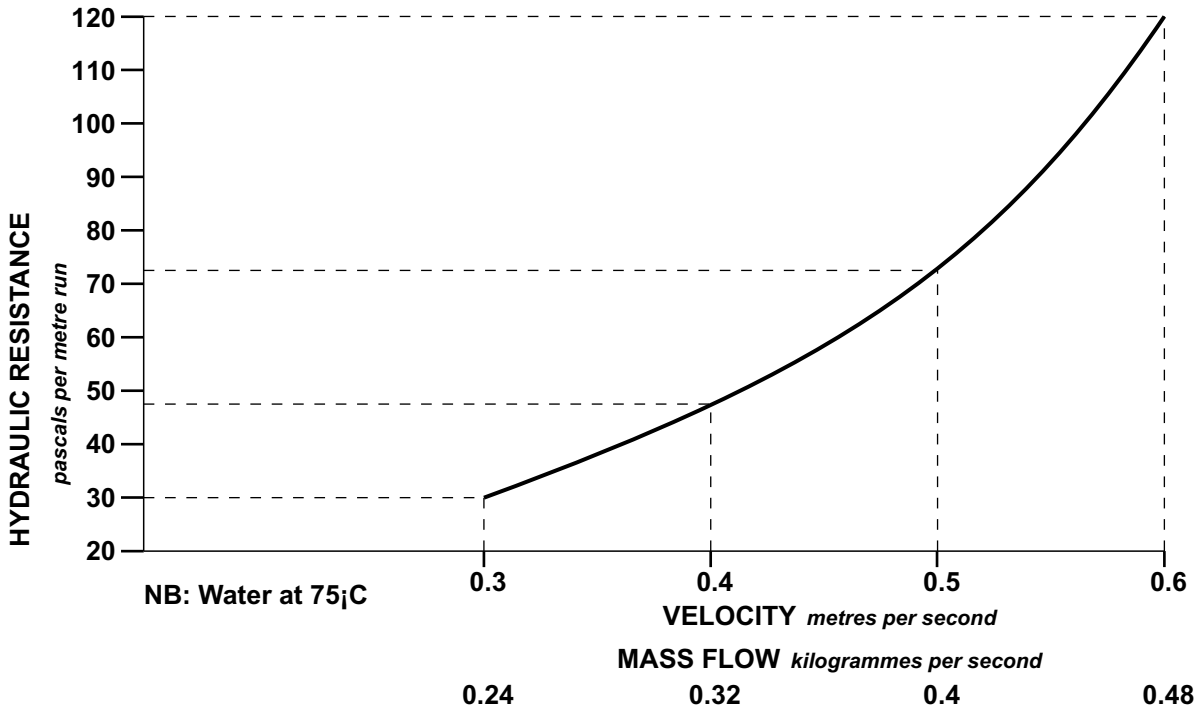


Table 4 Correction Factors

Mean Water Temperature °C	75	100	125	150
Multiply by Resistance per metre	1	0.98	0.96	0.93

Table 5 Radiant Output - Hot Water

WATER MEAN TEMP TEMP iC	AMBIENT TEMP iC	TOTAL EMISSIONS - Watts per metre RUN							
		HORIZONTAL MOUNTING No OF TUBES				VERTICAL MOUNTING NUMBER OF TUBES			
		1	2	3	4	1	2	3	4
70	10	193	372	553	735	222	430	638	847
	15	174	333	495	656	199	385	570	757
	20	152	293	434	577	174	339	500	665
75	10	213	411	610	810	246	476	704	933
	15	192	371	553	734	224	430	638	847
	20	174	333	495	656	199	385	570	757
80	10	234	452	672	893	270	522	775	1028
	15	213	411	610	810	246	476	704	933
	20	192	371	553	734	224	430	638	847
90	10	278	536	797	1059	321	619	920	1219
	15	258	493	734	976	295	570	848	1125
	20	234	452	672	893	270	522	775	1028
100	10	326	730	937	1247	376	729	1082	1436
	15	303	586	872	1157	350	677	1006	1333
	20	279	536	797	1069	321	619	848	1125
110	10	374	722	1078	1422	432	834	1246	1639
	15	350	676	1006	1335	404	782	1161	1538
	20	326	630	937	1247	376	729	1082	1436
120	10	421	816	1204	1606	486	940	1393	1850
	15	398	768	1142	1516	459	896	1318	1747
	20	375	723	1081	1402	423	837	1247	1639
130	10	471	916	1353	1800	544	1057	1560	2074
	15	450	862	1278	1708	515	997	1475	1966
	20	422	817	1204	1606	487	942	1393	1850
140	10	524	1013	1510	1907	606	1171	1742	2312
	15	498	962	1431	1895	575	1112	1651	2183
	20	471	910	1353	1800	544	1053	1560	2074
150	10	577	1114	1652	2200	666	1289	1906	2534
	15	551	1059	1578	2097	635	1225	1821	2302
	20	524	1013	1510	1907	606	1171	1742	2312
160	10	635	1227	1837	2436	733	1330	2119	2807
	15	606	1173	1741	2308	699	1357	2009	2659
	20	577	1114	1520	1907	666	1291	1906	2534
170	10	691	1335	1997	2648	798	1544	2304	3051
	15	663	1284	1905	2526	762	1486	2197	2910
	20	634	1227	1837	2436	733	1430	2119	2807
APPROXIMATE RADIANT EMISSION		64%				49%			

Installation Guidelines

Water

Water velocity in each 32mm tube should be maintained at 0.6m/s which equates to an approximate flow rate of 1820l/hr or 0.5kg/s. Flow rates in this order will be sufficient to sweep air out of level pipe runs and no gradient need be allowed for during installation. At lower velocities a gradient will be necessary. Water velocities below 0.3m/s will cause substantial reduction in heat output and therefore should be avoided. The limiting factors as to the maximum length of run are the amount of expansion to be accommodated and the maximum available pump head. Refer to Page 2 for the hydraulic resistance of standard 32mm BS1387 heavy grade tube. Multiple tube ARP units must be connected in parallel, so far as water flow is concerned, to avoid distortion due to differential expansion at uneven temperatures. Refer to Fig.1.

Steam

On steam installations a minimum gradient of 12mm in 3m must be built in on installation and the use of pipe grade adjusters will easily facilitate this. Multitube ARP units must always be connected in parallel through the multitube headers. Refer to Fig.2.

Mounting

The suspension brackets provided with each length of ARP are fitted with clevis pins for direct attachment of hooked drop rods, or drop rods in conjunction with hanger link sets or pipe grade adjusters. Although ARP is relatively light weight (*see inside back cover*) it must be ensured that the roof structure of the building is capable of adequately carrying the total weight of the ARP to be installed.

Table 6 Radiant Output - Steam

STEAM PRESS Bar	AMBIENT TEMP iC	TOTAL EMISSIONS - Watts per metre RUN							
		HORIZONTAL MOUNTING NUMBER OF TUBES				VERTICAL MOUNTING NUMBER OF TUBES			
		1	2	3	4	1	2	3	4
0	10	326	630	938	1248	376	726	1078	1437
	15	300	580	863	1144	347	671	998	1323
	20	276	533	793	1052	319	614	920	1215
0.15	10	347	669	995	1327	400	773	1147	1259
	15	321	619	919	1223	371	718	1067	1415
	20	295	570	849	1125	341	658	979	1298
0.5	10	382	739	1095	1460	443	854	1273	1911
	15	357	689	1025	1364	413	803	1188	1784
	20	333	643	957	1271	383	740	1101	1659
0.75	10	403	781	1156	1540	468	904	1348	1786
	15	379	732	1089	1445	440	848	1261	1672
	20	355	686	1020	1357	409	790	1175	1563
1.5	10	459	886	1321	1752	534	1031	1536	2032
	15	434	838	1247	1656	503	972	1443	1918
	20	407	785	1170	1551	473	911	1355	1799
2	10	490	946	1405	1866	612	1101	1635	2170
	15	466	898	1337	1771	583	942	1549	2055
	20	436	842	1255	1665	551	883	1455	1929
3	10	544	1050	1563	2071	629	1221	1818	2411
	15	530	1003	1490	1980	601	1163	1729	2293
	20	499	944	1403	1861	567	1097	1630	2162
4	10	587	1134	1683	2235	683	1316	1961	2595
	15	562	1084	1612	2143	651	1253	1865	2475
	20	529	1020	1520	2019	614	1189	1766	2343
5	10	628	1213	1798	2394	727	1402	2083	2773
	15	600	1157	1723	2291	694	1336	1987	2647
	20	567	1093	1629	2165	661	1279	1899	2519
7	10	694	1337	1823	2643	799	1538	2293	3047
	15	665	1280	1747	2538	766	1481	2197	2923
	20	633	1226	1653	2413	733	1417	2102	2795
10	10	767	1485	1971	2928	888	1713	2550	3388
	15	742	1436	1886	2832	855	1648	2456	3263
	20	710	1375	1791	2707	819	1584	2351	3118
APPROXIMATE RADIANT EMISSION		64%				49%			

Normally the roof purlins will be suitable as suspension points, however if they are not available and the trusses are not at a convenient pitch, it will be necessary to fit longitudinal supports between the trusses from which the drop rods can be hung. In all cases the length of drop rod used must be sufficient to allow the take up of movement due to expansion. The standard 3m spacing between supports must not be exceeded. The main lengths of ARP should be installed first and set to a gradient if required. With the securing U-bolts removed, the closer unit reflectors can be fitted over the pipe joints, the U-bolts then being fitted to secure the reflector in position. It will be necessary to push in the underside of the reflector to clear pipe unions and proud weld joints.

Guarding

Where ARP is operating at temperatures in excess of 80iC it must be located or protected so that persons cannot come into contact with it.

Finishing

As standard ARP is finished with a black primer coat and a finishing coat should be applied as soon as possible after completion of the installation. A good quality matt finish, heat resisting paint should be used, preferably of a 'warm' colour such as red or orange. Gloss and metallic paint finishes are not recommended as they will reduce the radiant heat output.

Fig.1

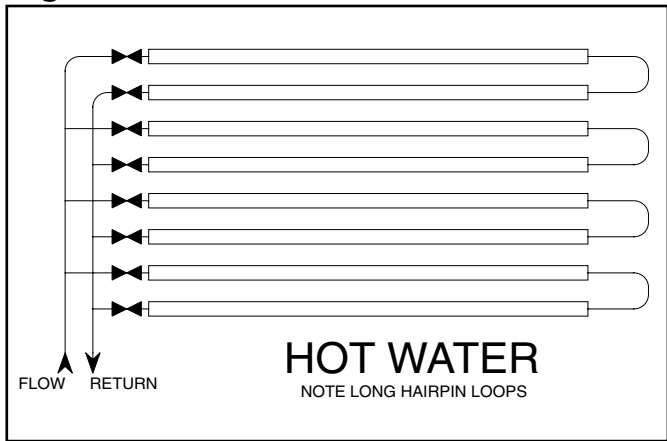


Fig.2

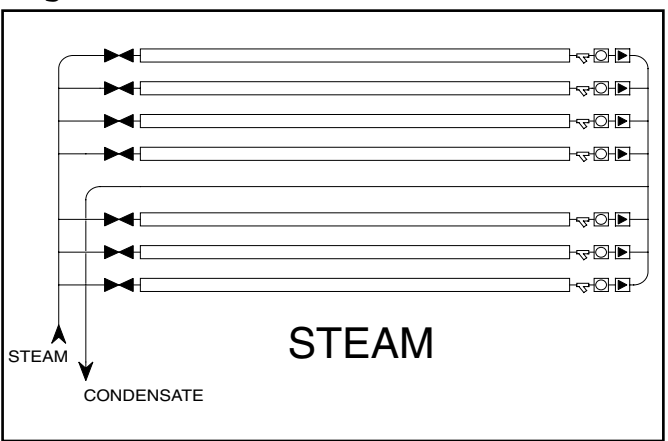


Fig.3

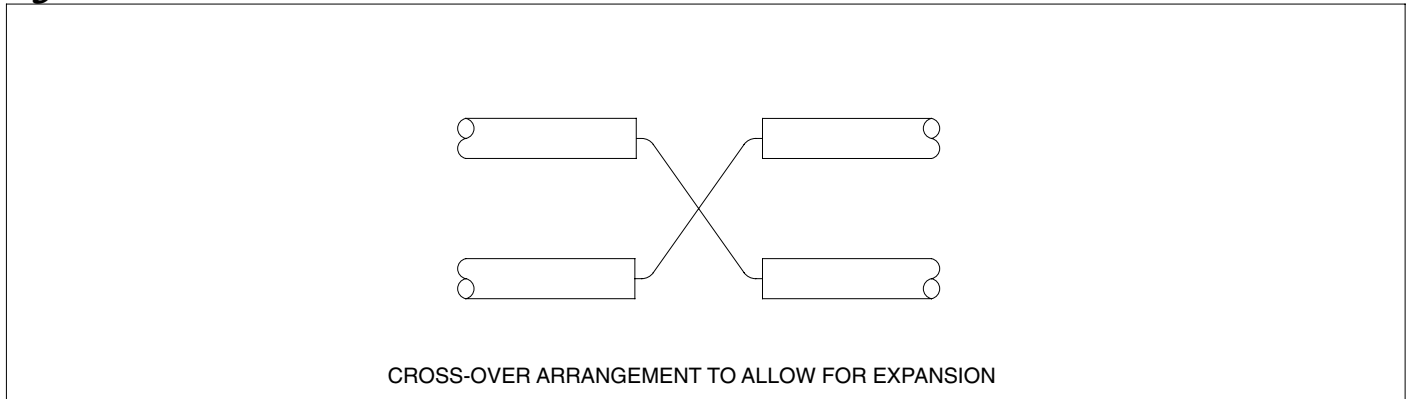


Fig.4

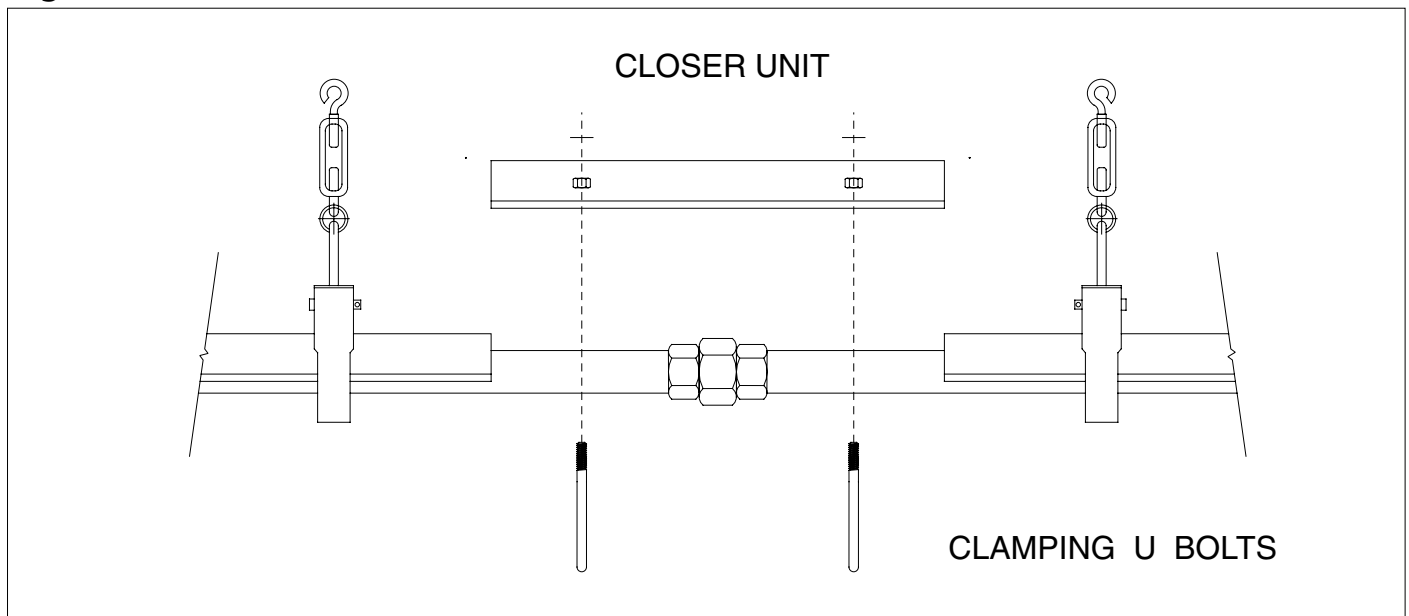


Table 7 Filled Weights

TUBE GRADE	SINGLE TUBE		TWO TUBE		THREE TUBE		FOUR TUBE	
	Kg/m	lbs/ft	Kg/m	lbs/ft	Kg/m	lbs/ft	Kg/m	lbs/ft
HEAVY (C)	7.3	4.9	14.6	9.8	21.8	14.6	29.2	19.6