
Armstrong®

Heat Treatment
From a Steam Viewpoint

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Armstrong-Hunt, Inc. – Div. All

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Kansas State University, Manhattan, KS.

Heat Treatment Workshop

Armstrong

ARMSTRONG-HUNT, INC.

- 50+ YEAR OLD HEAT TRANSFER PRODUCTS DIVISION OF ARMSTRONG INTL, INC.,
- A 100+ YEAR OLD MANUFACTURER AND SERVICE PROVIDER OF HEAT TRANSFER AND SPECIALTY SYSTEMS FOR:
  - THE STEAM
  - HOT WATER
  - FLUID HANDLING AND
  - AIR SYSTEMS MARKETPLACE.

Armstrong

ARMSTRONG FOOD INDUSTRY INVOLVEMENT

- DECADES OF INVOLVEMENT WITH ALL ASPECTS OF THE FOOD INDUSTRY
  - EQUIPMENT DESIGN AND OEM SUPPORT
  - PRODUCT APPLICATIONS DEVELOPMENT AND SUPPLY
  - ENERGY SYSTEM ANALYSIS
  - OPERATIONAL SUPPORT OF FACILITIES
  - TRAINING & EDUCATION OF INDUSTRY PERSONEL
- GLOBAL MANUFACTURING PLANTS AND FACTORY TRAINED TECHNICAL REPRESENTATIVES.
- REFER TO OUR WEBSITE AT :
  - www.armstrong-intl.com

Armstrong

ARMSTRONG-HUNT
HEAT TREATMENT INVOLVEMENT

- FIXED OR PORTABLE STEAM HEAT TREATMENT EQUIPMENT IN REGULAR USE IN MANY FOOD INDUSTRY FACILITIES THROUGHOUT NORTH AMERICA;
- INCLUDING
  - NESTLE'S (PURINA PETCARE), (10+ Years)
  - QUAKER, (25+ years) (dates back to Hunt & Moscrop, Div.)
  - NABISCO,
  - GENERAL MILLS ,
  - KRAFT, AND OTHERS.
- KANSAS STATE UNIVERSITY, DEPT. OF GRAIN SCIENCE HAS UTILIZED ARMSTRONG-HUNT PORTABLE STEAM HEATERS SINCE THE MID '90's IN ONGOING HEAT TREAMTENT RESEARCH.

  (Dr. Eustace)

Armstrong

ARMSTRONG'S VIEW OF HEAT TREATMENT

- *HEAT TREATMENT IS ONLY ONE KEY PART OF AN INTEGRATED PEST MANAGEMENT PROGRAM!*
- HEAT, ***ALONE*** IS NOT THE TOTAL SOLUTION!
- USE OF HEAT IS A CRITICAL PART OF INSECT CONTROL, TO INCLUDE RESIDUALS, FOGGING, AND RELATED PEST MANAGEMENT SOLUTIONS.
- USE OF HEAT HAS PROVEN TO BE CONSISTANTLY POSITIVE WHEN HEAT IS COMBINED WITH AN INTEGRATED PEST MANAGEMENT PROGRAM.

ARMSTRONG'S VIEW OF HEAT TREATMENT

- CONFIRMED BY RESULTS FROM LONG TIME USERS OF STEAM HEATER SOLUTIONS AND THEIR RESPECTIVE QUALITY / SANITATION DEPARTMENTS :
  - QUAKER OATS (PEPSICO) (Ken Sheppard)
  - PURINA PETCARE (NESTLE'S) (Larry Dean)
  - And Many Other Well-Respected Authorities

STEAM HEATER SELECTION

- SELECTION OF PROPER STEAM HEATING COMPONENTS FOR USE IN A HEAT TREATMENT PROGRAM REQUIRES AN *INTEGRATED* APPROACH.

- A THOROUGH AND PROFESSIONAL AUDITING OF THE SITE AND FACILITIES INFRASTRUCTURE IS ESSENTIAL TO A SUCCESSFUL EQUIPMENT SELECTION

STEAM HEATER SELECTION

- INVOLVED PARTIES MUST CONSIST OF:
  - SANITATION AND / OR QUALITY MANAGEMENT
  - HOUSEKEEPING/BUILDING MAINTENANCE
  - UTILITIES MANAGEMENT
    - MECHANICAL, ELECTRICAL, PLUMBING
  - PRODUCTION MANAGEMENT
  - FINANCE / ACCOUNTING INPUT

STEAM HEATER SELECTION

- SITE AUDIT PARTICIPANTS (MINIMUM)

  1) CURRENTLY CONTRACTED INTEGRATED PEST MANAGEMENT SERVICE WITH HISTORICAL KNOWLEDGE OF THE SITE AND EXISTING PEST TARGETS AND PAST RESULTS HISTORY

  2) COMPETENT FACTORY TRAINED UTILITIES SYSTEM SPECIALIST OR ENGINEER WITH STRONG STEAM AND AIR MOVEMENT BACKGROUND

  NOTE: *FREE AUDITS PRODUCE POOR RESULTS. CHARGES FOR AUDITS CAN OFTEN BE ROLLED INTO EQUIPMENT PURCHASES OR PROJECT COSTS.*

STEAM HEATER SELECTION

WHY USE STEAM?

- PROVEN TECHNOLOGY.
- HIGH ENERGY (BTU) CONTENT OF MEDIUM.
- HIGH HEAT (TEMPERATURE) CONTENT OF MEDIUM
- SELF DISTRIBUTING (STEAM SYSTEM DOES NOT REQUIRE CIRCULATING PUMPS)
- CLEAN SOURCE OF ENERGY (WHEN WATER IS TREATED WITH FDA APPROVED CHEMICALS)
- RECOVERABLE / REUSABLE ENERGY SOURCE
  - (HOT CONDENSATE) CAN BE RECOVERED FOR REUSE WITH FRACTIONAL ENERGY ADDITION).

STEAM HEATER SELECTION

- POTENTIAL PLANT SITE UTILITIES SCENARIOS:
  - EXISTING PLANT WIDE STEAM SYSTEM IN PLACE
  - PARTIAL PLANT USE OF STEAM SYSTEM
  - NO STEAM CURRENTLY IN USE
    - MAY ALLOW FOR IN-PLACE PIPING WITH EXTERNAL PERIODIC STEAM GENERATION RENTAL SUPPLY
- POTENTIAL PLANT HEAT TREATMENT REQUIREMENTS:
  - TOTAL PLANT STRUCTURE (PLANT WIDE)
  - PARTIAL PLANT STRUCTURE (TARGETED SPACE)
  - EQUIPMENT TARGETS (BINS, EQUIPMENT…)
  - SPECIAL APPLICATIONS (R & D REQUESTS)

STEAM HEATER SELECTION

	HEAT TREATMENT OPTION MATRIX FOR STEAM USAGE		
STEAM ACCESSIBILITY →	AVAILABLE / EASILY ACCESSIBLE	AVAILABLE / REMOTE	NO STEAM ON SITE
TYPE OF HEAT HEAT TREATMENT REQUESTED ↓			
PLANT WIDE HEAT TREATMENT			
PARTIAL PLANT HEAT TREATMENT			
EQUIPMENT TARGETED HEAT TREATMENT			
SPECIAL APPLICATIONS (R&D)			

Armstrong-Hunt, Inc.
Piping Considerations

- EXISTING STEAM AND CONDENSATE LINE SIZES WHICH CAN BE ADAPTED FOR HEAT TREATMENT
- EXISTING ELEVATIONS (above floor level) FOR STEAM AND CONDENSATE CONNECTIONS TO BE ADDED.
- DRAINAGE CONSIDERATIONS:
  - Draining to Floor (Waste)
  - Draining to Floor Level Condensate Returns
  - Draining to Overhead Condensate Returns or Against Backpressures.

STEAM HEATER SELECTION
BUILDING CONSIDERATIONS:

- SINGLE FLOOR, MULTI-FLOOR, OPEN MEZZANINE
- GEOMETRY OF FLOOR SPACE
  - RECTANGULAR, SQUARE, MULTIPLE CUBICLE
- OUTSIDE WALL EXPOSURE & CONSTRUCTION
  - NUMBER OF SIDES EXPOSED DIRECTLY TO OUTSIDE AFFECTS HEAT LOSS CALCULATIONS
  - WALL CONSTRUCTION – CAVITIES, UTILITY CHASES
- ROOF CONSTRUCTION
  - STRUCTURAL MEMBER MATERIALS:
    - STEEL, CONCRETE/STEEL, WOOD, BEAM, TRUSS
- WINDOW AREA IF SIGNIFICANT
- FLOOR CONSTRUCTION – POURED / WOOD

STEAM HEATER SELECTION

EXISTING VENTILATION / AIR CIRCULATION:

- OUTSIDE AIR MAKE-UP UNIT SIZE & LOCATIONS
  - CONTROL SET POINT RANGE
  - ABILITY TO RECIRCULATE AIR
  - TYPE OF MIXING –
    - 100% OUTSIDE AIR, MIXED AIR, ECONOMIZER
- RECIRCULATING UNITS (FAN COIL SYSTEMS)
- RECIRCULATING UNITS (FAN ONLY SYSTEMS)
- EXHAUST FAN PLACEMENT / SIZING / CONTROL
- AIR CURTAINS (WITH OR WITHOUT HEATING) AT DOORWAYS OR DOCK AREAS.
- PRESSURIZATION (+ or -) OF ADJACENT ATTACHED BUILDINGS

STEAM HEATER SELECTION
THERMODYNAMIC / HEAT LOSS GUIDELINES

- REFERENCES:
  - ASHRAE FUNDAMENTALS: LOAD AND ENERGY CALCULATIONS CHAPTER 26-31
  - ENGINEERING FOR FOOD SAFETY AND SANITATION GUIDELINES :
  - $Q_{TOTAL} = Q_{ES} + Q_I + Q_{SS}$ = (TOTAL BTU/HR REQUIRED)
    - Q_{ES} = A x U x TD (EXPOSED SURFACE CALC.)
    - Q_I = (Cu.Ft./Hr) x (TD) x 0.018 (INFILTRATION HEAT LOSS)
    - Q_{SS} = 0.12 x M x (TD) (BUILDING STEEL & EQUIP. SURF.)
      - BLDG STEEL AND EQUIPMENT WEIGHT ESTIMATES
  - QUICK CALC GUIDELINE:
    - ((V/25) + (EA/4)) x (TD/1000) = TOTAL MBH
      - V = Bldg. Volume, EA = Exposed Area, TD = Temp. Diff.

STEAM HEATER SELECTION
Proprietary (In-House Software)

ARMSTRONG-HUNT

INSECT CONTROL ESTIMATION PROGRAM

VERSION 3.3 (06-05-2003)

DESIGN			
Design outside Air temperature		40	F
Steam Pressure (saturated at coil)		30	psig
Steam Core Tube material		SS 304	
BUILDING CHARACTERISTICS			
Space length	(10 to 1000 feet)	75	ft
Space width	(10 to 1000 feet)	100	ft
Space height	(6 to 40 feet)	20	ft
HEAT LOAD			
Total MBH		963	MBH

UNIT SELECTIONS ARE AVAILABLE ON "**RESULT"** TAB

STEAM HEATER SELECTION
Proprietary (In-House Software)

ARMSTRONG-HUNT

UNIT SELECTION FOR INSECT CONTROL

VERSION 3.3 (06-05-2003)

1 ROW UNITS

Units (Model)	AFPM	EAT	LAT (F)	Q (MBH)	Steam (pph)/ea	Qty req'd (ea)	Throw	Total Throw (ft)	Possible choices
AQ-101-HS	598	140	178	28.79	31	34	30	1082	No
AQ-121-HS	749	140	174	42	45	24	44	1120	No
AQ-141-HS	1120	140	166	61	66	16	53	899	>>Yes
AQ-161-HS	1153	140	165	78	84	13	66	910	>>Yes
AQ-181-HS	1254	140	164	98	105	10	72	764	>>Yes
AQ-201-HS	1285	140	164	118	127	9	76	726	>>Yes
AQ-241-HS	1191	140	165	160	172	7	82	609	>>Yes
AQ-301-HS	1143	140	165	251	270	4	84	357	No
AQ-361-HS	1127	140	166	319	343	4	88	374	No
AQ-421-HS	1045	140	167	415	447	3	118	376	No
AQ-481-HS	1117	140	166	524	564	2	118	251	No

STEAM HEATER SELECTION
Proprietary (In-House Software)

ASSUMPTIONS TAKEN FOR EVALUATION

1- Average building construction (STD warehouse)
2- The temperature to control insect is 140 F.
3- The selection is regardless of the size of the unit.
4- All the walls are considered exposed to OAT.
5- Assumed at sea level.
6- Correction factor of 0.855 for Air temp.
7- A11-Q08 construction only.
8- Rectangle or square building foot print. (other shapes, consult factory)

NOTES

IF POSSIBLE CHOICE FLAG IS AT "NO", CONSULT FACTORY
FOR EXPLOSION PROOF APPLICATION CONSULT FACTORY.
FOR CEILING HIGHER THAN 18 FT CONSULT FACTORY
SINGLE PHASE MOTOR AVAILABLE UP TO MODEL 24. (CAN GO THROUGH DOOR OPENING)
MODEL 24 CAN GO THROUGH A 33" DOOR OPENING.
IF THE BUILDING IS OLD CONSULT FACTORY
IF THE BUILDING HAS LARGE WINDOW AREA CONSULT FACTORY
LAT AROUND 160 F IS RECOMMENDED.
SOME UNITS COULD BE REQUIRED TO COMPENSATE AIR LEAKAGE.
FOR FINAL SELECTION CONSULT FACTORY OR YOUR LOCAL A-H REP.

STEAM HEATER SELECTION
Proprietary (In-House Software)

Armstrong Service

HEAT STERILIZATION

DESIGN CONDITIONS

Outdoor Design Temperature	-10	°F
eated Space Design Temperature	70	°F
Space Design Temperature	140	°F
Room Width	40	Feet
Room Length	60	Feet
Ceiling Height	25	Feet
Air Changes Per Hour	1	
Start-Up Load	76,364	BTU/hr
Outdoor Exposure Load	62,010	BTU/hr
Heated Space Exposuresl Load	111,650	BTU/hr
Total Load	250,024	BTU/hr

Please fill out the below information:

Customer:	NICOR
Address:	
Phone:	
Fax:	
Contact:	

R

Exit

	OUTDOOR EXPOSURE	HEATED SPACE EXPOSURE	
Walls			
8" Thick Concrete	1500	3500	ft^2
8" Thick Block	0	0	ft^2
Bare Metal	0	0	ft^2
Metal with 1" Insulation	0	0	ft^2
Metal with 3" Insulation	0	0	ft^2
Wood Framing/Sheating	0	0	ft^2
Wood Framing/Sheating with insulation	0	0	ft^2
Roofing			
Bare Corrugated Metal	0	0	ft^2
Corrugated Metal w/ 1-1/2" Insulation	0	0	ft^2
Bare Flat Metal	0	0	ft^2
Bare Flat Metal w/ 2" Insulation	0	0	ft^2
Wood	0	0	ft^2
Wood w/ Insulation	0	0	ft^2
Concrete Slab	0	2400	ft^2
Concrete Slab w/ Insulation	0	0	ft^2
Windows			
Single Pane	0	0	ft^2
Double Pane	0	0	ft^2
Skylight	0	0	ft^2
Doors			
Metal	32	0	ft^2
1" Wood	0	0	ft^2
2" Wood	0	0	ft^2

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STEAM HEATER SELECTION
Proprietary (In-House Software)

DESIGN CONDITIONS

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STEAM HEATER SELECTION
Proprietary (In-House Software)

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Wood Framing/Sheating with insulation	0	0	ft^2
Roofing			
Bare Corrugated Metal	0	0	ft^2
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Doors			
Metal	32	0	ft^2
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STEAM HEATER EQUIPMENT
Armstrong-Hunt, Inc.

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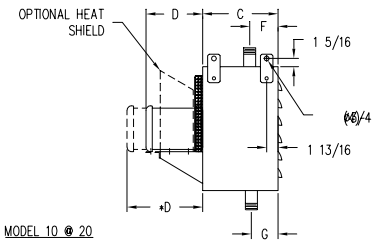
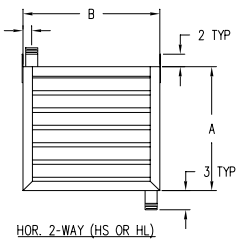
STEAM HEATER EQUIPMENT Armstrong-Hunt, Inc.

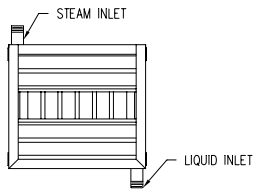
10” to 48” Fan Dia. / 800 - 22,000 CFM / Single Unit



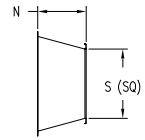
MODEL 10 @ 20



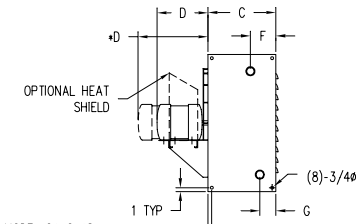
HOR. 2-WAY (HS OR HL)



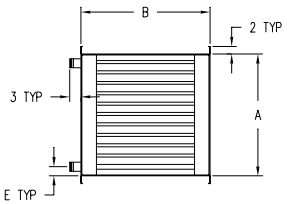
VERT. 4-WAY (VS OR VL)



HIGH VELOCITY NOZZLE (NS OR NL) (IN PLACE OF LOUVRES)



MODEL 24 @ 48



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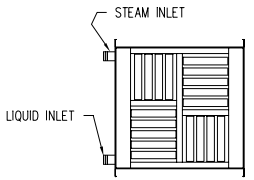

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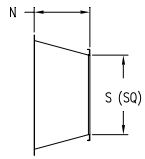


HIGH VELOCITY NOZZLE (NS OR NL) (IN PLACE OF LOUVRES)

MODEL	A	B	C	D	*D HT SHIELD	E	F	G	CONN MPT	N	S	CAPACITY CFM	H.P. @ RPM	WEIGHT ST/AL	WEIGHT ST/ST	WEIGHT SS/SS
101 102	15	17 3/4	12	9	12	1 3/8	4 1/2	4 1/4	1 1/2	10	7	810 700	1/3 @ 1725	95 LBS 135 LBS	105 LBS 155 LBS	95 LBS 145 LBS
121 122	17 1/4	19 3/4	12	9	12	1 3/8	4 1/2	4 1/4	1 1/2	10 3/4	9 3/4	1350 1320	1/3 @ 1725	105 LBS 150 LBS	120 LBS 180 LBS	110 LBS 165 LBS
141 142	19 1/2	21 3/4	12	9	12	1 3/8	4 1/2	4 1/4	1 1/2	11 1/2	11 3/4	2590 1980	1/3 @ 1725	120 LBS 175 LBS	140 LBS 210 LBS	125 LBS 190 LBS
161 162	22	23 3/4	12	9	12	1 3/8	4 1/2	4 1/4	1 1/2	12 1/4	14 1/4	3330 2910	1/2 @ 1725	135 LBS 195 LBS	165 LBS 240 LBS	145 LBS 220 LBS
181 182	24 1/4	25 3/4	12	9	12	1 3/8	4 1/2	4 1/4	1 1/2	13	16 3/4	4420 3900	3/4 @ 1725	150 LBS 220 LBS	185 LBS 280 LBS	160 LBS 250 LBS
201 202	26 1/2	27 3/4	12	9	12	1 3/8	4 1/2	4 1/4	1 1/2	13 3/4	18	5430 4560	1 @ 1725	170 LBS 245 LBS	210 LBS 315 LBS	180 LBS 285 LBS
241 242	32	34 1/4	18	12	15	2 7/16	6 3/4	4 1/4	2	14 1/2	20 3/4	7020 6000	1.1/2 @ 1125	290 LBS 360 LBS	350 LBS 470 LBS	320 LBS 420 LBS
301 302	39 1/4	40 1/4	18	12 1/2	15 1/2	1 13/16	6 3/4	4 1/4	2	18 13/16	26	10660 9400	2 @ 1125	360 LBS 460 LBS	460 LBS 650 LBS	410 LBS 550 LBS
361 362	45 1/4	46 1/4	18	12 1/2	15 1/2	2 5/8	6 1/2	4 1/2	2 1/2	22 7/8	29 1/2	13440 12160	2 @ 1125	440 LBS 550 LBS	560 LBS 800 LBS	500 LBS 680 LBS
421 422	52 1/4	52 1/4	22	15	18 3/4	2 5/8	6 1/4	4 3/4	3	29 3/8	33	16530 15160	3 @ 870	680 LBS 830 LBS	850 LBS 1150 LBS	770 LBS 1010 LBS
481 482	59 1/4	58 1/4	22	15	18 3/4	2 3/8	6 1/4	4 3/4	3	31 1/4	38	22110 20040	3 @ 870	800 LBS 990 LBS	1030 LBS 1430 LBS	920 LBS 1240 LBS

MODEL NUMBER

A__Q-182-H S-T 58-HS

- A__ : MODEL SIZE
- Q : TUBE MATERIAL
- 182 : No. FIN/INCH (SEE NOTE 1)
- H : FIN TYPE
- S : CORES
- T : MOTOR TYPE
- 58 : MOTOR ELECT. CHARACTERISTICS
- HS : OPTIONAL HEAT SHIELD

NOTE 1. If the number of fins/inch is standard the number between fin type and tube mat. will be missing

Armstrong-Hunt Inc.
03-04-16
CERTIFIED FOR MANUFACTURE

GENERAL NOTES:
A) ALL DIMENSIONS IN INCHES
B) TOLERANCE + OR - 1/8 UNLESS OTHERWISE NOTED
C) SEE RECOMMENDED PIPING LAYOUT IN CATALOGUES

No	REVISION	DATE	BY
6	GA#10 TUBE ADDED	98-04-02	M.D.
5	HEAT SHIELD, FLG & SS 316 ADDED	96-12-04	M.D.
4	LIQUID UNIT ADDED	95-07-21	M.D.
3	UPDATED WITH NEW STANDARD	94-11-28	M.D.
2	UPDATED WITH NEW STANDARD	93-09-15	M.D.

DIMENSIONAL DATA
STEAM UNIT HEATER

CONSTRUCTION

MODEL : GQ / GR (STEEL/STEEL)
FINNED TUBES : 1 OD X GA#12 (GQ) / GA#10 (GR) @ 2 5/32 C/C, SA-214
FINS : 2.138 OD X 0.024 THK, 'L' FIN , C.STL 11 FINS/INCH (STANDARD FIN PITCH)
CONNECTIONS : SCH80 (1 ROW SCH40) MPT, SA-106B
HEADER 1 ROW : SCH40 , SA-106B
HEADER 2 ROW : SCH40 1/2RD & PLATE SA-106B & SA-285C
DESIGN STEAM : 250 PSIG - 450°F, (ASME VIII-1)
DESIGN LIQUID : 350 PSIG - 450°F, (ASME VIII-1)

MODEL : AQ / AR (STEEL/ALUMINUM)
FINNED TUBES : 1" OD X GA#12 (AQ) / GA#10 (AR) @ 2 9/32 C/C, SA-214
FINS : 2.250 OD X 0.020 THK, KEYFIN , ALUMINUM 11 FINS/INCH (STANDARD FIN PITCH)
CONNECTIONS : SCH80 (1 ROW SCH40) MPT, SA-106B
HEADER 1 ROW : SCH40 , SA-106B
HEADER 2 ROW : SCH40 1/2RD & PLATE SA-106B & SA-285C
DESIGN STEAM : 250 PSIG - 750 °F, (ASME VIII-1)
DESIGN LIQUID : 350 PSIG - 750 °F, (ASME VIII-1)

MODEL : JU/JW (ST.STL 304/ST.STL 304)
MODEL (ALT. GRADE) : KV/KY (ST.STL 316/ST.STL316)
FINNED TUBES : 3/4 NPS SCH10 OR 1" OD X GA#14 @ 2 C/C, SA-312 TP 3XXL
FINS : 1.96 OD X 0.020 THK, 'L' FIN , ST.STL 3XX 10 FINS/INCH (STANDARD FIN PITCH)
CONNECTIONS : SCH40 MPT, SA-312 TP3XXL
HEADER 1 ROW : SCH10 , SA-312 TP3XXL
HEADER 2 ROW : SCH10 1/2RD & PLATE SA-312 TP3XXL & SA-240 3XXL
DESIGN STEAM : 250 PSIG - 600 °F, (ASME VIII-1)
DESIGN LIQUID : 250 PSIG - 600 °F, (ASME VIII-1)

FAN : ALUMINUM , (CAST ALUMINUM MODEL 36" @ 48")
CASING : GA#14 GALV.STL ENAMELED ONE COAT GREY
LOUVRES : FRICTION TYPE CURVED STEEL BLADES
FAN GUARD : GALV. STEEL WIRE
HYDROSTATIC TEST : 600 PSIG, 60 MINUTES
C.R.N. : 0H0506.608571342

MOTOR : T = TEFC
X = X-PROOF

VOLT : 12 = 115/1/60
20 = 208/1/60
22 = 220/1/60
21 = 208/3/60
23 = 230/3/60
46 = 460/3/60
58 = 575/3/60

Armstrong-Hunt,Inc
Granby,Qc, Canada J2G 8E5

DATE	SCALE	
92-01-20	N.T.S.	
DRAWN BY CHECKED BY	DRAWING No	REV
	C1095	5

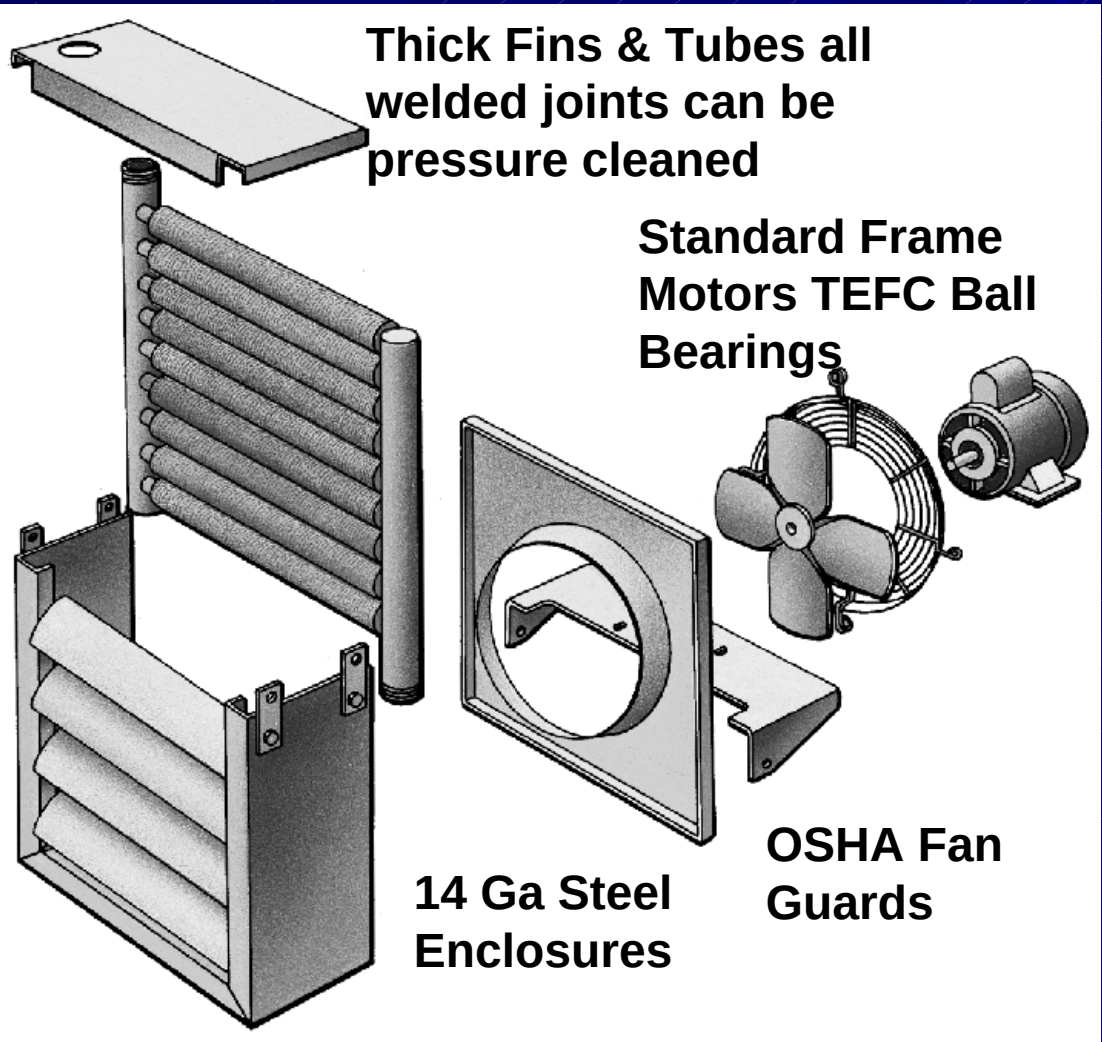
CUSTOMER

MODEL GQ , GR , AQ , AR , JU , JW

Armstrong

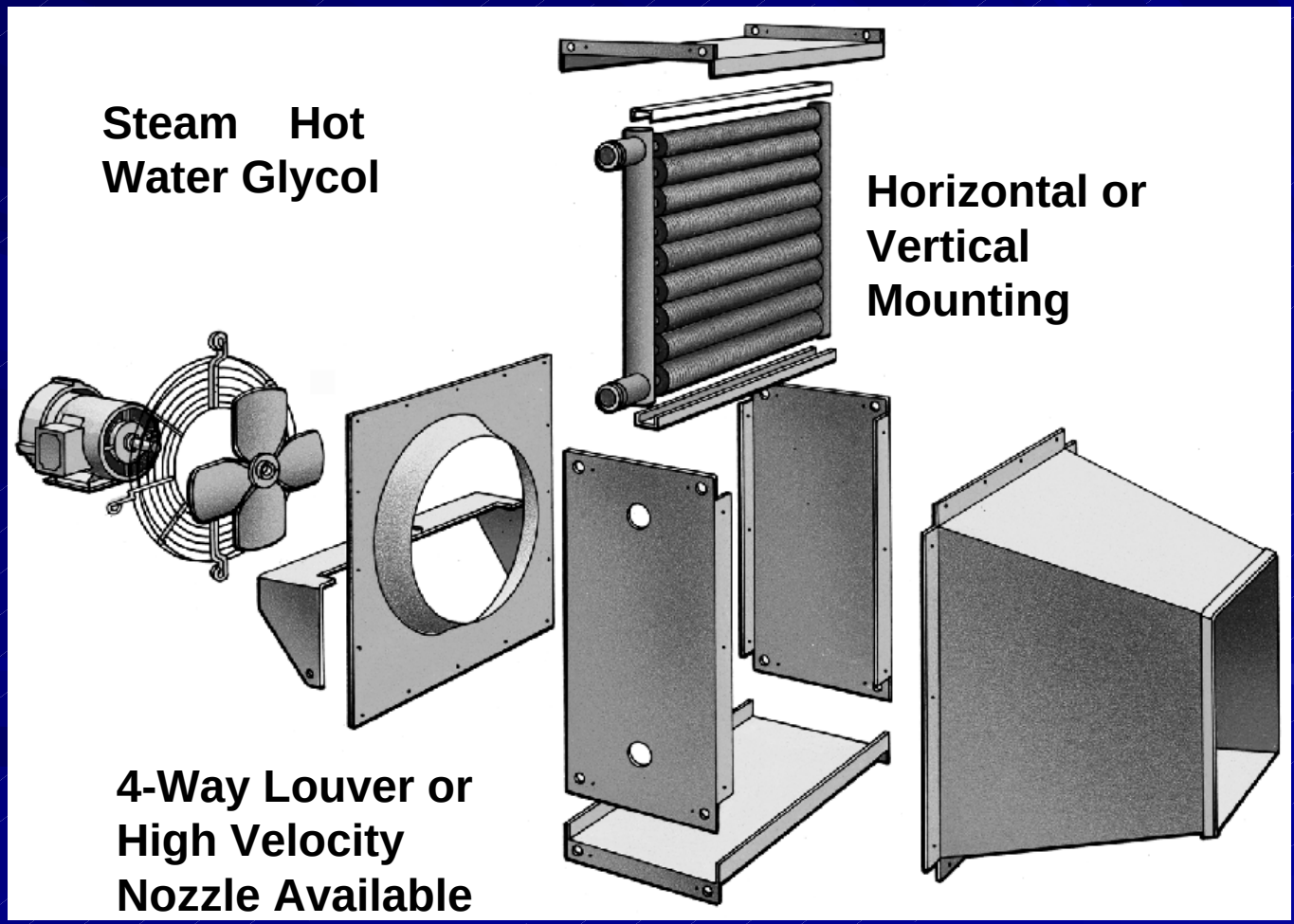
STEAM HEATER EQUIPMENT
Armstrong-Hunt, Inc.

10” to 20” Sizes



STEAM HEATER EQUIPMENT
Armstrong-Hunt, Inc.

24” to 48”



STEAM HEATER SELECTION
Armstrong-Hunt, Inc.

Unit Heater Materials

STEAM HEATER SELECTION

Tubes		Fins				Headers		Conns.	
Mtl	Wall	Mtl	Type	FPI	Thick	Mtl	Thick	Mtl	Thick
Standard Materials									
Steel	.109”	Steel	L-Foot	11	.024”	Steel	.145’	Steel	.133”
Steel	.109”	Alum	Keyfin	11	.020”	Steel	.145”	Steel	.133”
Special Order Materials									
Steel	.109”	Cu	Keyfin	11	.016”	Steel	.145”	Steel	.133”
SS	.083”	Steel	L-Foot	11	.024”	SS	.109”	SS	.109”
SS	.083”	SS	L-Foot	10	.020”	SS	.109”	SS	.109”
SS	.083”	Alum	Keyfin	11	.020”	SS	.109”	SS	.109”
SS	.083”	Cu	Keyfin	11	.016”	SS	.109”	SS	.109”

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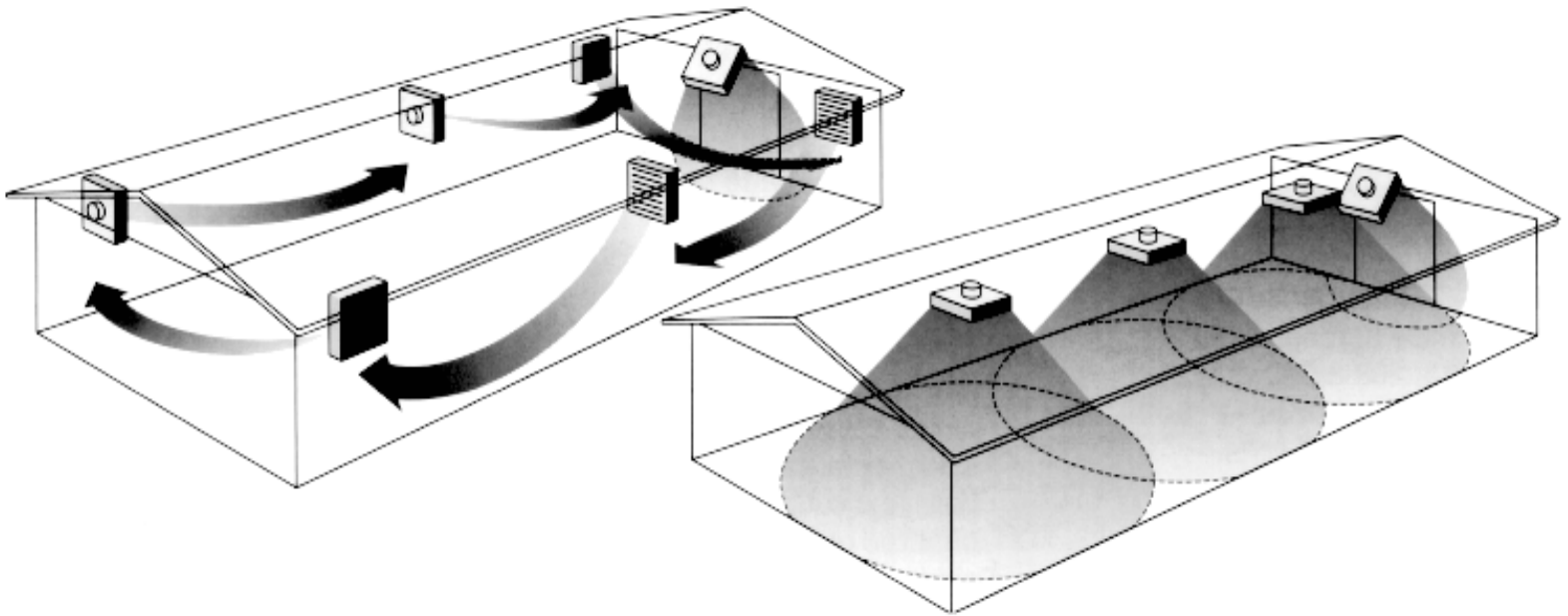
STEAM HEATER SELECTION
ART or SCIENCE?

- ART & SCIENCE – COMBINED:
  - SCIENCE:
    - ENGINEERING CALCULATIONS (HEAT LOSS)
    - ENGINEERING / PIPING / ELECTRICAL LAYOUT
    - EQUIPMENT SELECTION
    - EQUIPMENT MONITORING AND CONTROL
  - ART: EACH SITE HAS DIFFERENT CONSIDERATIONS
    - EQUIPMENT LAYOUT COMBINING:
      - **NEW STEAM HEATING COMPONENTS**
      - **EXISTING STEAM HEATING COMPONENTS**
      - **OTHER HEATING COMPONENTS**
      - **FAN / CIRCULATION SYSTEM INTERPLAY**
      - **CIRCULATING FAN PLACEMENT FOR OPTIMUM CIRCULATION**

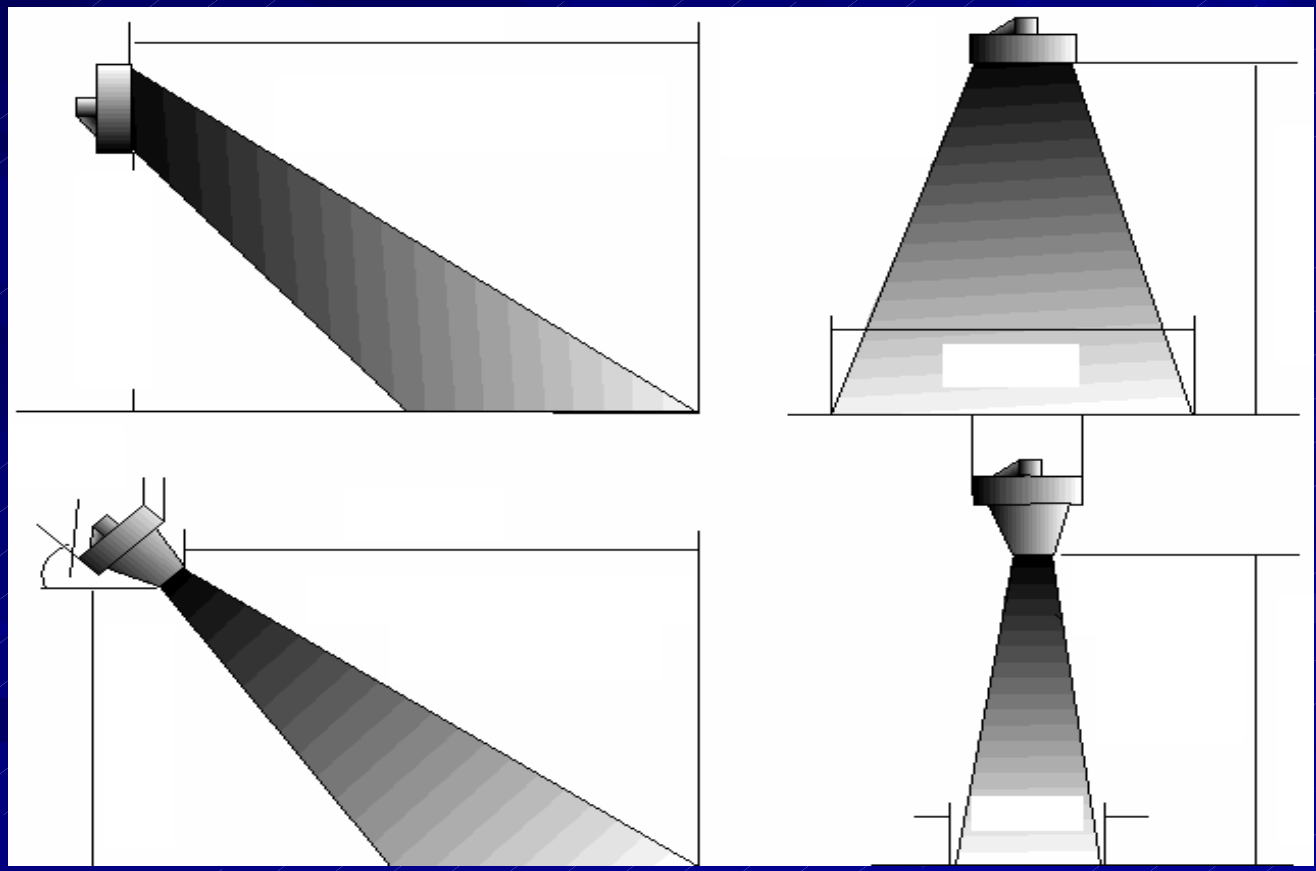
STEAM HEATER SELECTION
Armstrong-Hunt, Inc.

Unit Heater Placement



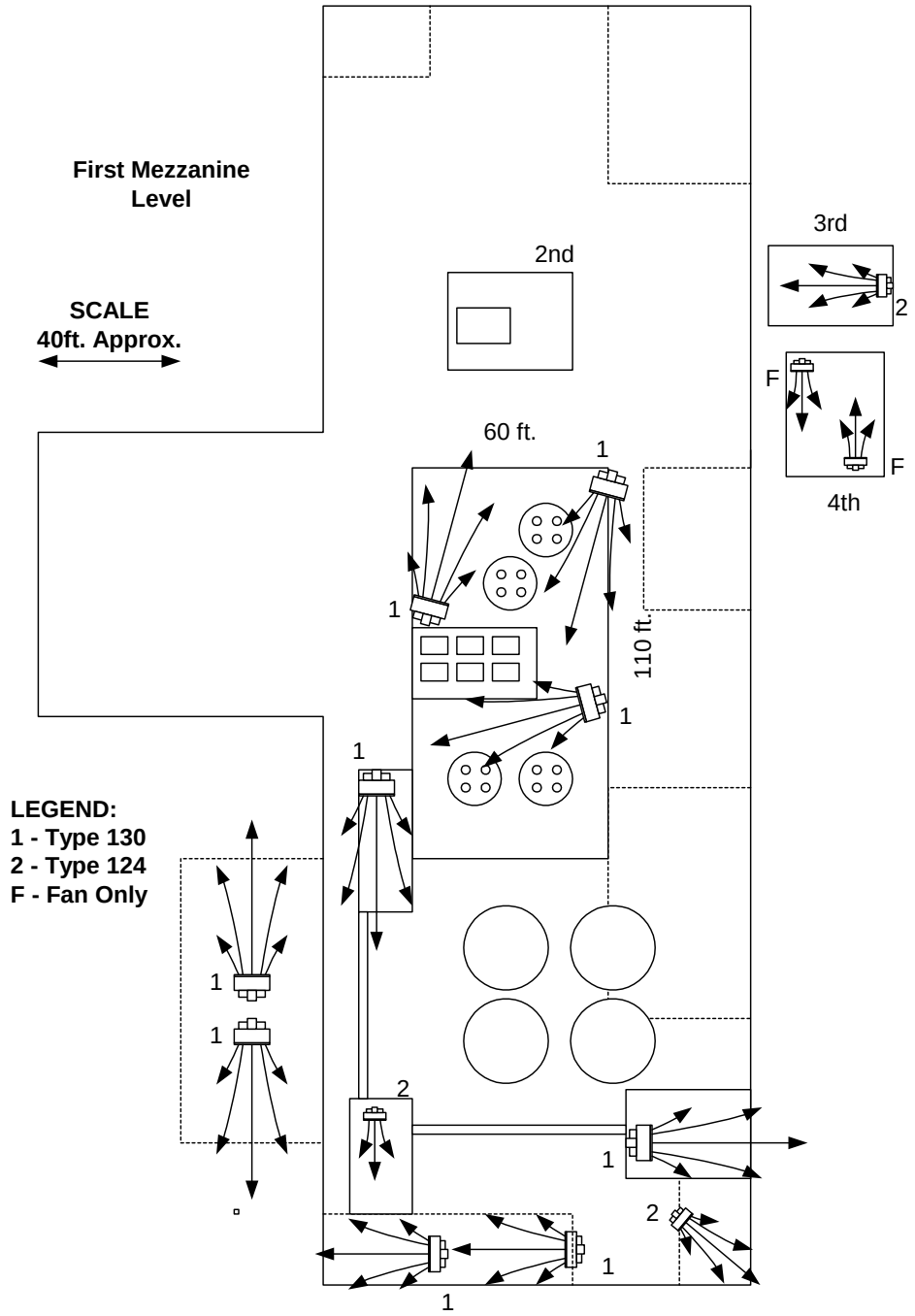
STEAM HEATER SELECTION
Armstrong-Hunt, Inc.

Mounting/Floor Coverage



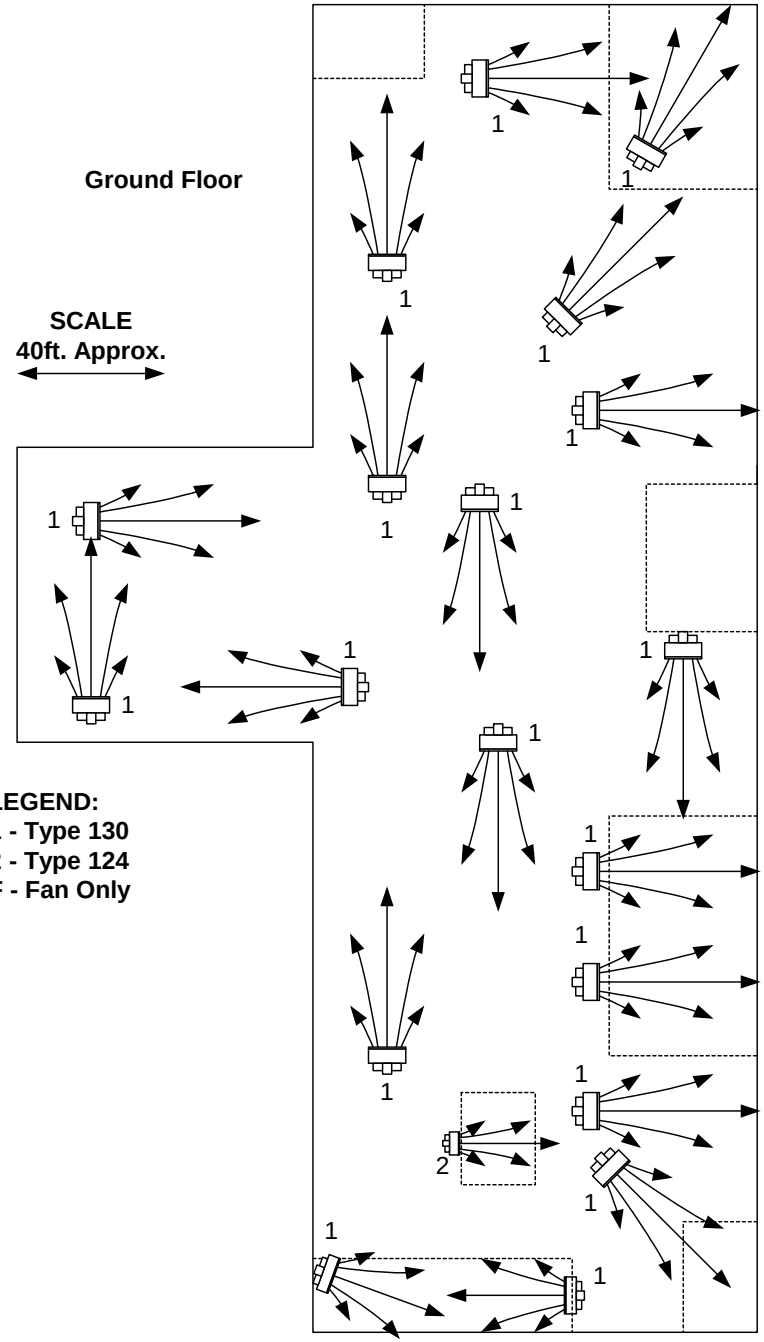
Typical Facilities Layout – Multi-Level

(Extremely Large Square Ft. Floor Area)



Typical Facilities Layout – Multi-Level

(Extremely Large Sq. Ft. Floor Area)



STEAM HEATER SELECTION
Armstrong-Hunt, Inc. (COOL FLOW) Approach

- ***COOL FLOW*** STEAM HEAT TREATMENT CONSIDERATIONS

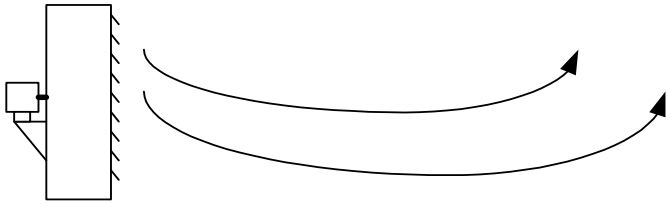
- SUGGESTED ***COOL FLOW*** STEAM PRESSURE RANGES:
  - **30 PSIG (274dgF) - 75 PSIG (320dgF) - Saturated Steam**
  - **USE OF HIGHER PRESSURE STEAM IS RECOMMENDED FOR REDUCING EQUIPMENT COST AND AIDING IN CONDENSATE RETURN.**

- SUGGESTED ***COOL FLOW*** OUTLET AIR TEMPS. FM HEATERS
  - **160-180 dgF (nominal)**
  - **DEPENDENT ON TARGET TEMP RANGE OF 125 – 140dgF**

- SUGGESTED ***COOL FLOW*** NUMBER OF ROWS OF FIN TUBE - ONE

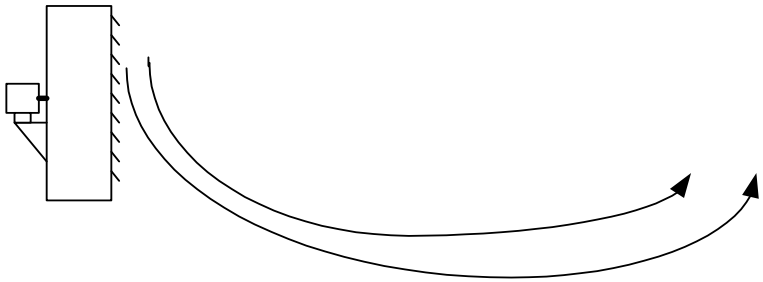
STEAM PRESSURE & THROW

CEILING or ROOF LINE



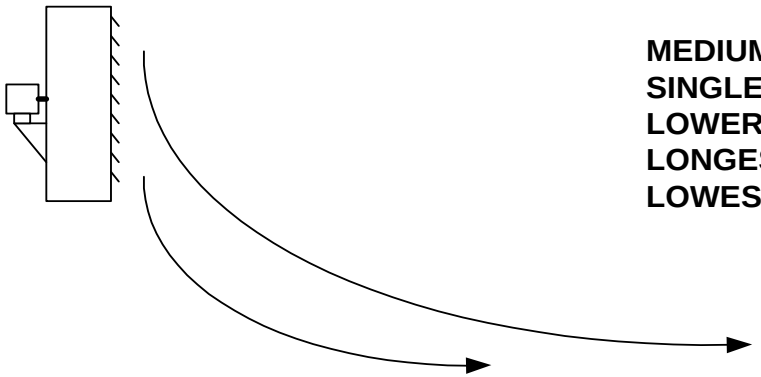
HIGH PRESSURE STEAM
MULTI-ROW
HI OUTLET TEMP
SHORT THROW
HIGH CEILING TEMPS.

CEILING or ROOF LINE



HIGH PRESSURE STEAM
SINGLE ROW
MEDIUM OUTLET TEMP
LONGER THROW
MEDIUM CEILING TEMPS.

CEILING or ROOF LINE

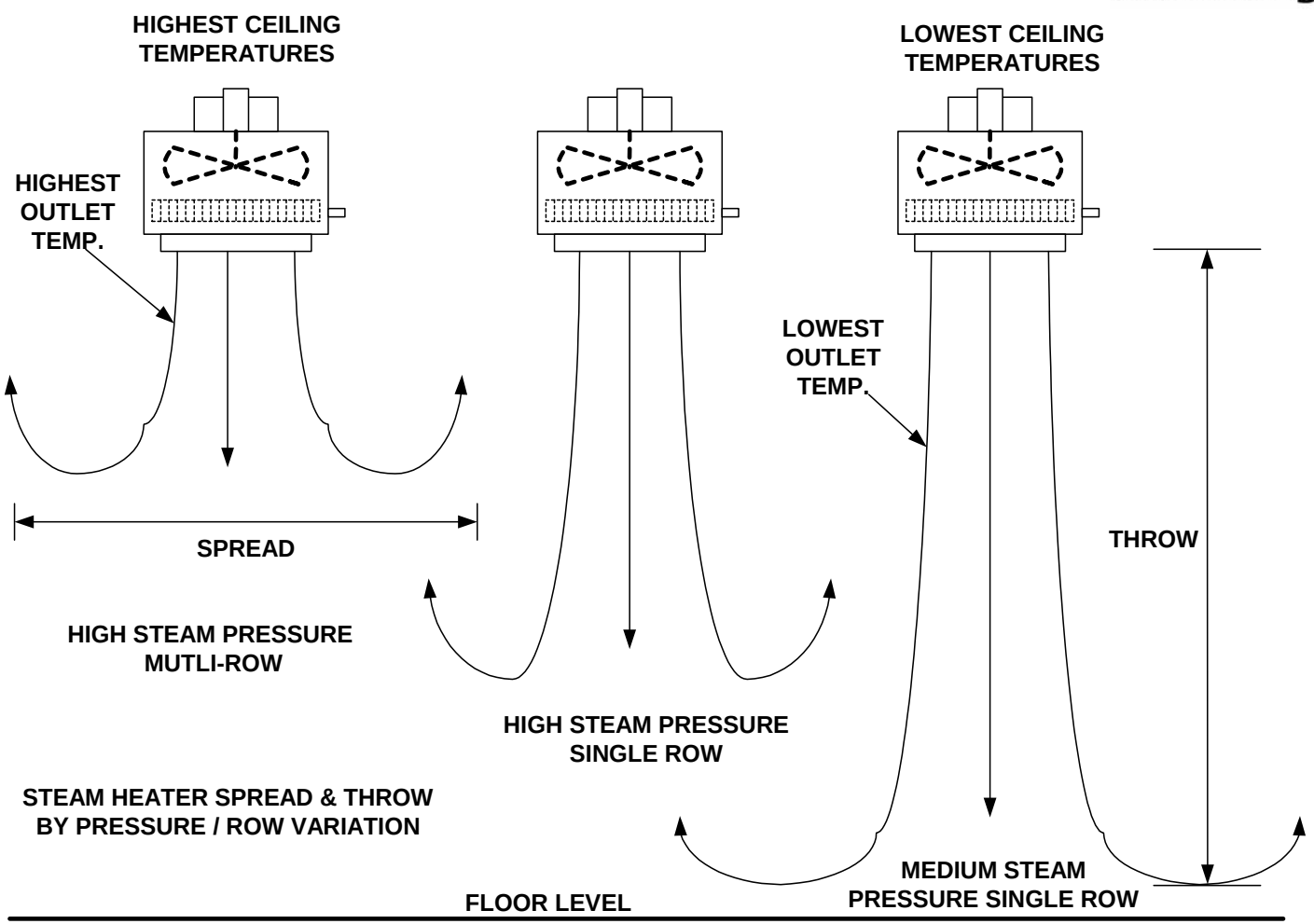


MEDIUM PRESSURE STEAM
SINGLE ROW
LOWER OUTLET TEMP
LONGEST THROW
LOWEST CEILING TEMPS.

J.R.Smith - AH
5/26/2003

STEAM PRESSURE AND SPREAD

J.R.Smith - AH
5/26/2003



Armstrong-Hunt, Inc.
Equipment Considerations Paper (AIB)
Low Outlet Temperature Considerations

- See attached copy (or request a copy) of
  - "EQUIPMENT CONSIDERATIONS: HEAT STERILIZATION FOR INSECT CONTROL" ; Presented to The American Institute of Bakers (AIB) in the early '90's by Tom Clark (Ret), former Mgr. of the Armstrong-Hunt, Inc. Div.
  - Technical Article related to why large fan volume steam heaters utilizing higher steam pressures (vs. low pressure 2-15 PSIG) and fewer rows results in ability to keep air from stratifying.

STEAM HEATER SELECTION
Armstrong-Hunt, Inc.

- EXISTING PROCEDURES:

- **Coverage and Circulation Often Based on Trial/Error**
- **Physically Checking Area with Infra-Red Scanning**
- **Manpower in Space to Move Heaters, and Shift Circulating Fans**

STEAM HEATER SELECTION
Armstrong-Hunt, Inc.

THE FUTURE INVOLVES A SYSTEMS SOLUTION APPROACH!

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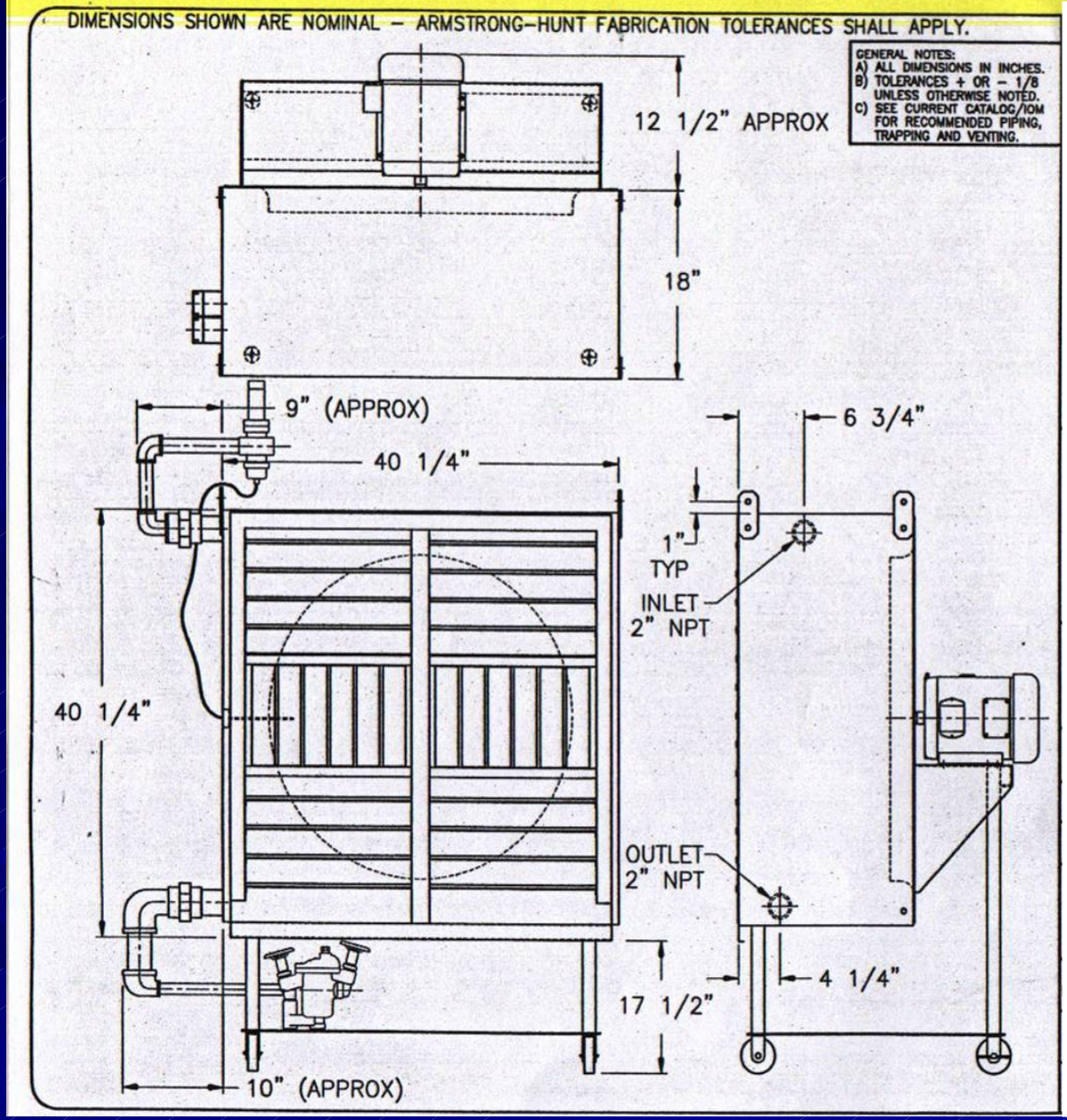

Single Portable with PREPIPED Temp. Controller and Condensate Drainage

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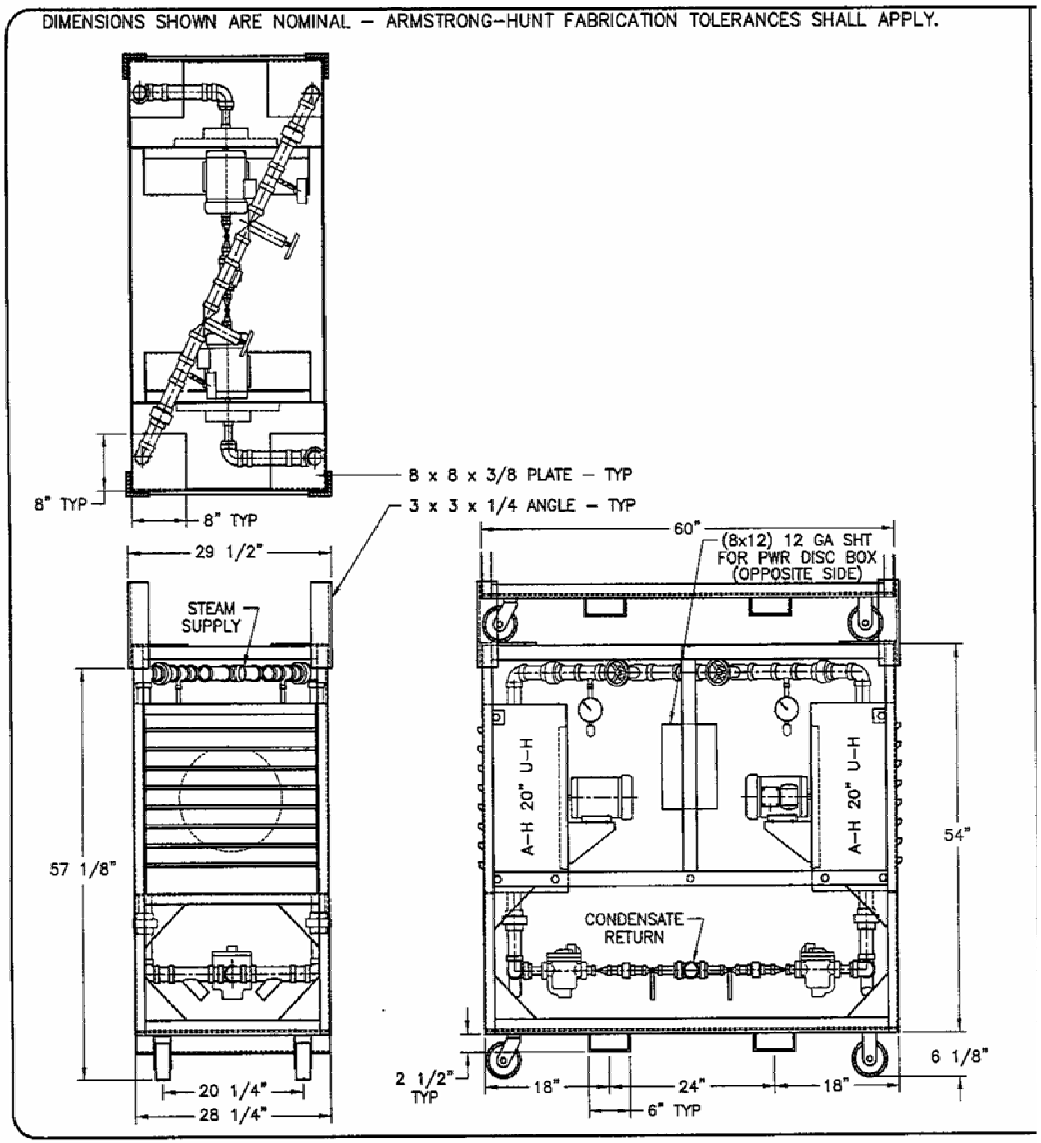


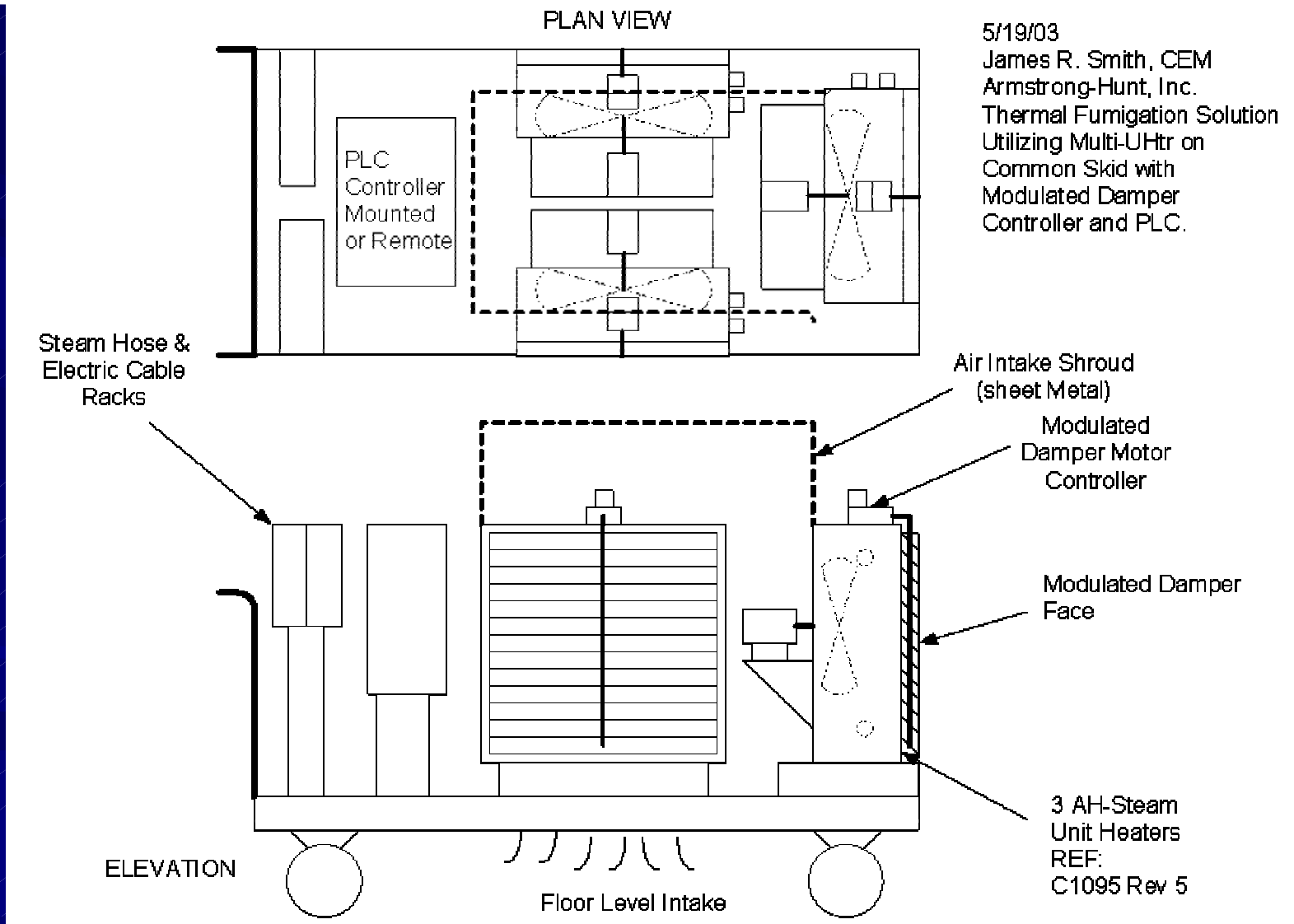
CERTIFIED DRAWING

FOR RECORD

Double Heater Package with Prepiped Temp. Control and Drainage

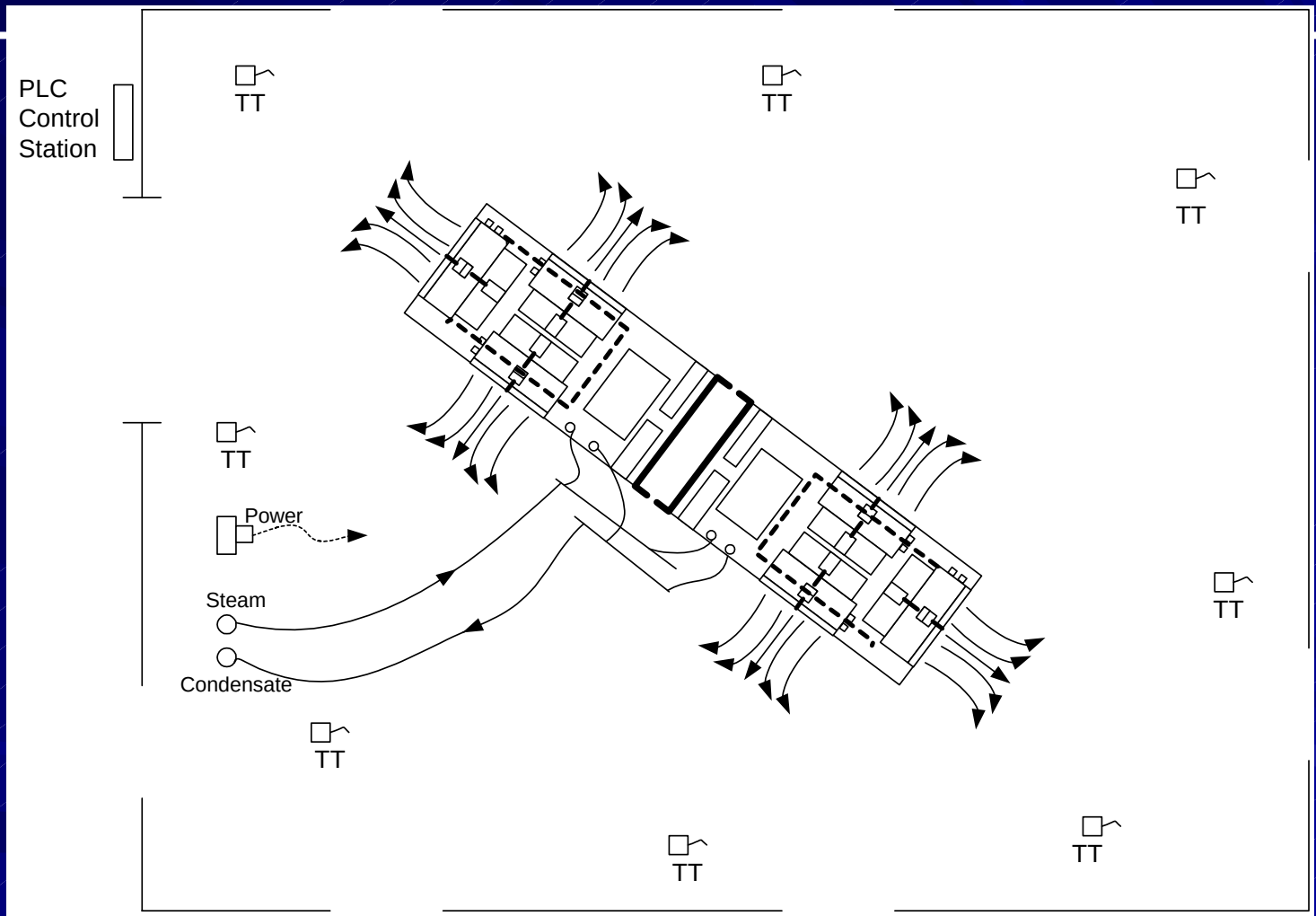
(with Stackable Storage Option)

STEAM HEATER SELECTION
Armstrong-Hunt, Inc. – Triple Heater w/Modulating Control



STEAM HEATER SELECTION

Armstrong-Hunt, Inc. – Steam Eye (Remote Monitoring) Adaptation

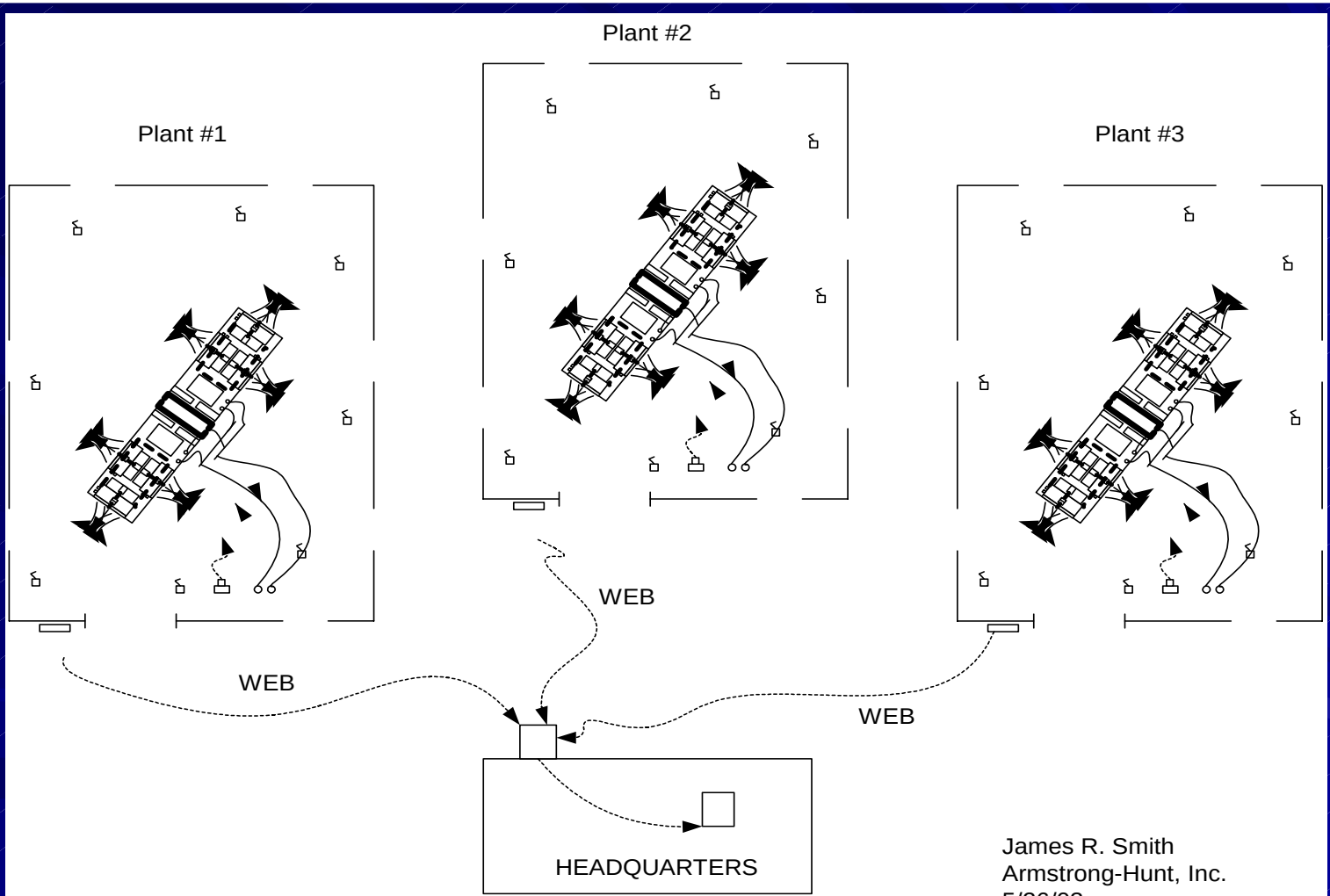


TT = Unwired Temp. Transmitter
PLC = Programmable Logic Controller and PC Station

Armstrong-Hunt Steam Heat Sterilization
Portable - Multi-Unit Installation

James R. Smith
Armstrong-Hunt, Inc.
5/26/03

FUTURE OPTIONS ADAPTING EXISTING TECHNOLOGIES
Armstrong-Hunt, Inc., E.O.S. (Web Based Control) Adaptation



HQ OPS. for MULTI-SITE
REMOTE MONITORING

James R. Smith
Armstrong-Hunt, Inc.
5/26/03

Armstrong-Hunt, Inc.
Summary

- Using Steam Heaters as part of an INTEGRATED PEST MANAGEMENT SOLUTION is not new, but is CONSTANTLY EVOLVING.
- Involve Only Steam Heater Suppliers with many years of industry involvement and *abilities to integrate the key components* of on-site audits, energy infrastructure availability and modifications should be considered.
- *INTEGRATED SYSTEM SOLUTIONS* include the ability to *work creatively with financial options* from renting, lease/own, off-balance sheet financing and capital assistance must be part of the offering.
- An *ability to TURNKEY the ENTIRE PROCESS* is critical based on reduced in-house resources at facilities.

Armstrong-Hunt, Inc.
Summary

- ***WORKING WITH YOUR PEST CONTROL/MANAGEMENT SPECIALIST AS PART OF AN INTEGRATED PROGRAM WILL YIELD THE BEST OVERALL SOLUTION!***

- ARMSTRONG-HUNT, Inc., Div.
  - PROVIDING EQUIPMENT SIZING AND SELECTION
- ARMSTRONG SERVICE, Inc.
  - PROVIDING INTEGRATED AUDIT AND TURNKEY INSTALLATION, SUPPORT SERVICES
- ARMSTRONG Intl., Inc.
  - GLOBAL RESPONSIBILITY AND MULTI-DIVISIONAL ***SYSTEMS SOLUTIONS***

Armstrong

Armstrong-Hunt, Inc.
Summary

- FOR FURTHER INFORMATION:
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- Website: www.armstrong-intl.com