M. P. MOLLER Organ Factory

Pipe Organ No. 9480 Date February 25, 1960

For Protestant - Cadet Chapel, United States Air Force Academy, Colorado Springs, Colo.

Action Electro-Pneumatic Console Detached - All electric

Casing No. M. P. Moller, Inc. Finish As per sample

Decorations None Motor 7-1/2 H.P. Style 3-P-3330

Width of Key-bed Standard - English Keys Ebony Sharps Stop Controls Stop Keys

No. Manuals Three - level manuals- tracker touch Wind Pressure 3"

To be Completed 24 months Blower Pipe furnished by Purchaser

Pitch: A-440

SPECIFICATIONS

GREAT ORGAN

1. 16' Quintadena.....1-12 Zinc....13-61 Spotted.....scales attached..61 pipes
   13-18 Zinc Tubs
2. 8' Principal..... Spotted.....1-17 Zinc Tubs.....scales attached..61 pipes
3. 8' Flute..... Wood.....1-12 Gedackt.13-49.opens-scales attached 61 pipes
   50-61 Spotted
4. 8' Gedackt..... Spotted.....1-17 Zinc Tubs.....scales attached..61 pipes
5. 8' Quintflöte..... Spotted.....1-17 Zinc Tubs.....scales attached..61 pipes
6. 4' Octave..... Spotted.....1-5 Zinc Tubs.....scales attached..61 pipes
7. 4' Spitzflöte..... Spotted.....1-5 Zinc Tubs.....scales attached..61 pipes
8. 2-2/3' Quinte..... Spotted.....scales attached..61 pipes
9. 2' Superoctave..... Spotted.....scales attached..61 pipes
10. 2' Waldflöte.....Spotted .....scales attached..61 pipes
11. V RK. Mixture..... Tin.....scales attached.305 pipes
12. III Rk. Scharf..... Tin.....scales attached.183 pipes
13. 16' Fagott..... Zinc and Spotted.....scales attached..61 pipes
14. 8' Trumpet..... Zinc and Spotted.....1-49 reeds.scales attached..73 pipes
    50-61 Double Flues
15. 4' Clarion..... Spotted.....1-37 reeds.....scales attached..85 pipes
    38-61 Double Flues

SWELL ORGAN

16. 16' Lieblich Gedackt - Wood and Spotted.....scales attached..61 pipes
17. 8' Principal..... Spotted-1-17 Zinc Tubs.....scales attached..61 pipes
18. 8' Chimney Flute... Wood....1-49 Spotted...Opens 50-61.scales attached..61 pipes
19. 8' Gambe..... Spotted.1-15 Zinc Tubs.....scales attached..61 pipes
20. 8' Voix Celeste FF. Spotted.6-15 Zinc Tubs.....scales attached..61 pipes
21. 8' Flauto Dolce.... Spotted.1-12 Zinc Tubs.....scales attached..61 pipes
22. 8' Flute Celeste FF Spotted.6-12 Zinc Tubs.....scales attached..56 pipes
23. 4' Octave Geigen... Spotted.1-5 Zinc Tubs.....scales attached..61 pipes
24. 4' Bourdon..... Spotted.....scales attached..61 pipes
25. 2' Doublette..... Spotted.....scales attached..61 pipes
26. 1-1/3' Quinte..... Spotted.....scales attached..61 pipes
27. IV Rks. Plein Jeu..... Tin.....scales attached.244 pipes
28. 16' Dulzian..... Zinc and Spotted.....61 reeds.....scales attached..61 pipes
29. 8' Trumpet..... Zinc and Spotted.....49 reeds.....scales attached..73 pipes
    50-61 Double Flues
30. 8' Oboe..... Zinc and Spotted..49 reeds-12 Flues-scales attached.61 pipes
31. 4' Rohrschalmey.... Zinc and Spotted..37 reeds-24 Flues-scales attached.61 pipes
32. Tremolo

POSITIV ORGAN

33.	8'	Copula	wood	50-56	Open Spotted	scales attached. 56 pipes
34.	8'	Gemshorn	Spotted	1-20	Zinc Tubs	scales attached. 56 pipes
35.	4'	Principal	Spotted	1-20	Zinc Tubs	scales attached. 56 pipes
36.	4'	Rohrflöte	Spotted	38-56	Opens	scales attached. 56 pipes
37.	2-2/3'	Nazard	Spotted			scales attached. 56 pipes
38.	2'	Octava	Tin			scales attached. 56 pipes
39.	2'	Blockflöte	Spotted			scales attached. 56 pipes
40.	1-3/5'	Tierce	Spotted			scales attached. 56 pipes
41.	1'	Piccolo	Spotted			scales attached. 56 pipes
42.	III Rk.	Fourniture	Tin			scales attached. 168 pipes
43.	II Rk.	Cymbal	Tin			scales attached. 112 pipes
44.	16'	Rankett	Zinc and Spotted	56 reeds		scales attached. 56 pipes
45.	8'	Cromorne	Copper and Spotted	49 reeds-7 Flues		scales attached. 56 pipes
46.	16'	Trompetas	Zinc	1-12 half length		scales attached. 109 pipes
47.	8'	Trompetas	Zinc and Tin	13-61	from #46	61 notes
48.	4'	Trompetas	Spotted	62-85 Double Flues	from #46	61 notes

PEDAL ORGAN

49.	16'	Principal	1-15 Zinc	16-32 Spotted with Zinc Tubs		scales attached. 32 pipes
50.	16'	Subbass	wood and Spotted			scales attached. 51 pipes
51.	16'	Quintadena	from #1			32 notes
52.	16'	Lieblich Gedackt	from #16			32 notes
53.	8'	Grossoctav	Spotted	1-20	Zinc Tubs	scales attached. 32 pipes
54.	8'	Octave	Spotted	1-18	Zinc Tubs	scales attached. 32 pipes
55.	8'	Gedackt	Wood			scales attached. 32 pipes
56.	5-1/3'	Quinte	Spotted	1-12	Zinc Tubs	scales attached. 32 pipes
57.	4'	Choralbass	Spotted	1-5	Zinc Tubs	scales attached. 32 pipes
58.	4'	Nachthorn	Spotted	Gedackt		scales attached. 32 pipes
59.	2'	Rohrgedackt	Spotted			scales attached. 32 pipes
60.	III Rk.	Mixture	Tin			scales attached. 96 pipes
61.	V Rk.	Mixture	Tin			scales attached. 160 pipes
62.	32'	Cornet	See Below			scales attached. 160 pipes
63.	32'	Contra Bombarde	Zinc			scales attached. 32 pipes
64.	16'	Posaune	Zinc			scales attached. 32 pipes
65.	16'	Fagott	from #13			32 notes
66.	16'	Dulzian	from #28			32 notes
67.	8'	Trumpet	Zinc and Spotted			scales attached. 32 pipes
68.	4'	Schalmey	Spotted			scales attached. 32 pipes

COMPOSITION - 32' CORNET

16'	C	16'	Principal	
10-2/3'	G		Extension of 16' Subbass	7 pipes
8'	C	8'	Octave	
6-2/5'	E	(1)		32 pipes
5-1/3'	G		Extension of 16' Subbass	12 pipes
4-4/7'	A#	(2)		32 pipes
4'	C	4'	Choralbass	
3-1/2'	D	(3)		32 pipes
2-3/4'	F#	(4)		32 pipes
2-1/2'	G#	(5)		32 pipes
			Total	179 pipes

COUPLERS

69. Great to Pedal
70. Swell to Pedal
71. Positiv to Pedal
72. Swell to Great
73. Positiv to Great
74. Swell to Positiv

ADJUSTABLE COMBINATIONS
(By Remote Control)

Pedal 1-2-3-4-5-6	Toe Studs
Great 1-2-3-4-5-6	Pistons and Toe Studs
Swell 1-2-3-4-5-6	Pistons and Toe Studs
Positiv 1-2-3-4-5-6	Pistons
General 1-2-3-4-5-6-7-8-9	Pistons and Toe Studs
General Cancel Piston	Pistons only for Nos. 7-8-9
Combination Setter Piston	

ACCESSORIES

Swell Pedal
Crescendo Pedal
Crescendo Indicator Single Light
Full Organ Reversible Piston and toe Stud
Full Organ Indicator Single Light
*Reversible Piston (Swell) and Toe Stud
*Reversible Piston (Great) and Toe Stud
*Reversible Piston (Positiv) and Toe Stud
*Make all six coupler tablets reversible type and wire on the job to selected three
Single Lamp (Organ Action Current) wired to lines from relay in pedestal control panel alongside console
Music Rack of Transparent Plastic, See Fig. #13 on Sheet #c-6
Blower: 7-1/2 HP Motor 1165 R.P.M.
AC to DC Rectifier: 75 ampere Orgelectra or equal
Light for Pedal Key

NOTE: Blower Capacity to compensate for High Altitude of USAFA Site

B. Air Filters
The organ builder shall supply Air Filters for the Blower and may choose:
(1) to supply a plenum chamber as shown on Sheet #B-1 or
(2) an independent filter to each blower as specified by the manufacturer to rated full capacity of each machine

C. Thermo-Humidigraph Instruments
The organ builder shall supply one Thermo-Humidigraph instrument, mounted in Protestant Chapel Organ. Instrument shall be Bristol Model #4069th, without fan.

The Bristol Company
P. O. Box 1790
Waterbury 20, Connecticut.

D. Preparation for Future Choir

The present preparation for the future Choir shall consist of:

(1) Mechanism for 6 Pistons See Sheet P-9
(2) Space to left of Swell Pedal for Choir Pedal
(3) Manual and Pedal Contacts
(4) Adequate number of wires in cable from console to organ
(5) Adequate number of wires in cable from organ to combination action

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2/3/61
Revised 8/30/61

DETAILS OF CONSTRUCTION

4. THE CONSOLES

A. The console cabinets shall be the simple table type with box cover for keys and tablets and constructed to the minimum dimensions possible to conform to American Guild of Organists' Standard. See Organ Drawings, Sheets Nos. C-5 and P-3 for floor plan dimensions.

B. The material of the console cabinets shall be:

	CATHOLIC	PROTESTANT
Music Rack	Transparent Plastic	Transparent Plastic
Box Cover	Walnut	Walnut
Table	Walnut	Walnut
Sides and Back	Walnut	Walnut
Base	Walnut	Walnut
Bench	Walnut	Walnut
Pedal Frame	Walnut	Walnut

NOTE: Color of Walnut finish shall conform with approved sample No. 2-piece No. 2 for the Catholic Organ and approved sample No. 1-piece No. 4 for the Protestant Organ.

C. The organ builder shall submit his console design, including music rack, bench and pedalboard, in six copies to the Custodian for approval.

5. MANUAL KEYS

Compass C-C-61

A. Naturals: Covered with genuine Ivory, cut 10 to the inch.
B. Sharps: Ebony or Black Plastic
C. Touch: "Tracker Touch" from a top resistance of 4-1/2 oz. reducing to holding weight of 2 oz. at bottom of travel. The key dip or travel shall be "A scant 3/8 inch".
D. Organ builder shall submit a working model for approval
Model shall be of no less than three keys -- two naturals and one sharp between
Model shall also include key contacts and one complete piston assembly.

E. End Blocks, Key Slips and Tablet Board to be Walnut.

F. Manual keyboards shall be hinged at back

6. PEDAL KEYS

Compass C-G-32 Standard AGO

A. Naturals: Hard Rock Maple
B. Sharps: Ebony or Black Plastic
C. Key Dip: 1/2" at Natural playing point

7. STOP TABLETS

A. Stop Key Type set at 32 degree angle.
B. Movement of Tablets (by other than manual operation) shall be by electro-magnetic force. The organ builder shall provide a working model of no less than three complete tablet mechanisms for approval.

8. MANUAL PISTONS

A. The mechanical design shall permit a travel of 5/16 inch between fixed points, without jamming the contacts of closing the spring coil.

8. MANUEL PISTONS - Contd.

B. Spring action to require 6 oz. pressure.
C. Contact point at 3/16 inch.

9. PEDAL TOE STUDS

A. The mechanical design shall permit a travel of 5/16 inch between fixed points, without jamming the contacts or closing the spring coils.

B. Contact point at 3/16 inch.

10. SWELL AND CRESCENDO PEDALS

A. Pedals shall be hardwood, covered with ribbed rubber or soft plastic.

B. The mechanical design of the friction device shall produce an even resistance for the full movement without "gripping". Friction device shall be adjustable.

11. TRANSPARENT PLASTIC MUSIC RACK

See Fig. #13, Sheet #C-6

12. STOP TABLET AND PISTON CONTACTS

May be either round silver wires or flat strip silver, against either silver or phosphor bronze tangents.

13. ELECTRICAL CONTACTS

A. The following electrical contacts shall employ the system of a straight-edged plate or tangent, crossing a group of round contact wires set level and parallel to the edge of the plate.

B. The striking edge of the tangent shall be rounded and polished; free from all tool and abrasive marks. Thickness of plates shall be no less than .025 inch or, the tangent may be a round wire of no less than .025 gauge.

C. Tangents and/or contact wires shall be Grade A Phosphor Bronze or Sterling Silver (0.925 silver, plus 0.075 copper).

D. The usual practice is to use Phosphor Bronze tangents against silver wires, and this combination is preferred and to be used wherever possible. In certain instances, the organ builder may use silver against silver. In no instance, however, shall phosphor bronze be used against phosphor bronze.

E. Wires are to be fixed in contact blocks; wires shall project no more than 1/2" from end of contact blocks.

14. MANUAL KEY CONTACTS

A. Contact Wires shall be at the front end of the keys.

B. Gauge of wire to be no less than .014 inch.

C. Tangents shall be screwed to the underside of the keys and made adjustable. Tangents shall be gauge no less than .025 inch. The contact point to be at 3/16 inch down, or approximately 1/2 the travel of the key.

15. PEDAL KEY CONTACTS

A. Contact Wires: Located at the midpoint in the length of the keys.
B. Gauge of Wire: No less than .020 inch.
C. Tangents: Screwed to underside of keys and made adjustable
D. Gauge of Tangent Metal: No less than .025 inch
E. The contact point to be at 1/2 the travel of the key.

16. RELAYS

A. Specified for the Protestant Chapel Organ are Four "High Speed Electro-pneumatic Relays". Organ builder shall submit his design for approval, in six copies and one reproducible to Contracting Office of USAFA.

B. Tangents: Screwed to top of power pneumatics

C. Gauge of Tangent Metal: No less than .025 inch.

D. Wires: No less than gauge .014 inch.

17. OFFSET CONTACTS

A. 16' Lieblich Gedackt 1-32 SWELL Protestant Chapel Organ to play through Switches and Pneumatic Relays.

18. OTHER CONTACTS

A. Coupler and Stop Switches
(1) Shall be pneumatic motor type, placed in the organs
(2) Wire contacts: Silver not less than .014 inch.
(3) Junction Strips: Phosphor Bronze

B. Stop Tablet Contacts
(1) 0.925 Silver against Silver or Silver against Phosphor Bronze, Grade A. May be strip or wire.

C. Remote Control Combination Action
(1) Same as Stoptablet Contacts
(2) Organ builder shall submit design of his action for approval, together with a list of installations wherein this action is used and available for inspection.

D. Pedal Relay -- Catholic Chapel Organ
(1) May be either magnetic action, like or similar to the Reisner Relay Magnet No. C-5-B; or Electro-Pneumatic, same as above Item #16.

19. CABLES

A. All Electric Cables from console to organ and from organ to Basement Room #104 shall be the machine-made type as generally used in U.S.A. Organ building, such as supplied by Philadelphia Insulated Wire Company to meet conditions of National Board of Fire Underwriters. Each conductor shall be no less than gauge #24.

B. The cables from one part of the organ to another and not going between points above designated, may be hand-made; using individual double cotton covered and paraffined copper conductors, with the aggregate wound with Electrical Tape; Minnesota Mining and Manufacturing Company No. 33 or equal.

19. CABLES (Cont'd.)

C. Feed and Return wires shall not be included in the individual cables, from console to organ to Room #104, but may be run in the conduits, along with the cables.

D. For the purpose of minimizing the possibility of interference with broadcasting or recording equipment, the following material precautions are to be provided and installed by the organ builder:

(1) The cables, including the feed and return wires, from console to organ, and organ to Room #104, shall be individually encased in braided tinned copper shields. These shields shall be continuous from end to end of the conduits and soldered together at the ends for grounding as subsequently outlined.

(2) At the console end, a #12 stranded and insulated copper wire shall be soldered to the shield and run to the organ and through the conduit. #12 wire may be either inside or outside of the shield.

(3) At the organ end of the cable, from organ to Room #104, a #12 stranded and insulated copper wire is likewise attached to the shield and run to the cable end in Room #104.

(4) In the organ, the two #12 wires are to be joined with wire of the same Particulars.

(5) In the organ, the two shield ends are to be joined by a #12 stranded and insulated copper wire.

(6) In Room #104, the #12 wire, starting at the console, shall be continued and grounded to the 1/4" copper water feed pipe.

(7) In Room #104, a #12 wire shall be soldered to the braided copper shield and grounded to the 1/4" copper water supply pipe.

(8) The above prescribed shielding applies to both the Catholic Chapel Organ and the Protestant Chapel Organ. This, four (4) ground wires are to be attached to the 1/4" copper water supply pipe; grounding the major cabling of both organs.

(9) SPECIAL NOTE: In attaching the #12 wire to the shield, the wire shall be wrapped bare around the shield no less than three (3) times and well soldered to all strands of the shield. Likewise, the splicing of the shield within the conduits (if necessary) shall be done so that all strands of the joining ends are well soldered together.

20. THE WINDCHESTS

A. The windchests shall be of two types and designed to work on three inch (3") wind pressure.

(1) The pitman action
(2) The unit action

20. THE WINDCHESTS (Cont'd.)

B. The key action of the Pitman Chests shall incorporate an inside valve primary station. No windchest shall have over six (6) stops per station. Details of construction shall be submitted for approval.

C. The Unit or individual magnet chests shall have primaries throughout.

D. All borings of the windchests shall be sealed by soaking in shellac.

E. All Unit chests and the key actions of all Pitman Chests shall be covered with heavy mufflers. See Figs. #7, 8, 9, on Sheet #C-4. Mufflers must fit tightly to action boards. To relieve air pressure, one or more soft rubber hoses of not less than 6" length are to be installed.

F. The pipe hole borings of the windchests shall be of generous size to assure a full flush of wind to the pipes. See Fig. #12, Sheet #C-4.

G. The organ builder shall furnish proof that his chest mechanisms work perfectly on three inch (3") wind pressure.

H. From front to back the order of the stops of the Pitman Chests is as follows:

(1) Catholic Chapel Organ:
Great, Swell and Positiv: as shown on Sheet #c-1

(2) Protestant Chapel Organ:

	LOWER PEDAL
2'	Rohrgedackt
5R	Mixture
4'	Nachthorn
8'	Gedackt
4'	Schalmey

	UPPER PEDAL
3R	Mixture
4'	Choralbass
5-1/3'	Quinte
8'	Octave
8'	Trumpet

	LOWER SWELL
4'	Rohrschalmey
4R	Plein Jeu
8'	Rohrflöte
16'	Lieblich Gedackt (32 off)
2'	Doublette
4'	Octave Geigen
1-1/3'	Quinte
8'	Oboe

	UPPER SWELL
16'	Dulzian (Duplex 1-32)
8'	Flauto Dolce
8'	Flute Celeste
8'	Gambe Celeste
4'	Bourdon
8'	Gembe
8'	Principal
8'	Trumpet

	LOWER POSITIV
2R	Cymbal
2'	Bleckflöte
2-2/3'	Nazard
4'	Rohrflöte
8'	Copula
8'	Cremorne

	UPPER POSITIV
3R	Fourniture
1'	Piccolo
1-3/5'	Tierce
2'	Octava
4'	Praestant
8'	Gemshorn
16'	Rankett

20. THE WINDCHESTS (Cont'd.)

H. (Cont'd.)

	LOWER GREAT		UPPER GREAT
4R	Mixture	3R	Scharf
2'	Waldflöte	2'	Super Octave
2-2/3'	Quinte	4'	Octave
4'	Spitzflöte	8'	Flute
8'	Quintflöte	8'	Principal
8'	Gedackt	8'	Trumpet
4'	Clarion	16'	Fagott (Duplex 1-32)

NOTE: The organ builder may request a change in the order listed above to suit his chest construction.

21. BELLOWS AND WIND SUPPLY

A. Great care must be exercised to obtain the maximum possible wind steadiness. To this end, a number of double-fold bellows are specified. Wind ducts have also been doubled up and arranged to connect various chests. It being a recognized fact in organ building circles that wind steadiness cannot be entirely predetermined, it may be necessary to fit a number of concussion bellows to the organs and otherwise to work to steady the wind.

B. The organ builder shall agree to resolve the wind steadiness problem to the satisfaction of the USAFA, and at his own expense. It is understood and mutually agreed that the test for wind steadiness shall be the playing of legitimate organ music without precipitating a serious sag or shake. Correcting the wind steadiness is construed as being a part of the final on-the-job finishing process.

22. WIND DUCTS

A. The USAFA shall furnish and install metal ducts from the basement (Room #104) to the organ spaces as shown on Sheets #B-1, C-5, P-3. The organ builder shall make the connections from these ducts to the organ parts. See also Sheets #C-2 and P-7.

B. All major wind ducts shall be plywood trunks or round galvanized iron ducts. Minor wind ducts may be "Flexaust" or equal.

C. Plywood Trunks shall be constructed of 3/4" stock with flexible joints at strategic spots, as necessary.

D. Galvanized iron ducts shall be:

No less than gauge #24 for 18" diameter
#24 for 12" diameter
#26 for 10" diameter
#26 for 8" diameter
#26 for 6" diameter
#30 for 4" diameter

22. WIND DUCTS (Cont'd.)

E. All metal ducts shall terminate in wooden collars of no less than 3/4" thickness, packed with Sealskin. Duct end to be swedged out on the underside of the collar in a properly prepared chamfer.

F. Flexible fabric ducts shall terminate over round galvanized iron nipples set in wooden collars.

G. Where a duct is greater in diameter than the terminating organ part will permit, short rectangular wooden wind trunks shall be interposed. Inside dimensions of trunks always slightly greater in square inches than the round duct.

23. WIND TIGHTNESS

A. It is most disagreeable to have to listen to wind leaks in an organ. Care must be taken throughout the organs to eliminate leaks.

B. Steel Expansion Springs, placed between steel washers, shall be used under screw heads on all bungs and collars or wherever removable wind fittings occur.

24. TREMOLOS

A. The Tremolos shall be the Bellows Type with separate regulation for speed and intensity. Completely around each Tremolo and insulated from the floor or other support, shall be a heavy muffler. Exhaust from this enclosing box shall be through a sound trap of a size great enough to cause no interference with the working of the Tremolo.

B. Should it be necessary in accordance with Item #24-A above, to install one or more concussion bellows to the Swell, each such concussion bellows shall be fitted with a cutout.

C. The regulation of the Tremolos to produce a satisfactory result, may require alteration on-the-job in the size, length, and position of the wind connections. The organ-builder must make the necessary adjustments or alterations.

25. BELLOWS VALVES

A. Bellows valves shall be the rolling-curtain type.

B. Bellows weights shall be used on all horizontally placed bellows. Springs shall be used only on bellows placed vertically. On occasion, it may be found necessary or advisable to use a combination of weights and springs to achieve desired results. The organ builder shall make such corrections on-the-job.

C. A wind pressure of three inches (3") is specified for all pipes of both organs.

26. SHUTTERS AND SWELL MOTORS

A. Perfectly fitted Shutters (See Fig. #6, Sheet #C-4) of lightweight, with bearings of minimum friction actuated by Swell Motors designed to respond quickly on a wind pressure of no more than five inches (5") is the combination of forces to which the organ builder shall apply himself.

B. The Catholic Chapel Organ Swell Shutters shall be moved by two (2) swell motors of no less than five (5) stages each; one motor to each swell shutter frame.

C. The Protestant Chapel Organ Swell Shutters shall be moved by four (4) Swell motors of no less than five (5) stages each; one motor to each swell shutter frame.

D. Counteracting coil springs shall be as per the following particulars and installed in groups of two or more to achieve the desired counteraction.

(1) Outside Diameter: 1/2"
(2) Length of Spring: 12"
(3) Material: .040" Music Wire

E. The organ builder's attention is called to the possible use of counter weights in conjunction with springs or alone, to achieve a fine adjustment.

27. LUMBER

A. The softwood lumber to be used in the construction of the organs shall be No. 1 and 2 Clear California Sugar Pine, Kiln-dried to 10% moisture content and with proper care taken to relieve case hardening.

B. The hardwood lumber shall be Birch or Maple, kiln-dried to a 6 to 8% moisture content and with proper care taken to relieve case hardening.

C. Where the organ builder has developed standard practices, using lumber of other varieties, he shall so state in detail and apply for approval thereon.

28. PLYWOOD

A. Plywood shall be Uniform Light Birch on a Fir core, Grade A-2. (Select Front and Solid Back)

B. Adhesive shall be Type 2 Interior Glue, meeting C S 35-56 standard.

C. 3/4" Plywood shall be 7 ply.

29. MAGNETS

A. All magnets shall be placed in the vertical position with the pneumatic-valve-armature at the bottom. Certain exceptions to this condition are tolerable and the organ builder must receive approval thereon in advance.

B. Armature of all magnets shall be round, free-floating discs.

C. Magnet cap shall be removable and incorporate a dirt trap.

D. Magnets shall be wound for no less than 150 ohms resistance at 10 volts, D.C.

30. LEATHER

A. All pouches and pneumatics shall be covered with the best available grade of English or German lamb skin, using hot animal glue as adhesive.

B. Alum Tanned Sheepskin shall be used for covering all bellows, with hinges reinforced with a stout woven fabric.

C. Pipe hole and primary valves shall be covered with soft alum tanned valve leather.

31. WOOD PIPES

A. Wood pipes shall be made of clear stock Sugar Pine, fitted with hard wood block-fronts and caps.

B. Stopper Handles of all visible wood pipes shall be round, straight, hardwood dowels, graduated in diameter as follows:

16'	SUBBASS
4@	1-3/4"
4@	1-1/2"
4@	1-1/4"
4@	1-1/8"
4@	1"
4@	7/8"
4@	3/4"
4@	5/8"

8'	COPULA
8@	1"
8@	7/8"
8@	3/4"
7@	5/8"
7@	1/2"
7@	3/8"
4@	5/16"

C. Pipe Feet diameters shall be as follows:

16'	SUBBASS
1-3	@ 2"
4-6	@ 1-3/4"
7-9	@ 1-1/2"
10-12	@ 1-1/4"
13-16	@ 1" Gated
17-20	@ 1" Metal Toe
21-24	@ 7/8"
25-28	@ 3/4"
29-32	@ 5/8"

8'	COPULA
1-4	@ 7/8"
5-10	@ 3/4"
11-16	@ 5/8"
17-24	@ 1/2"
25-32	@ 7/16"
33-40	@ 3/8"
41-49	@ 5/16"

31. WOOD PIPES (Cont'd.)

D. Following the voicing of the wood pipes, the organ builder shall trim the over length of the pipes; and, if necessary, the stopper handles to a nice graduation from bass to treble to remove unsightly length inequalities.

E. To preserve a nice length contour, the organ builder is cautioned to also graduate carefully the chest top countersinkages and the proportions of the ends of the pipes at the blocks.

32. METAL PIPES

A. Spotted Metal (termed "Spotted" in the stoplist) shall be a composition of 50% Pure Tin and 50% Pure Lead.

B. Tin Metal (termed "Tin" in the stoplist) shall be a composition of 75% Pure Tin and 25% Pure Lead.

NOTE: Both "Spotted" and "Tin" shall be cast in sheets in the time-honored organ builders way.

C. Zinc Metal (termed "Zinc" in the stoplist) shall be 99% Pure Zinc, rolled in sheets and annealed. Care must be exercised to avoid annealing the zinc too far. Pipe makers as a class of men are inclined to anneal zinc too far, to the detriment of the tone of the pipe. The degree of hardness desired cannot be stated definitively except to say that the metal shall be as hard as can be conveniently formed for each particular application.

D. Copper Metal (termed "Copper" in the stoplist) shall be 99% Pure Copper.

E. All the open metal Flue Pipes of the organs shall be cut "dead length", -- that is, unslotted. The dimension difference between the trimmed physical length of the pipe and the tuning length, as fixed by the sleeve tuner, shall in all cases be held to a minimum, consistent with the needs of final, on-the-job tuning. The organ builder is advised to graduate this difference from 2" @ 16' to 1/32" @ 1/16' C.

F. Foot lengths of stops of metal Flue Pipes shall be evenly graduated from bass to treble so that no abrupt differences occur to spoil the natural contour of the silhouette of the stop. See Fig. #5, Sheet #P-10.

G. All the metal flue pipes of the organs shall be fitted with sleeve tuners carefully rounded to conform to the pipes. These tuners shall be measured out so as to leave a slight gap or opening at the back, about the width of the solder joint of the seam of the pipe body. Length of tuners shall be graduated evenly from bass to treble. Material of the tuners shall be sheet aluminum or tinplate; to the organ builder's choice. Tuners of large pipes shall be fitted with coil springs to maintain a snug fit. See Fig. #1 on Sheet #P-10.
The gripping tension of the tuners, whether established by the spring of the metal or by applied coil springs, shall not be so great as to tend to crimp at the end of the pipes.

H. The lengths of the Spotted mouth sections of those pipes calling for zinc or copper tubs shall be longer than the flat of the upper lip by varying amounts proportioned to the diameters and lengths of the pipes. To look well, an open pipe requires a longer mouth section in "Spotted" than does a Gedackt of the same diameter. The organ builder shall draw out four (4) examples for approval: one large and one small diameter open stop, and one large and one small diameter Gedackt.

32. METAL PIPES (Cont'd.)

I. The Caps of Metal Gedackts shall be packed with thin black felt of firm texture. On the inside of the caps, the felt is to extend to a point no less than one-half the length of the cap.

33. THE REEDS

A. See Figs. #2, 3, 4, of Sheet #P-10 for schedule of lengths of sockets to be soldered to the blocks of the reeds to receive the tips of the bodies.

B. The boots of all reeds shall be constructed of wood or of spotted metal. Zinc Boots are not acceptable.

C. The bodies of Zinc and Copper reeds shall have Spotted Metal inserts for roll tuners.

D. The escallots of reeds shall not be leathered.

E. All Reeds, as stated below, shall have a stout socket or sleeve soldered to the block to receive the tip of the reed body. These sleeves shall be made of Spotted Metal, except for 32 Bombarde which shall be Zinc, and, in their interior form, fit perfectly the exterior form of the tips of the reed bodies. The bodies shall not be soldered directly to the blocks.

(1) Catholic Chapel Organ

16'	Fagott	1-32
8'	Trumpet	1-36
8'	Cromorne	All Tapered tips to C-37
4'	Oboe Clarion	1-24
8'	Schalmey	1-36

(2) Protestant Chapel Organ

32'	Bombarde	1-32
16'	Posaune	1-32
16'	Fagott	1-48
16'	Dulzian	All Tapered tips to C-49
16'	Rankett	Depending on organ builder's pattern
16'	Trompetas	1-48
8'	Trumpet	1-36
4'	Schalmey	1-24
4'	Clarion	1-24
8'	Oboe	1-36
4'	Rohrschalmey	Depending on organ builder's pattern
8'	Cromorne	All tapered tips to C-37

34. PIPE SUPPORTS

A. Other than the normal rackboards of the chests, pipe supports are to be used as follows:

32'	Bombarde	1-32
16'	Posaune	1-32
16'	Fagott	1-32 Pedal
16'	Fagott	1-49 Manual
16'	Dulzian	1-32
16'	Rankett	Depending on construction and length

34. PIPE SUPPORTS (Cont'd.)

16'	Trompetas	As shown on Sheet #P-4
8'	Trumpet	1-37
8'	Oboe	1-37
8'	Cromorne	1-25
8'	Schalmey	1-25
4'	Clarion	1-25
4'	Schalmey	1-18
4'	Rohrschalmey	1-12
16'	Principal	1-25
16'	Quintadena	1-19
8'	Grossoctav	1-14
8'	Octav	1-17
8'	Principal	1-12
8'	Gambe	1-12
8'	Flauto Dolce	1-12
8'	Gemshorn	1-12
8'	Dulciana	1-12
8'	Metal Gedackts	1-7 & 1-8
16'	Subbass	1-32
16'	Lieblich Gedackt	1-32
8'	Wood Gedackts	1-7, 1-12 & 1-19

B. The system of racking for the above shall be by metal loops (Zinc, Copper, Spotted) soldered to the pipe bodies and fitted over pins in the racks. Each of the large diameter pipe to have two loops and pins. Tying of pipes with tapes is not acceptable.

C. Wood pipes may use metal or wooden hooks. Hooks shall fit into grooves on the back of racks or over pins set in the racks.

D. Racks of visible stops shall be so arranged and located as to be concealed among the pipes to as great a degree as possible. The horizontal upper boards, in which the pins are secured, shall be maple or birch dieboard or similar crossbanded stock of heavy plys, for maximum strength at minimum thickness. Vertical struts shall be round metal tubing wherever possible.

35. SCALING OF PIPES

A. The organ builder shall submit his scaling and details of construction of all stops of the organ for approval.

B. Since the dimensions and the graduations of scales, stated in the American system or numbers, varies somewhat in every pipe shop and would therefore not be definitive, the organ builder shall, in presenting his scales, adopt and use Tabelle 3 (Durchmessermensur förLabialpfeifen in MM) shown in the textbook (Page 14) DIE ORGELREGISTER, IHRE GESCHICHTE UND IHR BAU by Christhard Mahrenholz.

C. On request by USAFA, the organ builder shall provide selected voiced sample pipes (including Reeds) for approval.

36. THE CASEWORK

A. Catholic Chapel

(1) The casework of the Catholic-Chapel organ shall consist of : (1) 3/4" plywood cover for Positiv, around four (4) sides. An entrance door shall be cut on the back as shown on Sheet #C-1. Door to swing on a continuous hinge, in length to the full height of the door.

(2) 3/4" plywood cover for Quintadena-Octave chest, around four (4) sides.

(3) 3/4" plywood cover for Gedackt-Choralbass chest, around four (4) sides.

(4) 3/4" plywood cover for Mixture-Quintadena treble chest, around four (4) sides.

(5) One side of the covers for Items #2, 3, 4 above, shall be made removable for access to chests.

(6) All of the above casework shall be of 3/4" Walnut plywood, edged with solid Walnut.

(7) The Positiv bellows (#4) shall remain uncovered by casework and reveal its working to the onlooker. In appearance it shall harmonise with the adjacent casework.

(8) 1/4" Transparent Plastic Shield (See Sheet #C-3) over the end of the Positiv, to a height of 2'-10", two returns to a length of 1'-6" and height of 1'-0".

B. Protestant Chapel

(1) The casework of the Protestant Chapel organ shall consist of: (1) 3/4" plywood cover for the lower Pedal Chest, around four (4) sides and over the bottom.

(2) 3/4" plywood cover for the upper Pedal Chest, around three (3) sides and over the bottom.

(3) Same as Item #1 above, for the lower Positiv.

(4) Same as Item #2 above, for the upper Positiv.

(5) 3/4" plywood cover for the lower Great Chest, around three (3) sides and over a portion of the bottom as shown on Sheets #P-2 and #P-8.

(6) Same as Item #5 above, for the upper Great, except that soffit shall extend over the entire bottom of the chest.

(7) All of the above casework shall be of 3/4" Walnut plywood, edged with solid Walnut.

37. FINISHES

A. CASEWORK and all other VISIBLE wooden parts of both organs (except pipes) shall be of a Walnut finish. This finish shall be applied in a professional manner and be acceptable to the Custodian. Color of Walnut finish shall conform with approved sample No. 2 - Piece No. 2 for the Catholic Organ and approved sample No. 1 - Piece No. 4 for the Protestant Organ.

37. FINISHES (Cont'd.)

B. INVISIBLE wooden parts of both organs: Lacquer Finish. Use Lacquer conforming to Federal Specifications TT-L-58.

(1) Stain as necessary to harmonize with exposed woodwork.

(2) One coat Lacquer sealer as recommended by the lacquer manufacturer for use with the lacquer to be used.

(3) Two coats clear lacquer.

(4) Rub with steel wool, if necessary, to conform to adjoining woodwork.

SPECIAL NOTE: Small stock-parts, if invisible, may be finished in organ builder's regular way.

C. METAL, except speaking pipes:
Same as (B above) using first a metal cleaner as recommended by the lacquer manufacturer for use with the lacquer to be used.

D. FLEXIBLE AIRDUCTS:
All flexible wind conductors are concealed and are supplied in natural black rubber finish.

E. Spotted, Tin and Copper Pipes: Natural - Paladin #3200 Clear Lacquer.

F. ZINC:
All Zinc pipes shall be finished according to the following procedure:

(1) Wash pipes with Paladin #75 lacquer thinner and leave dry thoroughly.

(2) Apply coat of clear Paladin consisting of 3 parts Paladin #3200 clear lacquer and 1 part Paladin #75 lacquer thinner.

(3) Apply mist coat of the following lacquer and color mixture:
Mix 2-1/2 Gal. Paladin #3200 Clear Lacquer and 2-1/2 Gal. Paladin #75 Lacquer Thinner. Add color, etc., as follows:
12 oz. (avdp.) Baer Bros. #325 Fine Mesh aluminum Lining Powder.
3 pts. Paladin #13154 Gray Lacquer, 1/2 Pt. Nason #5215 Burnt Umber lacquer Tinting Color
Mix thoroughly.

G. WOOD PIPES
One coat of water-white sealer and two coats of water-white Flat Lacquer; sanding between coats.

NOTE: In all of the foregoing finishes, the organ builder shall exercise caution to use no more material than is absolutely necessary to achieve the desired effect. This caution is of utmost importance in determining the amount of Aluminum Paste to be used on zinc pipes. The zinc, as metal, is to shine through. The purpose of the coating is to protect the metal against finger marks and to even-out discolorations in the zinc.

H. CONSOLE CABINET - BENCH - PEDALBOARD.

1. Catholic Organ

Apply three coats of boiled linseed oil, thinned 50/50 with turpentine.

NOTE: After each coating let stand for one hour and rub off unabsorbed oil with steel wool.
Let dry 24 hours before applying next coat.
24 hours after applying last coat, rub briskly with a cloth.

2. Protestant Organ

a. Bleach Walnut with Glidden Co. wood bleach and leave dry six hours.

b. Sand lightly with 7/0 sandpaper.

c. Apply coat of Mahogany stain mixture (see below) and leave dry.

d. Apply coat of Glidden Co. Lacquer Sealer.

e. Sand lightly with 7/0 sandpaper.

f. Apply coat of Glidden Co. Clear Gloss Lacquer.

g. Apply coat of Glidden Co. Dead Flat Lacquer.

Mahogany stain mixing procedure.

Mix thoroughly:

1 oz.	H. Behlen Bro. #127 Mahogany Stain Powder
1/2 oz.	H. Behlen Bro. #102 Mahogany Stain Powder
10 dwt.	H. Behlen Bro. #18 Silver Gray
2 dwt.	H. Behlen Bro. #94 Lemon Yellow Stain Powder
4 Gal.	Hot water.

NOTE: The organ builder shall submit two samples of all finishes for approval to the Custodian; one to be returned with approval and the other to be kept on file by the Custodian. Wood samples shall be submitted in size 9" x 9". Wood samples shall include all varieties of wood to be used.

PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 1

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
				GREAT ORGAN			
Quintadena	16'	61					3"
#1			40	19-1/2	2/9	1-12 Zinc	
#13			56	19-1/2	2/9	13-61 Spotted metal	
#25			68	19-1/2	2/9	13-18 Zinc Tubs	
#37			80	19-1/2	2/9	1-61 Capped	
#49			92	19-1/2	2/9		
#61			104	19-1/2	2/9		
Principal	8'	61					3"
#1			46	18-1/2	2/9	1-17 Zinc Tubs	
#13			58	18-1/2	2/9	Spotted Metal	
#25			70	18-1/2	2/9		
#37			84	19-1/2	2/9		
#49			96	19-1/2	2/9		
#61			108	19-1/2	2/9		
Flute	8'	61				3½x4½" ID (Large Stopped Bass)	3"
#1			X-Large Stopped Bass 1-12			CC ~~4-1/8" x 5-3/8" I.D.~~	
#13			#3 Gross Flute			C 3 5/16 x 4 5/8" ID	
#25			#3 Gross Flute			C# 2 1/32 x 2 9/16" ID	
#37			#3 Gross Flute			C## 1 7/8 x 1 19/32" ID	
#49			#3 Gross Flute			C### 3/4" x 1" ID	
#50			89 Sc	18-1/2	2/9	Wood 1-12 Gedackt 13-49 Open Wood	
#61			100 Sc	18-1/2	2/9	50-61 Spotted metal	
Gedeckt	8'	61					3"
#1			54	21-1/2	2/9	1-17 Zinc Tubs	
#13			66	21-1/2	2/9	Spotted Metal	
#25			78	21-1/2	2/9	1-49 Capped	
#37			90	21-1/2	2/9	50-61 Open	
#49			102	21-1/2	2/9		
#50			99	21-1/2	2/9		
#61			110	21-1/2	2/9		

PITCH A-440

COMPLETION 24 months

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PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 2

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			GREAT ORGAN (Cont'd.)				
Quintflöte	8'	61					3"
#1			58	20-1/2	1/5	1-17 Zinc Tubs	
#13			70	20-1/2	1/5	Spotted Metal	
#25			82	20-1/2	1/5	1-49 Capped	
#37			94	20-1/2	1/5	50-61 Open	
#49			106	20-1/2	1/5		
#50			104	20-1/2	1/5		
#61			115	20-1/2	1/5		
Octave	4'	61					3"
#1			~~57~~ 58	~~18~~ 18-1/2	1/4	1-5 Zinc Tubs	
#13			~~69~~ 70	~~18~~ 18-1/2	1/4	Spotted Metal	
#25			~~81~~ 82	~~18~~ 18-1/2	1/4		
#37			~~103~~ 94	~~18~~ ~~21~~ 18-1/2	1/4		
#49			~~115~~ 106	~~18~~ ~~20~~ 18-1/2	1/4		
#61			~~127~~ 118	~~18~~ ~~20~~ 18-1/2	1/4		
Spitzflöte	4'	61					3"
#1			58-2/3	19-1/2	2/9	Taper 1/3-0 #1 to #37	
#13			70	19-1/2	2/9	1-5 Zinc Tubs	
#25			82	19-1/2	2/9	Spotted Metal	
#37			94	19-1/2	2/9		
#49			106	19-1/2	2/9		
#50			114	21-1/2	2/9		
#61			125	21-1/2	2/9		
Quinte	2-2/3'	61					3"
#1			67-2/3	18-1/2	2/9	Taper 1/3-0 #1 to #24	
#13			79	18-1/2	2/9	Spotted Metal	
#25			91	18-1/2	2/9		
#37			103	18-1/2	2/9		
#49			115	18-1/2	2/9		
#61			127	18-1/2	2/9		

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PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			GREAT ORGAN (Cont'd.)				
Super Octave	2'	61					3"
#1			71	18-1/2	1/4	Spotted Metal	
#13			83	18-1/2	1/4		
#25			95	18-1/2	1/4		
#37			107	18-1/2	1/4		
#49			119	18-1/2	1/4		
#61			131	18-1/2	1/4		
Waldflöte	2'	61					3"
#1			70	20-1/2	1/5	Spotted Metal	
#13			82	20-1/2	1/5		
#25			94	20-1/2	1/5		
#37			96	17-1/2	1/5		
#49			108	17-1/2	1/5		
#61			120	17-1/2	1/5		
Mixture	V Rks.	305					3"
#1 Rk. I	1-1/3'		81	17-1/2	1/4	Refer to Mixture	
#1 Rk. II	1'		86	17-1/2	1/4	formula attached	
#1 Rk. III	2/3'		93	17-1/2	1/4	for breaks and	
#1 Rk. IV	1/2'		98	17-1/2	1/4	scales	
#1 Rk. V	1/3'		105	17-1/2	1/4	Tin	
Scharf	III Rks.	183					3"
#1 Rk. I	1/2'		100	17-1/2	1/4	Refer to Mixture	
#1 Rk. II	1/3'		107	17-1/2	1/4	formula attached	
#1 Rk. III	1/4'		112	17-1/2	1/4	for breaks and scales Tin	
Fagott	16'	61	4"				3"
						B (1/8) Eschallots Straight Taper Tpt. Pattern. 1-36 Zinc Spotted Metal tuners 37 up Spotted Metal. 1-61 Reeds.	
Trumpet	8'	73	3-1/2"				3"
						Reg. C(1/8) Eschallots 1-49 Reeds. 1-24 Zinc Spotted Metal tuners. 25 up Spotted Metal. 50-61 Double Flues.	
#50			92	17-1/2	1/4		

PITCH

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ORGAN NO. 9480

DATE September 1, 1961 (Revised)
February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 4

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			GREAT ORGAN (Cont'd.)				
Clarion	4'	85	2-1/2"				3"
#38			94	17-1/2	1/4	42-1/2. D(1/8) Eschallots 1-37 Reeds. Spotted Metal 38-61 Double Flues	
			SWELL ORGAN				
Lieblich Gedackt	16'	61					3"
#1			5" x 5-13/16" I.D.			1-49 wood	
#13			2-5/8" x 3-5/16" I.D.			50-61 Spotted Metal	
#25			1-13/16" x 2-3/8" I.D.			50-61 Capped	
#37			1-5/16" x 1-3/4" I.D.				
#49			7/8" x 1-3/16" I.D.				
#50			93	20-1/2	2/9		
#61			104	20-1/2	2/9		
Principal	8'	61					3"
#1			47	17-1/2	2/9	1-17 Zinc Tubs	
#13			59	17-1/2	2/9	Spotted Metal	
#25			71	17-1/2	2/9		
#37			83	17-1/2	2/9		
#49			95	17-1/2	2/9		
#61			107	17-1/2	2/9		
Chimney Flute	8'	61					3"
#1			3-1/2" x 4-1/2" I.D.			1-49 Wood Pierced	
#13			2-5/16" x 3-1/8" I.D.			Stoppers. 50-61 Open	
#25			1-1/2" x 2-1/16" I.D.			Spotted Metal. Stoppers	
#37			15/16" x 1-5/16" I.D.			to be made of round	
#49			5/8" x 15/16" I.D.			dowel as per specifications	
#50			98	21-1/2	2/9	Large Stopped Diapason	
#61			109	21-1/2	2/9		
Gambe	8'	61					3"
#1			55	18-1/2	2/9	1-15 Zinc Tubs	
#13			67	18-1/2	2/9	Spotted Metal	
#25			79	18-1/2	2/9	No Slots	
#37			91	18-1/2	2/9		
#49			103	18-1/2	2/9		
#61			115	18-1/2	2/9		

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Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			SWELL ORGAN (Cont'd.)				
Voix Celeste FF	8'	56					3"
#6			62	18-1/2	2/9	#6 to #15 Zinc Tubs	
#13			69	18-1/2	2/9	Spotted Metal	
#25			81	18-1/2	2/9	No Slots	
#37			93	18-1/2	2/9		
#49			105	18-1/2	2/9		
#61			117	18-1/2	2/9		
Flauto Dolce	8'	61					3"
#1			56-2/3	19-1/2	1/5	Taper 1/3-0 #1 to #48 inc.	
#13			68	19-1/2	1/5	#1-12 Zinc Tubs	
#25			80	19-1/2	1/5	Spotted Metal	
#37			92	19-1/2	1/5		
#49			104	19-1/2	1/5		
#61			116	19-1/2	1/5		
Flute Celeste FF	8'	56					3"
#6			63-2/3	19-1/2	1/5	Taper 1/3-0 #6 to #48 inc.	
#13			70	19-1/2	1/5	#6-12 Zinc Tubs	
#25			82	19-1/2	1/5	Spotted Metal	
#37			94	19-1/2	1/5		
#49			106	19-1/2	1/5		
#61			118	19-1/2	1/5		
Octave Geigen	4'	61					3"
#1			59	18-1/2	1/4	#1-5 Zinc Tubs	
#13			71	18-1/2	1/4	Spotted Metal	
#25			83	18-1/2	1/4		
#37			95	18-1/2	1/4		
#49			107	18-1/2	1/4		
#61			119	18-1/2	1/4		
Bourdon	4'	61					3"
#1			55	18-1/2	2/9	Spotted Metal	
#13			67	18-1/2	2/9	#1-37 Capped	
#25			79	18-1/2	2/9	#38-61 Open	
#37			91	18-1/2	2/9		
#38			89	18-1/2	2/9		
#49			100	18-1/2	2/9		
#61			112	18-1/2	2/9		

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PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1-1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

STOP		PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
				SWELL ORGAN (Cont'd.)				
Doublette		2'	61					3"
#1				72	18-1/2	2/9	Spotted Metal	
#12				84	18-1/2	2/9		
#25				96	18-1/2	2/9		
#37				108	18-1/2	2/9		
#49				120	18-1/2	2/9		
#61				132	18-1/2	2/9		
Quinte		1-1/3'	61					3"
#1				80	18-1/2	2/9	Spotted Metal	
#13				92	18-1/2	2/9		
#25				104	18-1/2	2/9		
#37				116	18-1/2	2/9		
#49				128	18-1/2	2/9		
#50				117	18-1/2	2/9		
#61				128	18-1/2	2/9		
Plein Jeu		IV Rks.	244					3"
Rk. I	#1	1'		86	17-1/2	1/4	See Mixture Formula	
	#13			98	17-1/2	1/4	attached for detailed	
	#25			110	17-1/2	1/4	scales and breaks	
	#37			122	17-1/2	1/4	Tin	
Rk. II	#1	2/3'		93	17-1/2	1/4		
	#13			105	17-1/2	1/4		
	#25			117	17-1/2	1/4		
Rk. III	#1	1/2'		98	17-1/2	1/4		
	#13			110	17-1/2	1/4		
Rk. IV	#1	1/3'		105	17-1/2	1/4		
Dulzian		16'	61					3"
				2"			B(1/8) Eschallots. 1-36 Zinc 37 up Spotted Metal. 61 Reeds Taper Tips 1-49	
Trumpet		8'	73					3"
				3"	Reg. Tpt.		C(F) Eschallots	
#50				92	17-1/2		1-24 Zinc. Spotted Metal tuners. 49 Reeds. 25 up Spotted Metal. 24 Flues (Double)	

PITCH

COMPLETION

COPIES TO:

PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 7

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			SWELL ORGAN (Cont'd.)				
Oboe	8'	61	3"			C(1/8) Eschallots Reg. Lifting Lid, Oboe pattern, 1-24 Zinc. Spotted metal tuners. #25 up Spotted metal. 49 Reeds 12 Flues.	3"
Rohrschalmey	4'	61	1-1/4"	Capped		D(F) Eschallots. Brass tube, Spotted metal tube. Moller standard capped lifting lid. 37 reeds 24 flues.	3"
			POSITIV ORGAN				
Copula	8'	56					3"
#1			3-1/2" x 4-1/2"	I.D.		1-49 Wood	
#13			2-5/16" x 3-1/8"	I.D.		50-56 Open Spotted Metal.	
#25			1-1/2" x 2-1/16"	I.D.			
#37			15/16" x 1-5/16"	I.D.			
#49			5/8" x 15/16"	I.D.			
#50			98	21-1/2	2/9		
#56			104	21-1/2	2/9		
Gemshorn	8'	56					3"
#1			50-1/2	17-1/2	2/9	Taper 1/2-0 #1 to #49 inc.	
#13			62	17-1/2	2/9	1-20 Zinc Tubs	
#25			74	17-1/2	2/9	Spotted Metal	
#37			86	17-1/2	2/9		
#49			98	17-1/2	2/9		
#56			105	17-1/2	2/9		
Principal	4'	56					3"
#1			58	19-1/2	2/9 1/4	1-20 Zinc Tubs	
#13			70	19-1/2	2/9 1/4	Spotted Metal.	
#25			82	19-1/2	2/9 1/4		
#37			94	19-1/2	2/9 1/4		
#49			106	19-1/2	2/9 1/4		
#56			113	19-1/2	2/9 1/4		

PITCH.....

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Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			POSITIV ORGAN (Cont'd.)				
Rohrflöte	4'	56					3"
#1			57	19-1/2	2/9	Outside Chimney	
#13			69	19-1/2	2/9	1-37, 38-56 open.	
#25			81	19-1/2	2/9	Spotted Metal.	
#37			93	19-1/2	2/9		
#38			91	19-1/2	2/9		
#49			102	19-1/2	2/9		
#61			109	19-1/2	2/9		
Nazard	2-2/3'	56					3"
#1			68-2/3	18-1/2	1/5	Taper 1/3-0 #1 to #24	
#13			80	18-1/2	1/5	Spotted Metal.	
#25			99	21-1/2	1/5		
#37			111	21-1/2	1/5		
#49			123	21-1/2	1/5		
#56			130	21-1/2	1/5		
Octava	2'	56					3"
#1			81	20-1/2	1/4	Tin	
#13			93	20-1/2	1/4		
#25			105	20-1/2	1/4		
#37			117	20-1/2	1/4		
#49			128	20-1/2	1/4)	graduate	
#56			131	20-1/2	1/4)		
Blockflöte	2'	56					3"
#1			74-3/4	20-1/2	1/5	Taper 1/4-0 #1 to #24 inc.	
#13			86	20-1/2	1/5	Spotted Metal.	
#25			98	20-1/2	1/5		
#37			110	20-1/2	1/5		
#49			122	20-1/2	1/5		
#56			128	20-1/2	1/5		
Tierce	1-3/5'	56					3"
#1			83-1/2	20-1/2	1/5	Taper 1/2-0 #1 to #24 inc.	
#13			95	20-1/2	1/5	Spotted Metal.	
#25			107	20-1/2	1/5		
#37			119	20-1/2	1/5		
#49			131	20-1/2	1/5		
#50			120	20-1/2	1/5		
#56			126	20-1/2	1/5		

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PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadel Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 9

STOP		PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
				POSITIV ORGAN (Cont'd.)				
Piccolo		1'	56					3"
#1				85	19-1/2	1/5	Spotted Metal	
#13				97	19-1/2	1/5		
#25				109	19-1/2	1/5		
#37				121	19-1/2	1/5		
#49				128	19-1/2	1/5)		
#50				117	19-1/2	1/5)	graduate	
#56				123	19-1/2	1/5)		
Fourniture		III Rks.	168					3"
Rk. I	#1	2/3'		93	17-1/2	1/4	See attached mixture	
Rk. II	#1	1/2'		98	17-1/2	1/4	formula for detailed	
Rk. III	#1	1/3'		105	17-1/2	1/4	scales and breaks. Tin	
Cymbal		II Rks.	112					3"
Rk. I	#1	1/4'		110	17-1/2	1/4	See attached mixture	
Rk. II	#1	1/6'		117	17-1/2	1/4	formula for detailed scales and breaks. Tin	
Rankett		16'	56					3"
				3"			C(1/8) Eschallots Scale and design to be developed. 56 reeds. 25 and up Spotted Metal. 1-24 Zinc.	
Cromorne		8'	56					3"
				3/4"			E(F) Eschallots. 49 Reeds, 7 flues. 1-18 copper. 50-56 Spotted Metal. Taper Tips 1-37	
Trompettas		16'	109					3"
#1				3-3/4"	1/2 length		E(F) Eschallots.	
#13				3-3/4"	Full length		1-48 Zinc. 49-61 Tin.	
#25				3"	Full Length		62-85 Double Flues Spotted Metal. 1-61 Reeds. 49-61 Harmonic & Hooded. No flare. All tuner inserts to be graduated.	

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ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			PEDAL ORGAN				
Principal	16'	32					3"
#1			30	17-1/2	1/4	1-15 Zinc	
#13			42	17-1/2	1/4	16-32 Spotted Metal	
#25			54	17-1/2	1/4	with Zinc Tubs.	
#32			61	17-1/2	1/4		
Subbass	16'	51					3"
#1			8-3/4" x 9-1/2"	I.D.		Large Pedal Bourdon scale	
#13			4-7/8" x 6-1/8"	I.D.		Wood & Spotted Metal.	
#25			2-1/4" x 3-3/8"	I.D.		#33-51 Capped.	
#32			1-3/4" x 2-5/8"	I.D.			
#33			62	17-1/2	2/9		
#37			66	17-1/2	2/9		
#49			78	17-1/2	2/9		
#51			80	17-1/2	2/9		
Gross Octave	8'	32					3"
#1			42	17-1/2	1/4	1-20 Zinc Tubs.	
#13			54	17-1/2	1/4	Spotted Metal.	
#25			66	17-1/2	1/4		
#32			73	17-1/2	1/4		
Octave	8'	32					3"
#1			42-2/3	17-1/2	2/9	Taper 1/3 1-32 inc.	
#13			54	17-1/2	2/9	1-18 Zinc Tubs.	
#25			66	17-1/2	2/9	Spotted Metal.	
#32			73	17-1/2	2/9		
Gedackt	8'	32					3"
#1			4-1/4" x 5-11/16"	I.D.		Wood.	
#13			2-3/8" x 3-1/2"	I.D.			
#25			1-3/16" x 1-7/8"	I.D.		Regular Pedal Bourdon Scale.	
#32			7/8" x 1-5/16"	I.D.			
Quinte	5-1/3'	32					3"
#1			51	17-1/2	2/9	1-12 Zinc Tubs.	
#13			63	17-1/2	2/9	Spotted Metal	
#25			75	17-1/2	2/9		
#32			82	17-1/2	2/9		

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COMPLETION

PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 11

STOP		PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
				PEDAL ORGAN (Cont'd.)				
Choralbass		4'	32					3"
#1				55-2/3	17-1/2	1/4	Taper 1/3 #1 to #32 inc.	
#13				67	17-1/2	1/4	1-5 Zinc Tubs. Spotted	
#25				79	17-1/2	1/4	Metal.	
#32				86	17-1/2	1/4		
Nachthorn		4'	32					3"
#1				56	19-1/2	1/5	Capped Gedackt.	
#13				68	19-1/2	1/5	Spotted Metal.	
#25				80	19-1/2	1/5		
#32				87	19-1/2	1/5		
Rohrgedackt		2'	32					3"
#1				66	19-1/2	2/9	Outside Chimneys	
#13				78	19-1/2	2/9	#1-#25 inc. Open Flue	
#25				90	19-1/2	2/9	#26-#32 inc. Spotted Metal.	
#26				88	19-1/2	2/9		
#32				94	19-1/2	2/9		
Mixture		III Rks.	96					3"
Rk. I	#1	2-2/3'		64	17-1/2	2/9	Tin	
	#13			76	17-1/2	2/9		
	#25			88	17-1/2	2/9		
	#37			95	17-1/2	2/9		
Rk. II	#1	2'		69	17-1/2	1/4		
	#13			81	17-1/2	1/4		
	#25			93	17-1/2	1/4		
	#32			100	17-1/2	1/4		
Rk. III	#1	1-1/3'		76	17-1/2	2/9		
	#13			88	17-1/2	2/9		
	#25			100	17-1/2	2/9		
	#32			107	17-1/2	2/9		

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Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 12

STOP		PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
			PEDAL ORGAN (Cont'd.)					
Mixture		V Rks.	160					3"
Rk. I	#1			71	17-1/2	1/4	Tin	
	#13			83	17-1/2	1/4		
	#25			95	17-1/2	1/4		
	#32			102	17-1/2	1/4		
Rk. II	#1	1-1/3'		78	17-1/2	2/9		
	#13			90	17-1/2	2/9		
	#25			102	17-1/2	2/9		
	#32			109	17-1/2	2/9		
Rk. III	#1	1'		83	17-1/2	1/4		
	#13			95	17-1/2	1/4		
	#25			107	17-1/2	1/4		
	#32			114	17-1/2	1/4		
Rk. IV	#1	2/3'		90	17-1/2	2/9		
	#13			102	17-1/2	2/9		
	#25			114	17-1/2	2/9		
	#32			126	17-1/2	2/9		
Rk. V	#1	1/2'		95	17-1/2	1/4		
	#13			107	17-1/2	1/4		
	#25			119	17-1/2	1/4		
	#32			126	17-1/2	1/4		
Cornet		32'	160					3"
Rk. I		10-2/3'	G from Subbass					
Rk. II	#1	6-2/5'	E	50	17-1/2	2/9	1-13 Zinc Tubs.	
	#13			62	17-1/2	2/9	Spotted Metal.	
	#25			74	17-1/2	2/9		
	#32			81	17-1/2	2/9		
Rk. III		5-1/3'	G from Subbass					
RK. IV	#1	4-4/7'	A#	56	17-1/2	2/9	1-7 Zinc Tubs	
	#13			68	17-1/2	2/9	Spotted Metal	
	#25			80	17-1/2	2/9		
	#32			87	17-1/2	2/9		
Rk. V	#1	3-1/2'	D	60	17-1/2	2/9	1-3 Zinc Tubs	
	#13			72	17-1/2	2/9	Spotted Metal.	
	#25			84	17-1/2	2/9		
	#32			91	17-1/2	2/9		
Rk. VI	#1	2-3/4'	F#	64	17-1/2	2/9	Spotted Metal.	
	#13			76	17-1/2	2/9		
	#25			88	17-1/2	2/9		
	#32			95	17-1/2	2/9		

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COMPLETION

PIPE SCALE SHEET

ORGAN NO. 9480 DATE September 1, 1961 (Revised) February 25, 1960

Protestant Cadet Chapel (Customer) United States Air Force Academy (City) Colorado (State)

Sheet 13

STOP	PITCH	PIPES	SCALE	HALVING	MOUTH	REMARKS	W.P.
PEDAL ORGAN (Cont'd)							
Cornet (Cont'd.)	32'	160				Spotted Metal	3"
Rk. VII #1	2-1/2'	C#	66	17-1/2	2/9		
#13			78	17-1/2	2/9		
#25			90	17-1/2	2/9		
#32			97	17-1/2	2/9		
Contra Bombarde	32'	32	8"			B(1/8) Eschallots 1-32 Hard Zinc. Spotted metal inserts for tuners Roll Tuners	3"
Posaune	16'	32	6"			B(F) Eschallots. 1-32 Hard Zinc. Spotted metal inserts for tuners Roll tuners.	3"
Trumpet	8'	32	4"			C(F) Eschallots 1-24 Hard Zinc. 25-32 Spotted Metal. Roll tuners.	3"
Schalmey	4'	32	2-3/4"			E(1/2) Eschallots. Oboe pattern lifting lid. Spotted metal.	

PITCH

COMPLETION

COPIES TO:

OPUS 9480 PROTESTANT CADET CHAPEL, UNITED STATES AIR FORCE ACADEMY, COLORADO.

MIXTURE FORMULAS

Great V Rks. Mixture

1-12	13-24	25-36	37-42	43-48	49-61
1-1/3' 29.9	2' 24.1	2-2/3' 17.8	4' 14.3	4' 11.0	4' 8.5
1' 24.1	1-1/3' 17.8	2' 14.3	2-2/3' 10.5	2-2/3' 8.1	2-2/3' 6.8
2/3' 17.8	1' 14.3	1-1/3' 10.5	2' 8.5	2' 7.1	2-2/3' 6.8
1/2' 14.3	2/3' 10.5	1' 8.5	1-1/3' 6.8	2' 7.1	2' 6.0
1/3' 10.5	1/2' 8.5	2/3' 6.8	1' 6.0	1-1/3' 5.7	2' 6.0

Great III Rks. Scharf

1-8	9-16	17-24	25-32	33-44	41-48	49-61
1/2' 13.1	2/3' 11.5	1' 11.0	1-1/3' 9.7	2' 9.3	2-2/3' 8.1	4' 7.8
1/3' 9.7	1/2' 9.3	2/3' 8.1	1' 7.8	1-1/3' 7.1	2' 6.8	2-2/3' 6.3
1/4' 7.8	1/3' 7.1	1/2' 7.1	2/3' 6.3	1' 6.0	1-1/3' 5.7	2' 5.5

Swell IV Rks. Plein Jeu

1-12	13-24	25-36	37- 48	49-54	55-61
1' 24.1	1-1/3' 17.8	2' 14.3	2-2/3' 10.5	4' 8.5	4' 7.1
2/3' 17.8	1' 14.3	1-1/3' 10.5	2' 8.5	2-2/3' 6.8	2-2/3' 5.7
1/2' 14.3	2/3' 10.5	1' 8.5	1-1/3' 6.8	2' 6.0	2-2/3' 5.7
1/3' 10.5	1/2' 8.5	2/3' 6.8	1' 5.9	1-1/3' 5.0	2' 5.2

Positiv III Rks. Fourniture

1-17	18-22	23-27	28-46	47-51	52-56
2/3' 17.8	1' 11.5	1-1/3' 11.5	2' 12.6	2-2/3' 7.1	4' 7.8
1/2' 14.3	2/3' 8.5	1' 9.3	1-1/3' 9.3	2' 6.3	2-2/3' 6.3
1/3' 10.5	1/2' 7.1	2/3' 7.1	1' 7.8	1-1/3' 5.2	2' 5.5

Positiv II Rks. Cymbale

1-7	8-14	15-21	22-28	29-35	36-42
1/4' 8.5	1/3' 8.0	1/2' 8.0	2/3' 7.4	1' 7.4	1-1/3' 7.1
1/6' 6.8	1/4' 6.8	1/3' 6.4	1/2' 6.4	2/3' 6.0	1' 6.0

43-49	50-56
2' 7.1	2-2/3' 6.7
1-1/3' 5.7	2' 5.7