NOTE: This paper is intended only for use by Mason-Neilan Representatives and is not for distribution.

Please refer to Instruction Book for reference numbers.

For checking, repairing, calibrating and otherwise placing combustion control equipment for direct pressure steam atomizing burner systems in first class working order, the following procedures should be followed:

To satisfactorily and completely check the system, it is imperative that the boiler be dead. Only a partial check of the combustion instrument can be made when the boiler is on the line by placing the control on manual and proceeding as outlined below up to the point where the instrument is ready for calibration.

In these cases, after the instrument has been checked and proper setting (see section on Control Settings) made, place control on automatic and observe instrument output pressure. If there are three tips, either "A" or "C" in the boiler, first make sure the fuel oil by-pass valve is properly set in accordance with Section K, then adjust initial vernier setting (29) as described in Section C, Part 2, until required pressure is obtained for the given draft condition. If there are less than three tips, either "A" or "C" in the boiler, observe quality of combustion and after checking fuel oil by-pass valve setting (see Section on Control Settings), adjust vernier initial setting (29) gradually until satisfactory combustion is obtained.

A. The first and very important step prior to testing the controls in any case is a performance check of the draft guages as follows:

1. Directly under each control panel board, there are two draft manifolds, one for each boiler. Each manifold (see Fig.12) has five "inlet pressure connections" (reading from left to right "uptake" Press,"After Damper","Fan Discharge Press","Air Duct at Burners",and "Furnace") and a common outlet connection leading to the upper side of the differential diaphragm on the side of the draft guage marked "Press. Drop Across Dampers", Immediately down stream of the outlet connection stop valve and up stream of the uptake, after damper, and air duct at the burners stop valves there are three-way cocks. These cocks can be a serious source of trouble. In almost every case the stop pins in these cocks have been sheared off by the operators at some time or other, making it impossible to turn them 360 degrees (thereby loosing the proper position of the cock in relation to the line).

Inasmuch as the draft actuating lines to the combustion instrument and the draft guage are one and the same, and the fact that the cocks vent to atmosphere for the purpose of zeroing the draft guages, it can readily be seen that, unless the cocks are tight and properly positioned, it would be impossible to properly calibrate the instruments or obtain good control results. Generally, upon close inspection, the original position of the stop pins on the cocks can be detected. If not, it then becomes necessary to remove the cocks from the lines to establish their proper position.

2. After checking the cocks in the draft line, be sure all the stop valves to the draft manifold are closed, except the one marked "Fan Discharge". Make sure stop valve on the outlet connection of the manifold is open.

3. With all cocks in a vertical position or open to the draft guage, except the one marked "After Damper", start up forced draft blower (after obtaining permission from the Engineer on Watch).

4. Place damper control on manual and close damper so that, with the blower running at minimum speed, the draft guage (4 Fig. 6) will indicate approximately 1" differential.

5. Turn cock on outlet connection of draft manifold to a horizontal position. Make sure the cock is turned in the proper direction; observe hand on side of draft guage marked " Press Across Dampers". The hand should fall rapidly to zero as the cock is turned. If not, either the cock is in the wrong position in relation to the line or the vent hole is plugged up. If the hand does not reset exactly on zero, make necessary adjustment by turning hex nut under the draft guage in the back of the panel board.

6. Turn cock marked "Uptake" to the horizontal position, then turn cock marked "Air Duct at Burners" also to horizontal position, again making sure that the cocks are turned in the proper direction. The hand on the side of the guage marked "Press. Across Boiler" should drop to zero rapidly. Make necessary adjustment so that hand will reset exactly at zero.

7. After both guages have been zeroed turn all cocks to a vertical position, except the one marked "After Dampers" making sure the cocks are turned in the proper direction.
Then increase and decrease fan speed gradually, observing whether or not both hands move freely for the entire range. If necessary, remove glass front of draft guage and free hands.

8. If draft guages do not respond properly for both changes in fan speed and opening and closing of the dampers, the indication is that the differential diaphragms has been ruptured. It is essential that the guage, or the side on which the diaphragm has been found ruptured, be isolated by turning the proper cocks to the horizontal position until such time as a new diaphragm is installed and the guage calibrated.

It is very important to first properly line up the draft guages and determine their accuracy before any attempt is made at calibrating the combustion instruments. If there is any doubt about the accuracy of the draft guages, a U tube should be used for the following tests.

B. To check the combustion control instruments before calibrating, proceed as follows:

1. Be sure the air supply pressure to the instrument is set at 22 lbs.

2. Make certain the Solenoid valve in the air line to the fuel oil control valve is closed (hand lever in the upward position).

3. Remove indicating plate (24).

4. Make sure nozzle (10) and Nozzle flapper (9) are clean.

5. Check pilot (5) operation by lifting Nozzle flapper (9) and placing finger over nozzle (10), at the same time observing diaphragm pressure guage (4). When the nozzle is uncovered, the pressure should drop to zero, and when it is covered, the pressure should rise and fall rapidly. But, if the boiler is dead and the instrument is on control, the rise and fall will be somewhat slower due to the capacity of the system. If the outlet pressure does not respond as described, it is recommended that the pilot be replaced.

6. Only when the boiler is dead can the cam (12) calibration or check test be satisfactorily performed since it is necessary to use the loading pressure guage on the board because of the inaccuracy of the instrument guage (4) at low pressures it is necessary also to have a zero draft condition on the differential diaphragm (27). Under these conditions unlock nut on the minimum pressure regulator (16) and turn adjusting screw to reduce the instrument output pressure to exactly two pounds on the air loading guage (5) (fig.6). Do not confuse the two pound mark with the lower red line on the guage. This red line indicates two and one-half pounds, which is the low end of the fuel oil control valve range. With the pressure exactly at two pounds, observe position of control arm (8) pin on the cam.

6. The pin should fall directly over the long line inscribed on the left hand side of the cam face. Make sure compensator bellows (11) plunger is properly resting in its place inside the bellows.
To Adjust, if necessary, loosen lock nut on compensator bellows (11) plunger, place small wrench over plunger and turn clockwise to move cam to the right and counter clockwise to move it to the left until pin of control arm rests directly over the line. Holding the plunger from turning lock adjustment in place, with the pin now resting on the proper point on the cam and with two pounds output pressure, insert instrument screw driver under spring arm (19) to the left of the zeroing adjustment (29)and lift arm gradually until the loading pressure guage indicates twenty pounds. The control arm (8) pin should now rest directly over the long line inscribed on the right front side of the cam. If not, first recheck two pound setting then again check twenty pound setting If still out, first check position of the compensator bellows (11) arm line on cam arm. If the cam arm has four bearing holes the line bearing pin should be in the third hole from the pivot end of the arm. If the arm has five holes, the link pin should be in the fourth hole from the pivot end of arm.
In the latest design, the cam arms have only one bearing hole. Reset, if necessary, and again check for the two pound and twenty pound positions of the control arm (8) pin on cam.
If the bellows arm link is found to be in the proper position or if the settings are still out after the link adjustment has been made, first make sure the compensator bellows plunger pivot is free (check bellows arm pivots, observe position of the bellows arm spring, make sure solenoid valve in air line to fuel oil control valve is closed and make sure the ratio control loading air pressure guage is properly zeroed and its calibration is fairly accurate). Then unlock compensator bellows arm link pivot (this adjustment was in every case locked and soldered in place before the instrument left the factory) and, melting the solder with an iron or cigarette lighter, move down slightly to decrease and up to increase the angular rotation of the cam for the two to twenty pound range. After each adjustment of the bellows arm link pivot, reset the two pound position. Continue this procedure until the desired results are obtained, then lock arm link pivot in place.

7. If the compensator bellows (11) is ruptured, replace and calibrate cam as described above under Part 6, Section B.

8. After cam calibration or check is completed, lift nozzle flapper (9) and with the nozzle (10) open to atmosphere, reset low limit valve (16) until air loading guage (5 fig.6) indicates 3.8 pounds. Return nozzle flapper to its normal position.

9. If the low limit valve chatters, remove diaphragm by removing valve cap, taking care not to damage the links in the instrument. Reverse diaphragm and place flat washer furnished between lock washer and diaphragm spring button under diaphragm or, in other words, raise position of diaphragm in relation to the exhaust port by placing two flat washers where only one is furnished between the diaphragm and the hex head of the exhaust port. If chatter persists after valve is again placed on control first check reducing air supply valve to instrument. If this is found to be all right, replace diaphragm in low limit valve. After valve is assembled and its performance is satisfactory, set as described under Parts, Section B.

10. To check the differential diaphragm (27), break the draft connections in back of the board and turn cocks in the lines to the draft guage marked "Uptake" and "Air Duct at Burners" to the horizontal position. Place mouth over the connection to the underside of the diaphragm. Blow, observing whether or not air continously blows out of the connection to the top of the diaphragm. If air blows out of the upper diaphragm connection, the indication is that the diaphragm is ruptured and should be replaced.

11. To check the sealing diaphragm, proceed in the same manner as described under Part 10, Section B, for the differential diaphragm test, except that it is necessary to have someone observe the action of the spring arm (19) at the same time.
When pressure is applied to the underside of the differential diaphragm (27), the spring arm (19) moves upward.
With the spring arm in the upward position, seal off connection to the upper side of the differential diaphragm by placing thumb tightly over it. When the pressure under the differential diaphragm is released, the spring arm will remain in the upward position. If not, the indication is that (first making sure all other connections are tight) the sealing diaphragm is ruptured and should be replaced.

12. To replace the differential diaphragm, break connection between spring arm (19) and connecting link (28). Remove "G" pointer (14) by removing pointer screws (25).
Remove union draft connections in the back of the panel to the instrument.
Remove four mounting screws (22) and lift complete diaphragm unit (15) out of the instrument.
Remove diaphragm screws (26) and replace differential diaphragm.

13. Do not, under any circumstances, ever disturb the position of the inner "G" setting scale of the position of the variable spring fulcrum (30).

14. To replace the sealing diaphragm (this diaphragm should always be replaced when the differential diaphragm is replaced whether or not it is required) remove diaphragm spring bearing bracket.
Remove spring only in the cases where spring setting adjustment (23) is locked in place by two Allen head screws; one on each side of the fulcrum pin.
If the spring adjustment is not locked as described, the sealing diaphragm must be replaced without disturbing the sealing diaphragm spring.
Remove sealing diaphragm screws and washer.
Replace diaphragm, taking care not to exert excessive torque on the differential diaphragm by placing wrench over the hex post under sealing diaphragm while loosening or tightening in place. After diaphragm has been made fast to the case, replace spring bearing bracket and adjust bearings so that spring moves freely with a mimimum of side thrust.

15. After the differential and sealing diaphragms have been installed, test as described under Parts 10 and 11, Section B, before replacing complete unit in the instrument.

16. To determine whether or not the spring calibration or the spring fulcrum (30) have been changed, check as follows:
With the differential diaphragm, Unit (16) in place and vented to atmosphere (draft lines broken in back of the board to insure the zero position) turn zeroing adjustment (29) setting the air loading pressure (Guage 5, Fig. 6) at approximately eight pounds.
Run variable spring fulcrum 1 to 9 on the inner "G" setting scale by turning load adjustment knob (7). at the same time observing loading pressure.
If the pressure varies more than plus or minus .5 pounds from the set point, the indication is that either the fulcrum, or the spring setting adjustment, or both, have been tampered with. Invariably, only the spring adjustment (23) has been changed.

17. Two different methods of locking the spring setting adjustment (23) were used previous to the latest method of locking and permanently establishing the position of the spring setting adjustment. The first method was as shown in our operating instructions for Federal Shipbuilding & Dry Dock Hulls 268-277 and 505 dated 1943-44, Page 5, Fig. 3. The spring setting adjustment (23) consisted of a block free to rotate on a fulcrum pin, two cap screws, two lock nuts, and a retainer plate.
The two screws were threaded thru the block and extended thru to the bottom of the fulcrum slot so that when one was turned in a clockwise direction and the other in the opposite direction, the block rotated about the fulcrum pin, When the desired position of the spring was attained, the adjustment was locked in place by locking the screws in place with the lock nuts which also fixed the spring to the fulcrum block.

Continued next page.

17. Continued:
The second method used in locking the adjustment in place was friction. This was done by using a fulcrum pin with a head on one end and threaded on the other together with two lock nuts. The spring was permanently fixed to the fulcrum block by using shorter cap screws, eliminating the lock nuts and placing lock washers under the cap screw heads. When the proper sprign position was obtained, the adjustment was locked by firmly tightening the lock nuts on the fulcrem pin, clamping the fulcrum block in the slot as in a vise. The present system permanently establishes the position as well as locks the adjustment.
This is done, as shown on dwg. A-50327-2, by using two allen head screws threaded to the side of the fulcrum block slot and projecting into the fulcrum block on each side of the fulcrum pin.

18. The third and present method permanently establishes the position of the spring adjustment and also eliminates the necessity to ever calibrate the spring even though the entire adjustment is taken apart, since it can only be assembled in one position.

19. In cases where the first method, as described above, are encountered (which require calibration of the spring) the following method must be followed.

With the differential diaphragm unit (15) in place and connecting link (28) fixed to the spring arm (19), vent both sides of the differential diaphragm to the atmosphere by breading the draft connections to the instrument in back of the control board.
Adjust vernier zeroing adjustment (29) so that the instrument output pressure will be approximately eight pounds with "G" at 9 (use inner scale for "G" setting).
Run the "G" adjustment down to 1, at the same time observing the output pressure that the variable spring fulcrum is in contact with the spring for the adjustment band.
If the maximum total deviation from the set pressure (8 pounds) is not greater than one pound, the calibration is acdeptable. It is desired that the variation, if any, be all minus when going from 9 to 1 with the "G" and all plus when going from 1 to 9.
If the variation is greater than one pound loosen lock nuts on spring setting adjustment (23) just enough to permit turning the cap screws.
If the deviation is plus when the "G" is moved from 9 to 1, first, back off the dap screw furthest away from the side of the case slightly, then screw down on the other the same amount. Tighten lock nuts and again run "G" from 9 to 1, observing the loading pressure and variable spring fulcrum position as described above.
Continue this procedure until the required results are obtained.

If the deviation is minus and greater than one pound when the "G" is moved from 9 to 1 (after loosening lock nuts) first, back off screw nearest the side of the case slightly, and screw down the other the same amount, then proceed as above.
The trial and error method described above is the only way by which the spring can be satisfactorily calibrated and unfortunately a long and tedious one at times.

20. In cases where the second method is encountered, the procedure for calibrating the spring is the same as described under Part 18, Section B. Except, that in these cases, the spring setting adjustment (23) is changed by loosening the lock nuts on the fulcrum pin just enough to allow the block to be slightly rotated by wedging an offset instrument screw driver between the block and the bottom of the slot on the side to be raised.
After each adjustment, the lock nuts must be tight before the "G" adjustment is changed.

21. Under Parts 18 and 19, Section B, it is very important that the variable spring fulcrum (30) be constantly in contact with the spring for the entire range of the "G" adjustment.
The pivot should be just touching the spring but not exerting any force whatever on it.
The position of the pivot should be checked at short intervals between 1 and 9 by placing a small screw driver directly in line with the pivot (30) under the spring and pressing up gently. At the same time observing whether or not any change in the output pressure of the instrument occurs. If the pivot is not quite in contact with the spring, the pressure will increase as the spring is pressed against the pivot.

To determine if the pivot is exerting any force at the spring, first calibrate the spring as described under Parts 18 and 19, Section B, to obtain the best results possible. Then loosen pivot (30) locking screw located directly under the "G" pointer between the two pointer screws. Place a wrench over the pivot hex and turn slightly to the right, observing whether or not the instrument output pressure varies.
If the pressure increases the indication is that the pivot is bearing down on the spring at this point.
Return the pivot to its original position, change location of the "G" and again proceed as above.
This check should be made at both ends of the scale (1 and 9) and at three intermediate points at least before making a permanent change on the pivot If the reaction is the same at all the check points adjust pivot so that it will just touch at all points, then lock in place.
If the reaction is not the same at all check points, then the indication is that the spring is not properly calibrated. Therefore, the spring must again be calibrated before the position of the pivot is changed.

CAUTION: Do not change position of pivot unless it is absolutely necessary. First make positively sure that the spring is properly calibrated.

22. After completion of the spring and spring fulcrum calibration, change zeroing adjustment so that output pressure will be about four pounds. Replace "G" pointer (14) making sure horizontal member of the pointer is exactly parallel to the bottom of the inner scale. Then replace indicating plate (24).
Make up draft connections in back of control board.

23. Make sure indicating plate is in the proper position by lining the two holes directly above the screw slots with the pins on the plate brackets.

24. Check position of load adjustment pointer (14) by comparing the reading on the indicating plate (24) with that on the inner scale indicated by the vertical line between the two pointer screws (25).
If necessary, bend pointer slightly so that its indication corresponds with that of the inner scale.

25. Check position "F" adjustment pointer (13) by turning knob (6) until line on adjustable member is directly opposite line marked "0" on side of the initial adjustment limit stops (29).
Reset the pointer, if necessary, so that it will indicate "0" on the indicator plate (24).

26. The instrument is now ready for calibration.

Section C

In most cases, the only instrument checks necessary prior to calibration are as described under Section B, Parts 1,2,4,5,6,8,10,11,23,24, and 25.

With the boiler dead, open one register (preferably the center one). Adjust the "C" to indicate 7.8 and the "F" to indicate - 1 Place damper control on manual and increase loading pressure to approximately eighteen pounds. Start up forced draft blower and make sure solenoid valve is closed.

Using the combustion Test Chart ED-1717-1 for the "A" tip condition proceed as follows:

1. Make sure all draft line cocks are in the vertical position except the one marked "After Dampers".

2. Observe draft reading and reset zeroing adjustment so that instrument output pressure will equal valve obtained from combustion chart for the given draft.
With this as a starting point, plot a curve as follows:

3. Increase the pressure drop across the boiler approximately 1" at a time by increasing the speed of the blower, plotting each point on the test chart (for point less than 1" draft, change position of the damper).

4. Observe slope of curve. If curve obtained (see example "B" Combustion Test Chart ED-1717-2, Page 18, Section H-1) is reasonably close to the theoretical curve "A", the instrument calibration can be assumed to be all right. If the curve dips either up or down C and D respectively, proceed as follows:

5. If the curve obtained is similar to example D (excess oil) it can be readily seen that the ouput pressure rate of increase is to fast for the draft rate of increase.
Loosen connecting link (28) pivot at the control arm (8) and move same slightly to the left (a very small adjustment will produce a wide change in the rate of output pressure).
Tighten pivot and again reset zeroing adjustment (29) to produce the required output pressure for the given draft. Plot curve as described under Part 3 above.
Continue this procedure until the final curve obtained falls within the acceptable range.

6. If the curve obtained is similar to example C (excess air) proceed exactly as described under Section 5 above, except that instead of moving the connecting link (28) pivot to the left, you now move it to the right.

7. A copy of the curves (use one sheet for each boiler) should be sent to the factory along with the service report.

Section D

The maintainence of and method of setting the #40-F.B. differential steam atomising control valve, the #38 Fuel oil control valve, and the #42-F differential fuel oil by-pass valve are throughly described in the operating instructions, Page 14 to 20 inclusive.
It is recommended, however, that the last three sentences begining "After the stem is locked, etc., of paragraph 4 under "Valve Setting" Page 14, be disregarded.
If the trim is replaced in a fuel oil control valve, it is satisfactory to just lock the stems in place with the two lock nuts.

1. When servicing a job, the three valves on each boiler should be thoroughly checked. To check the #38 fuel oil control valve, remove plug by disconnecting air line, removing valve supports, removing bonnet nuts, and very carefully lifting superstructure bonnet, plug and stem from the body.
Extreme care must be taken not to bend the plug stem.
Examine the plug and seat. If badly scored, replace as described in the operating instructions.

Remove drain plug immediately down stream of the fuel oil meter and clean line out with kerosene and compressed air.
If a bad condition is encountered, remove fuel oil meter and thoroughly clean out the line and the meter.

2. The diaphragm on the #40-FB atomizing steam control valve should be replaced at least every six months.
After the valve has been thoroughly checked and properly set as described in the operating instructions, turn the adjusting screw to the right as far as possible.
This will produce a minimum differential of 10 pounds.
With 150# steam pressure to the valve, close by-pass on burner steam line trap and open valve to and from the boiler trap.
Turn adjusting screw until the steam guage on the boiler panel indicates 20 pounds.
If the steam pressure continues to rise when the by-pass on the trap is closed, the indication is that the valve is not properly set or the seats need grinding.

In any case, final setting of this valve should be made when the boiler is on the line.
These valves should never be set for less than 20 pounds or more than 25 pounds differential over the fuel oil pressure to the burners.
The differential will remain constant from the minimum burner oil pressure to approximately 115 pounds.
At this point the steam pressure will remain at approximately 135 pounds and the oil pressure will continue to rise pending upon load conditions up to a maximum of 300 pounds.

3. When assembling the #42-F fuel oil by-pass valve, after checking and setting as described in the operating instructions, turn the hand wheel until the flange of the diaphragm case rests firmly on top of the diaphragm.
This is the approximate position for the minimum differential (the difference will be caused by the amount the diaphragm is compressed after bolting) and the vertical scale as well as the handwheel scale should indicate approximately 0 - 0.
If the indication is greater or less than a half turn, adjust (after the diaphragm case is firmly bolted) so that the indication is as near 0 - 0 as possible.
Final setting of the handwheel should be made after the boiler is on the line and the "A" tips are in use.

A constant for each one of these valves is given on the lower right hand corner of a data plate attached to the indicator bracket.
It will be noted that these constants vary slightly.
However it will also be noted that they are all very close to 4.0.
Therefore, for ordinary conditions, it is practical to use 4 as the constant for all these valves.
Using 4 as the valve constant, it follows that four times the number of valve turns equals the differential pressure between the fuel oil to the burners and the fuel to oil supply pressure.

For example: 4 X 14.82 equals 59.28 lbs.

Therefore, to check the setting of the handwheel, after making sure of the accuracy of the oil pressure guages on the boiler panel,

read the differential between the two oil guages and check as above against the number of turns indicated on the by-pass valve.
It is recommended that the final handwheel settings be made whenever possible while three "A" tips are in use.
(See Part 1, Section K, for by-pass settings).

4. For general performance data under maximum and minimum load conditions see Section G.

SECTION E

The following procedure should be taken in checking the damper control system.

1. If the boilers are on the line, only the instrument can be checked by placing the damper control for both boilers on manual.
First setting the pressure on the #99-A (small guage) controls equal to the control pressure on the #21ØØ prior to changing the control.
If one boiler only is on the line, place live boiler on manual as described and leave dead boiler on automatic.
If both boilers are dead, leave both on automatic.

2. Assuming both boilers are dead and with zero pressure on the boiler of the #21ØØ the pressure indicating pointer should indicate approximately zero. If necessary reset the pointer.

3. Make sure the supply pressure to the instrument is set at approximately 27 pounds, and the nozzle as well as the throttling arm is clean (Middle instrument on the control board).

4. Check pilot action as described under Section B, Part 5.
If XX pilot is found to be in use, replace with standard pilot.
NEVER USE "XX" pilots.
We recommend that whenever these pilots are encountered that precautions be taken to prevent their use by the operators.

5. Set sensitivity or proportional band so that indicator pointer rests just to the left of line between 3 and 4 on the dial.

6. To set the control setting pointer, turn control knob "R" until nozzle rack is in a horizontal position, then set pointer to indicate 44Ø.

7. Turn control knob so that the control setting pointer coincides with the pressure indicator pointer.
The instrument output pressure should now be approximately 18 pounds.
Reset is necessary, by turning synchronizer with a screw driver to produce the results required.

8. The settings as described above are only approximate, final settings should be made as described below under Part 11,13, and 14, when either one or both boilers are on the line.

9. Check the damper controllers #661 only on the boilers which are dead by placing the control on manual and observing the action of the #661 as the loading pressure is varied.
The total travel of the #661 is 3 inches for a 5 - 25# loading pressure change.
To adjust spring tension, turn adjusting screw (2ψ) clockwise to increase and counter clockwise to decrease.
It will be noted that in almost every case the spring adjusting screw is already hard against the shoulder.
Under these conditions, it is necessary to determine which of the two #661 controllers has the lowest range setting, then decrease the spring tension on the other until both controls have identical ranges.

1ψ. The dampers should be checked to see if they are free.
Disconnect the link between the damper arm and the #661 spring stem clevis by removing pin at the clevis.
Rotate dampers by hand, making sure that they are free.
If necessary, remove inspection plate in air duct directly above the dampers and observe whether or not the dampers are closing.
Because of the very close tolerance under which the clearances are held, considerable trouble has been experienced with the dampers seriously hanging up.
If necessary, recommend that the dampers be taken down and freed.

The dampers consist of two flappers which must be parallel to each other for proper operation. To parallel the flappers use the turnbuckle connecting the two flapper arms.

With the dampers free and with full stroke on the #661, hold dampers in closed position then make up link to clevis by turning clevis until holes in clevis arms line up with hole in the connecting link.
Replace pin, washer, and outer pin, then lock clevis to spring stem.

11. Final settings of dampers must be done when both boilers are on the line and when both are operating under the same conditions, namely, the same number and size of tips in each boiler.

12. When one or both boilers are on the line, the pressure indicating pointer of the #21ψψ Damper Controller should indicate the same pressure as registered by the steam pressure gauge (2) (Figure 6, Page 9, operating instructions). Set if necessary.

13. Proceed as described above under Section E, Parts 3,4,5, and 6. after placing the boiler or boilers on the line on manual control.

14. Turn control knob so that the control setting pointer coincides with the pressure indicator pointer. Set the instrument output pressure equal to the pressure output of the manual controller controlling the boiler pressure by means of the synchronizer (8) (operating instructions Fig.1, Page 3.)

15. Place control on automatic and, after allowing sufficient time for the boiler pressure to steady down, observe position of pressure indicator pointer.
Reset instrument output pressure, if necessary, a little at a time by means of the synchronizer until the pressure indicator pointer coincides with the control setting pointer.
When settings are completed the indication of the control setting pointer, the pressure indicator pointer, and the boiler pressure guage (2) (Fig.6 Page 9) should correspond.

16. With both boilers on the line, after first making sure the draft guages are in good order as described under Section A, Parts 1,2,3,4,5,6, and 7, adjust speed of force draft blowers so that the air supply pressure is exactly the same on both boilers.
Observe pressure drop across both boilers.
These pressures should be the same, providing the same number and size of the tips are in use in each boiler.

17. If conditions are the same in both boilers but the pressure drops very slightly (.2" or more), open damper on boiler having the lowest reading until a balanced condition is obtained.
To increase damper opening unlock clevis on #661 spring stem and remove clevis pin at the same time preventing damper from closing by firmly holding damper are in its original position.
Turn clevis clockwise 36ø deg., replace connecting link and pin in clevis and again compare boiler draft readings.
Increase speed of forced draft blower momentarily, then reduce until supply pressure equals that of the other boiler.
Observe boiler draft reading.
If a discrepancy still exists, again reset damper opening and check as described above.
After satisfactory results are obtained, replace washer and cotter pin and lock clevis in place.

18. In some cases, the boiler draft pressures will be equal under light load conditions (½ to 2"), but will indicate a decided difference under heavier steaming loads. This can be attributed to either one or a combination of the following four reasons.
    (a) Air leak in the system (this includes air lines from #21ØØ to #661, #661 diaphragm, draft connections from boiler to draft guage and draught or #21ø1-18 differential diaphragm partial failure).
    (b) Improper spring settings on the #661 damper controller.
    (c) Draft guage out of calibration.
    (d) Damper flappers not properly synchronized.

In most cases, the cause has been traced to reason (d). It is recommended therefore, that this phase of the system be checked first.

Section F

When answering a service request on the boiler controls, the procedure as described under all the previous sections should be followed, independent of the apparent causes for the existing difficulties. If the control equipment is thoroughly and properly checked and reasonable assurance is had of its performance by process of elimination the trouble is generally traced, more often than the operator would care to admit, to some factor other than the control equipment. In many cases, service engineers have a tendency to be only too ready to accept the operator's reasons for the particular difficulties which they are experiencing and invariably, as a consequence, approach the problem from an entirely different angle than they otherwise would if they stopped to analyze the conditions before jumping to conclusions. Wow

It must be remembered that before any replacement of parts is made, particularly in the combustion control instrument, that a thorough check as outlined in this paper be made, If the control equipment is found to be in good order and the trouble still persists, then an effort should be made to trace it to its source by process of elimination and recommendations made to the operator for necessary correction. Some of the points to which the trouble is combustion has been traced to: (a) Dirty burners (b) Burner tips assembled incorrectly (for example, "A" orifice plates with "C" sprayer plates) (c) Steam supply to burner atomizing steam differential control valve.

(d) Failure of steam trap in steam line to the burners.
(e) Condition of fuel.
(f) Temperature of fuel oil to the burners.
(g) Fuel oil meters (most of the original discs in these meters have been replaced with aluminum discs eliminating the trouble).
(h) Fuel oil strainers.
(i) Fuel pumps.
(j) Fuel oil relief valves.
(k) Fuel oil temperature in the settling tanks.
(l) Force draft blowers.

G - General performance of the Control System For Federal Hulls 268-277 :5Ø5

	General condition	Maximum	Minimum
a.	Burner Capacity	1.Ø	Ø.1
	Loading Press., lbs G.	2Ø	3.8
	Burner Oil Press. lbs. G.	3ØØ	4.2
b.	Tip A. Steaming		
	Burner Oil Flow lbs. per hr.	342Ø	342
	By-pass oil flow lbs. per hr.	24Ø	3318
	Excess air percent	15	5Ø
	Draft Press. inches water	5.82	Ø.Ø8
c.	Tip G. Port		
	Burner oil flow lbs. per hr.	1275	128
	By-pass oil flow lbs. per hr.	24Ø	1387
	Excess air percent	15	1ØØ
	Draft Press. inches water	1.Ø8	Ø.25
d.	Regulation (a)		
	Loading air pressure	1	5
	Excess air	2	8

(a) Max. variation from average, plus or minus, in percent.

Combustion Control Instrument and By-Pass
Valve Settings for Federal Hulls 268-277 :595

Port and Maneuvering

Tip Size	Number of Tips	"F" Setting	"G" Setting	By-Pass Valve Setting	Steam Pressure
C	1	Plus 3	6.ϕ	2.ϕ	440#
C	2	Plus 3	3.ϕ	2.ϕ	440#
A	1	Minus .2	8.ϕ	5.ϕ	440#
A	2	Minus .2	8.ϕ	1ϕ.	440#

Note: For three tip; Settings under Port, maneuvering or steaming conditions, consult chart posted on each boiler control panel.

Note: When steaming, steam pressure should be set for 465#

Note: The above as well as the posted settings are not final. Though in most every case in the past they have been proven best; slight deviations may be necessary in the final settings for best possible results.

W. A. Thompson
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