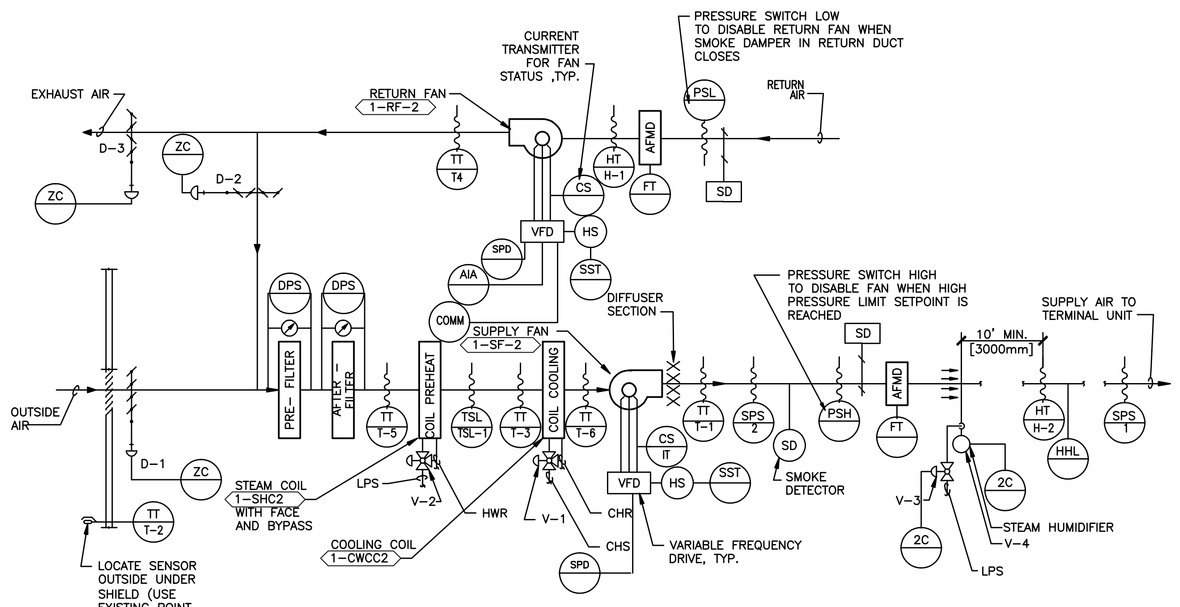


1 VARIABLE AIR VOLUME AIR HANDLING UNIT WITH MINIMUM OUTSIDE AIR CONTROL DIAGRAM

NTS

JOB: 0555.09
BUILDING: VA SAMPLE POINTS LIST

PAGE:

SYSTEM COMPONENT:	POINT ID	ABBREVIATION	SYSTEM OUTPUTS: BINARY: DESIGNATION-ALTERNATE MD; START/STOP; SAFETY DEVICE; STATUS/ALARM; ANALOG: CONTROL SIGNAL; VALVE POSITION	SYSTEM INPUTS: BINARY: HIGH LIMIT; FILTER DIRTY; SAFETY DEVICE; LOW TEMPERATURE; ANALOG: TEMPERATURE; HUMIDITY; PRESSURE; FLOW; CO2	SYSTEM SOFTWARE/CONTROL: ALARM PROCESSING: HIGH LIMIT; LOW LIMIT; DEVIATION; ROC; APPLICATION/FUNCTION: SCHEDULING; OPTIMUM START/STOP; DEMAND LIMITING; RESET SCHEDULE; PID CONTROL; SEQUENCING; INTERLOCK; TREND; TOTALIZATION; PASSWORD PROTECTION; ENERGY CALCULATIONS;	REMARKS
Return air Temperature	AI-1	RAT				
Return Air Humidity	AI-2	RAH				
Return Air Flow (cfm)	AI-3	RAF				
Mixed Air Temperature	AI-4	MAT				
Pre-Heat Temperature	AI-5	PHT				
Coolling Coil Temperature	AI-6	CCT				
Discharge Air Temperature	AI-7	DAT				
Discharge Static Pressure	AI-8	DASP				
Discharge Air Humidity	AI-9	DAH				
Supply Air Flow (cfm)	AI-10	SAF				
OUTSIDE AIR TEMPERATURE	AI-11	OAT				
RETURN LOW PRESSURE	BI-1	RLP				
RETURN FAN STATUS	BI-2	RF-STS				
SUPPLY FAN STATUS	BI-3	SF-STS				
MIXED AIR LOW LIMIT	BI-4	TSL-1				
STATIC PRESSURE HIGH LIMIT	BI-5	SPS-2				
HUMIDITY HIGH LIMIT	BI-6	HHL				
SUPPLY FAN VFD ALARM	BI-7	SF-ALA				
RETURN FAN VFD ALARM	BI-8	RF-ALA				
RETURN FAN VFD	AO-1	RF-SPD				FULL COMMUNICATION
SUPPLY FAN VFD	AO-2	SF-SPD				FULL COMMUNICATION
OUTSIDE AIR DAMPER	AO-3	OAD				
RETURN AIR DAMPER	AO-4	RAD				
EXHAUST AIR DAMPER	AO-5	EAD				
MINIMUM OUTSIDE AIR DAMPER	AO-7	MIN-OAD				
PRE-HEAT VALVE V-2	AO-8	PHT-V1				
COILING VALVE V-1	AO-9	CLG-V1				
STEAM HUMIDIFIER VALVE V-4	AO-10	HUM-V4				
RETURN FAN START/STOP	BO-1	RF-SST				
SUPPLY FAN START/STOP	BO-2	SF-SST				
STEAM ISOLATION VALVE V-3	BO-3	HUM-ISO-V3				

2 POINTS LIST FOR VAV AIR HANDLING UNIT WITH MINIMUM OUTSIDE AIR

NTS

SEQUENCE OF OPERATION FOR VARIABLE AIR VOLUME AIR HANDLING UNIT WITH MINIMUM OUTSIDE AIR

1. GENERAL

_1.1 UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC. H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN THE UNIT IS "OFF" D-1, D-3, SHALL BE FULLY CLOSED. WHEN THE UNIT IS "ON" D-1, SD-1 AND SD-2 SHALL BE FULLY OPEN. D-2 AND D-3 SHALL MODULATE IN ACCORDANCE WITH THE FOLLOWING SEQUENCE:

2. TEMPERATURE CONTROL

_2.1 SUPPLY AIR TEMPERATURE, SENSED BY TT-1, SHALL BE MAINTAINED AT SETPOINT VIA DIGITAL CONTROL PANEL BY MODULATING V-1 OR D-2 AND D-3 OR V-2 IN SEQUENCE.

2.2 WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY TT-2, IS ABOVE 75'F (ADJ) [23.8'C], THE DIGITAL CONTROL PANEL SHALL PREVENT THE MODULATION OF D-2 AND D-3 AND SHALL ASSUME THE MINIMUM OUTSIDE AIR POSITION (D-2 FULLY OPENED AND D-3 FULLY CLOSED). THE DIGITAL CONTROL PANEL SHALL MODULATE V-1 TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY TT-1.

2.3 WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY TT-2, IS BETWEEN 65'F [18.3'C] AND THE SUPPLY AIR TEMPERATURE SENSED BY TT-1, DAMPER D-2 SHALL FULLY CLOSE AND D1 AND D3 SHALL BE FULLY OPEN (MAXIMUM OUTSIDE AIR POSITION). THE DIGITAL CONTROL PANEL SHALL MODULATE V-1 TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY TT-1. SUPPLY AIR RESET CAPABILITY SHOULD BE PROVIDED TO PREVENT EXCESSIVE USE OF REHEAT COILS.

2.4 WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY TT-2, IS BELOW THE SUPPLY AIR TEMPERATURE, SENSED BY TT-1, DAMPERS D1, D-2 AND D-3 SHALL MODULATE TO MAINTAIN THE SCHEDULED SUPPLY AIR TEMPERATURE. IF D-2 IS OPEN AND D-3 IS CLOSED TO MINIMUM OUTSIDE AIR, V-2 SHALL MODULATE OPEN TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY TT-1.

3. AIR FLOW CONTROL

_3.1 THE SUPPLY AIR FLOW SHALL BE CONTROLLED BY THE DIGITAL CONTROL PANEL MODULATING THE SUPPLY FAN ADJUSTABLE SPEED MOTOR CONTROLLER TO MAINTAIN 1.0" [25mm] OF DUCT STATIC PRESSURE (FIELD ADJUSTABLE), SENSED BY SPS-1. RESET STATIC PRESSURE BASED ON ACTUAL BUILDING LOAD BY POLLING ALL ATU

3.2 THE DIGITAL CONTROL PANEL, USING TOTAL SUPPLY AIR AND RETURN AIR FLOW SIGNALS, SHALL RESET THE RETURN AIR FAN ASD TO MAINTAIN A CONSTANT AIR FLOW DIFFERENCE BETWEEN THE SUPPLY FAN AND THE RETURN AIR EQUAL TO MINIMUM OUTSIDE AIR.

3.3 USING HIGH PRESSURE SENSOR SPS-2 LOCATED AT THE SUPPLY FAN DISCHARGE, SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 3" [75mm] OF STATIC PRESSURE (FIELD ADJUSTABLE). IF STATIC PRESSURE AT SPS-2 DOES EXCEED 3" [75mm] THE SUPPLY AIR FAN SHALL STOP. SPS-2 SHALL BE HARDWIRED TO THE SUPPLY FAN UFD AND UNIT SHALL BE SHUTDOWN IN HAND,AUTO OR BYPASS MODE. SPS-2 WILL REQUIRE MANUAL RESET AT THE DEVICE.

4. HUMIDITY CONTROL

_4.1 WHEN THE DIGITAL CONTROL PANEL IS NOT CALLING FOR HUMIDITY, SENSED BY RETURN AIR HUMIDITY H-1, 2-WAY "ON-OFF" CONTROL VALVE V-3 SHALL REMAIN CLOSED. WHEN THE DIGITAL CONTROL PANEL IS CALLING FOR HUMIDITY, V-3 SHALL REMAIN OPEN.

4.2 RETURN AIR HUMIDITY SHALL BE MAINTAINED AT SETPOINT OF 35% RH (ADJ) VIA DIGITAL CONTROL PANEL BY MODULATING CONTROL VALVE V-4 TO MAINTAIN THE DESIRED HUMIDITY. THE DCP SHALL OVERRIDE THIS CONTROL TO MAINTAIN HUMIDITY OF 80% AS SENSED BY H-2. DCP SHALL CLOSE VALVE V-3 WHENEVER THE SUPPLY FAN IS OFF. VALVE V-4 SHALL BE INTERLOCKED WITH A TEMPERATURE SWITCH TO KEEP THE HUMIDIFIER OFF UNTIL CONDENSATE TEMPERATURE APPROACHES STEAM TEMPERATURE.

5. FREEZE PROTECTION

_5.1 IF THE AIR TEMPERATURE AS SENSED BY TT-3 FALLS BELOW 45'F [7'C], AN ALARM SIGNAL SHALL INDICATE AT THE DCP AND ECC. IF THIS TEMPERATURE FALLS BELOW 40'F [4.4'C], AS SENSED BY THE TSL THE SUPPLY AND RETURN FANS SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. TSL SHALL BE HARDWIRED TO THE SUPPLY FAN UFD AND UNIT SHALL BE SHUTDOWN IN HAND,AUTO OR BYPASS MODE. TSL WILL REQUIRE MANUAL RESET AT THE DEVICE.

6. AUTOMATIC SHUTDOWN/RESTART

6.1 WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR, SD, THE SUPPLY AND RETURN FANS SHALL SHUT "OFF" AND AN ALARM SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM. ALL SMOKE DAMPERS IN THE SUPPLY AND RETURN DUCTS SHALL CLOSE.

6.2 EXHAUST FANS SERVING AREA OF THE SUPPLY FAN SHALL CONTINUE TO RUN. SUPPLY AND RETURN FANS SHALL RESTART AND SMOKE DAMPERS SHALL OPEN WHEN FIRE ALARM CIRCUIT IS RESET.

7. EMERGENCY CONSTANT SPEED OPERATION

_7.1 UPON FAILURE OF THE VFD, THE SUPPLY AND RETURN FANS SHALL BE STARTED/STOPPED MANUALLY AT THE DIGITAL CONTROL PANEL OR THE ECC THROUGH THE BY-PASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.

CONTROL CYCLE DESCRIPTION

AIR HANDLING UNITS CONTROL:

THE SYSTEM SHALL BE ENABLED ON/OFF AS DETERMINED BY THE DDC SYSTEM AND RUN CONTINUOUSLY DURING OCCUPIED MODE OF OPERATION.

WHENEVER THE SYSTEM IS STOPPED THE UNIT CONTROL SYSTEM SHALL BE POSITIONED TO "FAIL SAFE" CONDITION: SUPPLY FAN (1-SF2) AND RETURN FAN 1-(RF2) SHALL STOP, THE OUTSIDE AIR, EXHAUST AIR AND TRANSFER DAMPERS SHALL CLOSE, RETURN DAMPERS OPEN, FACE AND BYPASS 100% FACE, VFD SUPPLY AND RETURN (1-SF2 AND 1-RF2) POSITION TO SOFT START, AND THE HEATING VALVE SHALL OPEN.

ECONOMIZER

FREE COOLING (ECONOMIZER) SHALL BE DETERMINED BY COMPARING THE ENTHALPY OF THE OUTSIDE AIR AND RETURN AIR STREAMS. WHENEVER THE OUTSIDE AIR HAS AN ENTHALPY LESS THAN THE RETURN AIR THE DDC SYSTEM SHALL PLACE THE AIR HANDLING UNIT IN THE ECONOMIZER MODE OF OPERATION.

THE OUTSIDE, RETURN, AND EXHAUST AIR DAMPERS SHALL MODULATE TO MAINTAIN A MIXED AIR TEMPERATURE AS RESET BY THE VAV BOX SPACE SENSORS. AS THE SPACE SENSORS CALL FOR HEAT, THE MIXED AIR TEMPERATURE SHALL BE RESET UP AND CONVERSELY AS THE SPACE SENSORS CALL FOR COOLING, THE MIXED AIR TEMPERATURE SHALL BE RESET DOWN.

THE MINIMUM OUTSIDE AIR DAMPER POSITION SHALL BE SET AT 15%. IF MORE THAN 20% DEGREES F OF HEATING IS REQUIRE TO REACH THE REQUIRED SUPPLY AIR TEMPERATURE, THE VENTILATION TRANSFER FAN SHALL START, AND OUTSIDE AIR, EXHAUST AIR DAMPERS SHALL CLOSE.

HEATING

ABOVE 35 DEGREES F OUTSIDE AIR TEMPERATURE THE DDC SYSTEM POSITIONS THE FACE AND BYPASS AIR DAMPERS OPEN TO 100% FACE (2-POSITION) AND MODULATES THE HEATING CONTROL VALVE TO MAINTAIN THE UNIT DISCHARGE AIR TEMPERATURE SUBJECT TO THE VAV BOX SPACE SENSOR RESET SCHEDULE.

BELOW 35 DEGREES F OUTSIDE AIR TEMPERATURE THE DDC SYSTEM OPENS THE HEATING COIL CONTROL VALVE TO 100% (2-POSITION) AND MODULATES THE FACE AND BYPASS DAMPERS TO MAINTAIN THE UNIT DISCHARGE AIR TEMPERATURE SUBJECT TO THE VAV BOX SPACE RESET SCHEDULES.

THE DDC CONTROLLER SHALL SELECT THE LEAD-LAG PUMP OPERATION. IN THE EVENT OF LEAD PUMP FAILURE, THE DDC SHALL STRAT THE LAG PUMP.

COOLING

BELOW 60 DEGREES F (ADJUSTABLE) OUTSIDE AIR TEMPERATURE THE CHILLED WATER SYSTEM SHALL BE OFF AND COOLING IS PROVIDED BY THE ECONOMIZER CYCLE.

ABOVE 60 DEGREES F (ADJUSTABLE) OUTSIDE AIR TEMPERATURE THE CHILLED WATER SYSTEM SHALL BE OFF AND COOLING IS PROVIDED BY THE ECONOMIZER CYCLE.

ABOVE 60 DEGREES F (ADJUSTABLE) OUTSIDE AIR TEMPERATURE THE HEATING VALVE SHALL BE POSITIONED CLOSED AND THE CHILLED WATER PUMP AND CHILLER STARTED. THE FACE AND BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A DISCHARGE AIR TEMPERATURE AS RESET BY THE VAV BOX SPACE SENSORS.

THE SYSTEM ECONOMIZER SHALL CONTINUE TO OPERATE ON MIXED AIR UNTIL THE ENTHALPY OF THE OUTSIDE AIR EXCEEDS THE RETURN AIR AT WHICH POINT THE SYSTEM SHALL CHANGEOVER TO 100% RETURN AIR. THE DDC SYSTEM SHALL OPEN THE VENTILATION TRANSFER FAN DAMPER, AND START THE VENTILATION TRANSFER FAN ACTIVATING THE HEAT RECOVERY SYSTEM. THE UNIT ECONOMIZER OUTSIDE AIR DAMPER SHALL BE POSITIONED CLOSED AND ALL VENTILATION SHALL BE PROVIDED BY THE HEAT RECOVERY SYSTEM.

VOLUME CONTROL

THE DDC SYSTEM SHALL MODULATE THE SUPPLY FAN (1-SF2) VARIABLE SPEED DRIVE (VSD) TO MAINTAIN THE DOWN STREAM SUPPLY FAN STATUS PRESSURE SETPOINT. THE SUPPLY FAN CFM SHALL BE MONITORED TO DETERMINE THE RETURN FAN (1-RF2) CFM SETPOINT TO INSURE FAN TRACKING. THE DDC SYSTEM SHALL MODULATE THE RETURN FAN VSD TO MAINTAIN MIXING PLENUM PRESSURE IN AND OUT OF ECONOMIZER CYCLE:

AUTOMATIC SHUTDOWN

IN THE EVENT OF HEATING COIL DISCHARGE AIR TEMPERATURE DROPPING BELOW 40 DEGREES F THE AIR HANDLING UNIT SHALL STOP AND ALL CONTROLS SHALL BE POSITIONED TO "FAIL SAFE" CONDITION.

WHEN A SMOKE DETECTOR IS IN ALARM THE AIR HANDLING UNIT SHALL BE STOPPED AND AN ALARM SIGNAL TRANSMITTED TO THE FIRE ALARM SYSTEM. THE EXHAUST FAN SHALL CONTINUE TO OPERATE IN FIRE ALARM CONDITION.

VAV SPACE CONTROL AND PERIMETER HEATING:

THE TERMINAL VAV BOX DDC SHALL MODULATE THE PERIMETER HEATING VALVE IN SEQUENCE WITH THE VAV BOX TO MAINTAIN THE SPACE SETPOINT.

CHILLED WATER:

WHEN THE AIR HANDLING UNIT CAN NO LONGER MAINTAIN THE SUPPLY AIR TEMPERATURE SETPOINT, AND THE OUTSIDE AIR TEMPERATURE IS ABOVE THE CHANGEOVER SETPOINT, THE DDC SHALL START THE CHILLED WATER PUMP AND THE CHILLER. THE CHILLER SHALL CYCLE BASED ON SYSTEM RETURN WATER TEMPERATURE. SUPPLY WATER SHALL BE RESET BY THE SPACE TEMPERATURE. CHILLED WATER PUMPS SHALL ALTERNATE AFTER 80 HOURS OF OPERATION.

DDC SHALL LEAD/LAG PUMP OPERATION EVERY 80 HOURS. IN THE EVENT OF LEAD PUMP FAILURE THE DDC SHALL AUTOMATICALLY START THE LAG HEATING PUMP.

CONDENSER WATER PUMP SHALL START ANY TIME A CHILLED WATER PUMP IS STARTED. WHEN THE COOLING TOWER RETURN WATER TEMPERATURE RISES ABOVE 85 DEGREES F, THE TOWER FAN VFD SHALL MODULATE AND OPERATE UNTIL THE RETURN WATER TEMPERATURE DROPS BELOW 70 DEGREES F.

STEAM HEAT:

WHENEVER THE OUTSIDE AIR TEMPERATURE IS BELOW 65 DEGREES F (ADJUSTABLE) THE HEATING CONTROL VALVES SHALL MODULATE AS RESET BY THE OUTSIDE AIR TEMPERATURE.

ABOVE 65 DEGREES F (ADJUSTABLE) THE HEATING CONTROL VALVE SHALL CLOSE.

EXHAUST FAN:

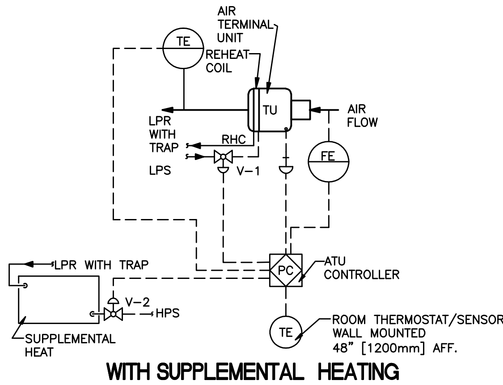
THE VFD SHALL BE MANUALLY SET THROUGH THE DDC.

SPACE TEMPERATURES

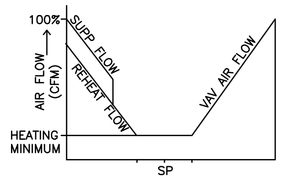
SPACE TEMPERATURES SHALL BE MANUALLY SET THROUGH THE DDC

HUMIDIFIER CONTROL

???



WITH SUPPLEMENTAL HEATING



VAV BOX CONTROL SEQUENCE
W/DEADBAND

A. DEADBAND OF 5° F BETWEEN HEATING AND COOLING SET POINTS WILL BE MAINTAINED.
B. UPON FALL IN SPACE TEMPERATURE THE VAV DAMPER WILL MODULATE TO MINIMUM POSITION.
C. UPON FURTHER DROP IN SPACE TEMPERATURE VALVE V-1 WILL MODULATE TO MAINTAIN SET POINT ± .5° F. THE ADJUSTABLE TOLERANCE OF ± .5° F HAS BEEN SELECTED TO PREVENT VALVE HUNTING
D. VALVE V-2 SHALL BE ENABLED WHEN OUTSIDE AIR FALLS BELOW 40° F (ADJ) AND VALVE V-1 HAS BEEN MODULATED OPEN ABOVE 30% (ADJ). VALVE V-2 SHALL MAINTAIN SET POINT ± .5° F. THE ADJUSTABLE TOLERANCE OF ± .5°F HAS BEEN SELECTED TO PREVENT VALVE HUNTING.
E. THE REVERSE SHALL OCCUR ON THE RISE IN SPACE TEMPERATURE.

3 VARIABLE VOLUME AIR TERMINAL UNIT CONTROL DIAGRAM

NTS

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INFECTION CONTROL	DATE	CARELINE MANAGER	DATE
SAFETY OFFICER	DATE	CHIEF OF STAFF	DATE

Drawing Title: MECHANICAL DETAILS (SHEET 2 OF 8)

MEDICAL CENTER DIRECTOR DATE

ASSOCIATE MEDICAL CENTER DIRECTOR DATE

Project Title: RENOVATION OF BLDG #1, 2ND FLOOR, B-WARD

Building Number: 1 | Checked | Drawn

Location: V.A.M.C. BATAVIA, NEW YORK

Date: JULY 2, 2010 (UPDATED 10/07/10)

Station No.: 528

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