

DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

A. System Information

01	HVAC System Identification or Name	
02	HVAC System Location or Area Served	
03	Verified Low Leakage Air-handling Unit Credit from NRCC-PRF-01-E	
04	Duct System Compliance Category	

B. Duct Leakage Diagnostic Test - MCH-04a - Completely New Duct System

01	Condenser Nominal Cooling Capacity (ton)	
02	Heating Capacity (kBtu/h)	
03	Leakage Factor	
04	Air-Handling Unit Airflow (AHU Airflow) Determination Method	
05	Calculated Target Allowable Duct Leakage Rate (cfm25)	
06	Actual duct leakage rate from leakage test measurement (cfm25)	
07	Compliance Statement:	

C. Additional Requirements for Compliance

01	System was tested in its normal operation condition.
02	All supply and return register boots sealed to the surrounding material.
03	Cloth backed rubber adhesive duct tape may not be used as the primary air sealing method for duct connections.
04	All connection points between the air handler and the supply and return plenums are completely sealed.
05	Verification Status:
06	Correction Notes:
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.	

D. Determination of HERS Verification Compliance

All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.

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DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 2 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

1. I certify that this Certificate of Verification documentation is accurate and complete.

Name:	Signature:
Company:	Date:
Address:	CEA / HERS Certification Identification (If applicable):
City/State/Zip:	Phone:

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

- The information provided on this Certificate of Verification is true and correct.
- I am the certified HERS Rater who performed the verification identified and reported on this Certificate of Verification (responsible rater).
- The installed features, materials, components, manufactured devices, or system performance diagnostic results that require HERS verification identified on this Certificate of Verification comply with the applicable requirements in Reference Nonresidential Appendices NA1 and NA2, and the requirements specified on the Certificate of Compliance for the building approved by the enforcement agency.
- The information reported on applicable sections of the Certificate(s) of Installation (NRCI), signed and submitted by the person(s) responsible for the construction or installation conforms to the requirements specified on the Certificate(s) of Compliance (NRCC) approved by the enforcement agency.
- I will ensure that a registered copy of this Certificate of Verification shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Verification is required to be included with the documentation the builder provides to the building owner at occupancy.

BUILDER OR INSTALLER INFORMATION AS SHOWN ON THE CERTIFICATE OF INSTALLATION

Company Name (Installing Subcontractor or General Contractor or Builder/Owner):	
Responsible Builder/Installer Name:	CSLB License:

HERS PROVIDER DATA REGISTRY INFORMATION

Sample Group Number (if applicable):	Dwelling Test Status in Sample Group (if applicable)
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HERS RATER INFORMATION

HERS Rater Company Name:	
Responsible Rater's Name:	Responsible Rater's Signature:
Responsible Rater's Certification Number w/ this HERS Provider	Date Signed:

Registration Number:

Registration Date/Time:

HERS Provider:

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance

May 2015

User Instructions NRCV-MCH-04a**A. System Information**

1. *HVAC System Identification or Name:* Provide an identification name or tag name that uniquely identifies the duct system. If there is a mechanical plan for the system, the tag name may be given on the plans.
2. *HVAC System Location or Area Served:* Provide a brief description of the area served by the duct system (e.g. upstairs; downstairs) to help distinguish one system from another in buildings with multiple systems.
3. *Verified Low Leakage Air-handling Unit (VLLAHU) Credit:* Indicate whether or not VLLAHU is required per PRF-01. For prescriptive alterations (change outs), choose "no".
4. *Duct System Compliance Category:* Choose from Completely New, Complete Replacement, or Alteration.
 - a. **New:** For new buildings with a new HVAC system or replacement of at least 75 percent of the duct system and up to 25 percent consisting of reused parts from the existing duct system (i.e. registers, grilles, boots, air handler, coil, plenums, duct material).
 - b. **Alteration:** For HVAC change outs or when the air handler, condensing unit of a split system, or cooling coil or any amount of duct is added to an existing system but does not constitute a new duct system.
 - c. **Alteration using Smoke Test:** For alterations that are unable to pass the leakage test and a smoke test is used to confirm that all accessible leaks have been sealed.

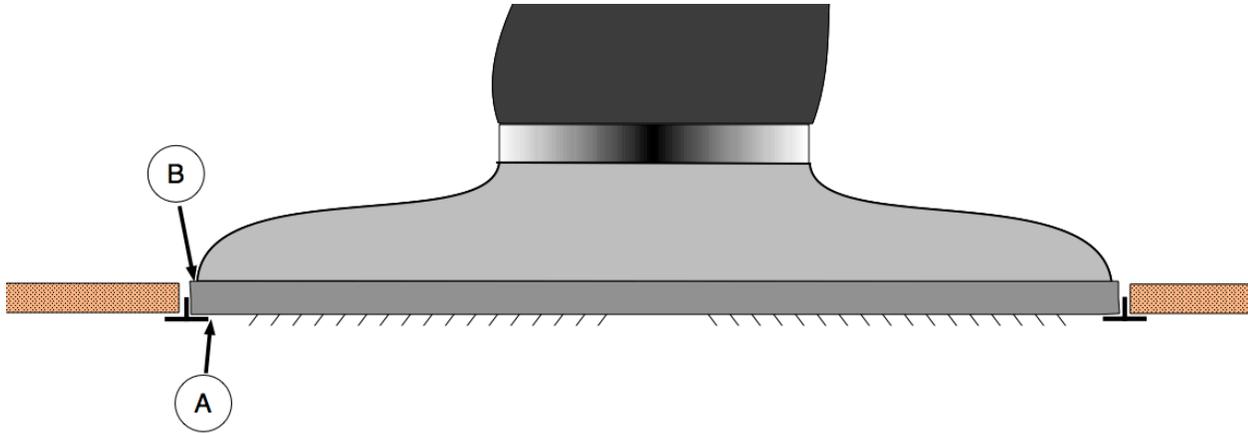
B. Duct Leakage Diagnostic Test - MCH-04a - Completely New Duct System

1. *Condenser Nominal Cooling Capacity (ton):* Enter the condenser nominal cooling capacity, refer to the manufacturer documentation. Example: if manufacture lists air conditioner total nominal output of 60,000 Btu/h, the user would divide this number by 12,000 and enter 5. Tonnage may also be determined by the model number. 018 = 1.5 tons, 024 = 2 tons, 030 = 3 tons, etc.)
2. *Heating Capacity (kBtu/h):* Enter the system heating capacity (output) in thousands Btu/h, refer to the manufacturer documentation. Example if manufacture lists furnace output of 90,000 Btu/h, the user would divide this number by 1,000 and enter 90.
3. *Leakage Factor:* Based on answers to questions A03 and A04 the leakage factor will be set at 0.06 (6% leakage).
4. *Air-Handling Unit Airflow (AHU Airflow) Determination Method:* User will select from the following options:
 - a. **Cooling System Method:** For systems with cooling, this selection must be made. The nominal air handler airflow shall be 400 CFM per nominal ton of condensing unit cooling capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices).
 - b. **Heating System Method:** For heating only systems this selection must be made. The nominal air handler airflow shall be 21.7 CFM per kBtu/hr of rated heating output capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices).
5. *Calculated Target Allowable Duct Leakage Rate (cfm):* This value will be automatically calculated. For systems with cooling, the target allowable duct leakage rate will be the leakage factor multiplied by the nominal air handler airflow of 400 CFM per nominal ton of condensing unit cooling capacity. For heating only systems, the target allowable duct leakage rate will be the leakage factor multiplied by the nominal air handler airflow of 21.7 CFM per kBtu/hr of rated heating output capacity.
6. *Actual Duct Leakage Rate from Leakage Test Measurement (cfm):* User will input this value from actual measurements from leakage test.
7. *Compliance Statement:* If Actual Duct Leakage Rate from leakage test is less than or equal to Calculated Target Allowable Duct Leakage Rate, "System passes leakage test" will automatically populate. If not, "System fails leakage test" will automatically populate.

C. Additional Requirements for Compliance

1. This must be a true statement (or not applicable) for the system to comply. The duct leakage test must be performed on the system while in its normal operating condition. Temporary taping of the supply registers, return grilles, outside air damper, outside air intake and economizers is allowed for the duct leakage test on non-residential buildings. Parts of the duct system may not be isolated for the test.
2. This must be a true statement (or not applicable) for the system to comply. For new systems and systems passing by the smoke test, all registers must be sealed to the air barrier when mounted in the air barrier. Note: T-bar ceiling is not an acceptable air

barrier in newly constructed buildings. In existing buildings a T-bar ceiling might define the conditioned boundary (insulation sits on T-bar ceiling), but it would not be effective to seal the register to the T-bar ceiling (location A in the diagram below). In this situation it is recommended but not required that the conditioned boundary be modified so that the insulation is aligned with an appropriate air barrier. When using the smoke test to pass an existing system with registers mounted in a T-bar ceiling, the register should be sealed to the register boot (location B in the diagram below).



3. This must be a true statement (or not applicable) for the system to comply. Cloth back rubber adhesive duct tape (old style duct tape) does not meet the UL181 requirements for any new connections and may not be used as the primary method of sealing a duct connection. It may be used in conjunction with UL181 rated mastic, draw bands, mesh, etc. on existing systems, it is recommended that old duct tape be covered with mastic to prevent further degradation. It is recommended that it not be used at all on new connections.
4. This must be a true statement (or not applicable) for the system to comply. All connection points between the supply and return plenums shall be completely sealed using approved materials. For newly installed equipment and systems passing by the smoke test, this is mandatory. On existing systems where the air handler and/or plenums have not been disconnected as part of the project these points do not need to be resealed as long as the system passes the 15% leakage rate, however it is recommended that they be resealed with approved materials to prevent further degradation.
5. User to select one of the following:
 - a. Pass – select this when all of the additional requirements listed above have been met.
 - b. Fail – select this when one or more of the additional requirements listed above cannot be met. Use Row 6 to explain reason for non-compliance. Non-compliance must be corrected prior to passing.
 - c. All n/a – select this when **all** of the additional requirements listed above do not apply. This is not a common situation. Selecting this option may subject the project to additional scrutiny.
6. When “Fail” is selected in Row 5, use this row to explain why. Be as detailed as possible.

D. Determination of HERS Verification Compliance

1. When all requirements of Section B and Section C comply, “System Passes Leakage Test” will display here, otherwise “System Does not Comply” will display here and corrections will need to be made.

DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

A. System Information

01	HVAC System Identification or Name	
02	HVAC System Location or Area Served	
03	Verified Low Leakage Air-handling Unit Credit from NRCC-PRF-01-E	
04	Duct System Compliance Category	

B. Duct Leakage Diagnostic Test - MCH-04c – Low Leakage Air-Handling Unit

01	Condenser Nominal Cooling Capacity (ton)	
02	Heating Capacity (kBtu/h)	
03	Leakage Factor (Value must match the PERF-1)	
04	Air-Handling Unit Airflow (AHUAirflow) Determination Method	
05	Calculated Target Allowable Duct Leakage Rate (cfm25)	
06	Actual duct leakage rate from leakage test measurement (cfm25)	
07	Compliance Statement:	

C. Additional Requirements for Compliance

01	System was tested in its normal operation condition.	
02	All supply and return register boots sealed to the surrounding material.	
03	Cloth backed rubber adhesive duct tape may not be used as the primary air sealing method for duct connections.	
04	All connection points between the air handler and the supply and return plenums are completely sealed.	
05	The installed air handler must appear on the Commission's list of certified low leakage air handlers.	
06	Verification Status:	
07	Correction Notes:	

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

D. Determination of HERS Verification Compliance

All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.

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DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 2 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Verification documentation is accurate and complete.	
Name:	Signature:
Company:	Date:
Address:	CEA / HERS Certification Identification (If applicable):
City/State/Zip:	Phone:
RESPONSIBLE PERSON'S DECLARATION STATEMENT	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> The information provided on this Certificate of Verification is true and correct. I am the certified HERS Rater who performed the verification identified and reported on this Certificate of Verification (responsible rater). The installed features, materials, components, manufactured devices, or system performance diagnostic results that require HERS verification identified on this Certificate of Verification comply with the applicable requirements in Reference Nonresidential Appendices NA1 and NA2, and the requirements specified on the Certificate of Compliance for the building approved by the enforcement agency. The information reported on applicable sections of the Certificate(s) of Installation (NRCI), signed and submitted by the person(s) responsible for the construction or installation conforms to the requirements specified on the Certificate(s) of Compliance (NRCC) approved by the enforcement agency. I will ensure that a registered copy of this Certificate of Verification shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Verification is required to be included with the documentation the builder provides to the building owner at occupancy. 	
BUILDER OR INSTALLER INFORMATION AS SHOWN ON THE CERTIFICATE OF INSTALLATION	
Company Name (Installing Subcontractor or General Contractor or Builder/Owner):	
Responsible Builder/Installer Name:	CSLB License:
HERS PROVIDER DATA REGISTRY INFORMATION	
Sample Group Number (if applicable):	Dwelling Test Status in Sample Group (if applicable)
HERS RATER INFORMATION	
HERS Rater Company Name:	
Responsible Rater's Name:	Responsible Rater's Signature:
Responsible Rater's Certification Number w/ this HERS Provider	Date Signed:

A. System Information

1. *HVAC System Identification or Name*: Same data given on MCH-01; provides an identification name or tag name that uniquely identifies the duct system. If there is a mechanical plan for the system, the tag name may be given on the plans.
2. *HVAC System Location or Area Served*: Same data given on MCH-01; provides a brief description of the area served by the duct system (e.g. upstairs; downstairs).
3. *Verified Low Leakage Air-handling Unit (VLLAHU) Credit*: Same data given on PRF-01; Details whether or not VLLAHU is required per PRF-01.
4. *Duct System Compliance Category*: Choose from Completely New, Complete Replacement, or Alteration.
 - a. **New**: For new buildings with a new HVAC system or replacement of at least 75 percent of the duct system and up to 25 percent consisting of reused parts from the existing duct system (i.e. registers, grilles, boots, air handler, coil, plenums, duct material).
 - b. **Alteration**: For HVAC changeouts or when the air handler, condensing unit of a split system, or cooling coil or any amount of duct is added to an existing system but does not constitute a new duct system.
 - c. **Alteration using Smoke Test**: For alterations that are unable to pass the leakage test, a smoke test is allowed to confirm that all accessible leaks have been sealed.

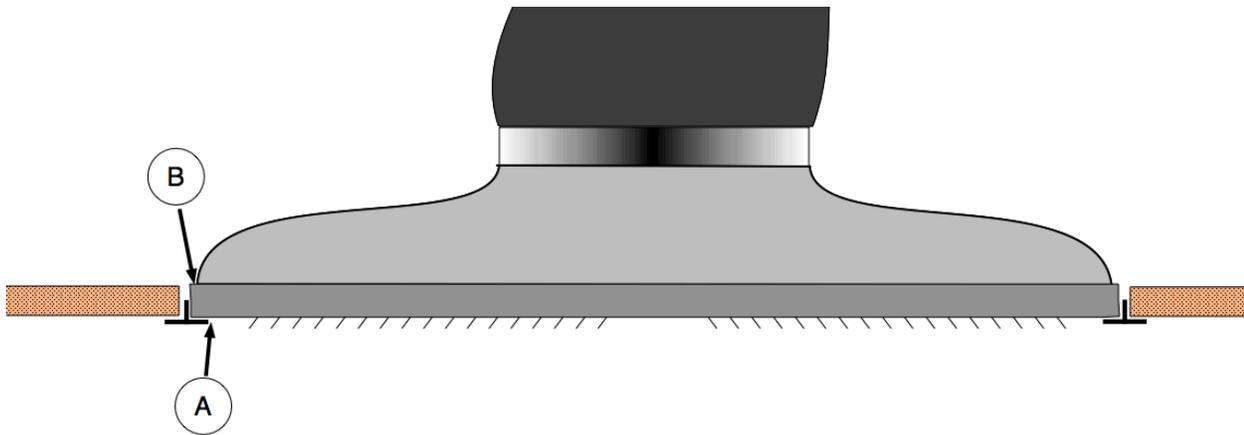
B. Duct Leakage Diagnostic Test - MCH-04c – Low Leakage Air Handling Unit

1. *Condenser Nominal Cooling Capacity (ton)*: Enter the condenser nominal cooling capacity, refer to the manufacturer documentation. Example if manufacture lists air conditioner output of 60,000 Btu/h, the user would divide this number by 12,000 and enter 5 on line B01.
2. *Heating Capacity (kBtu/h)*: Enter the system heating capacity (output) in thousands Btu/h, refer to the manufacturer documentation. Example if manufacture lists furnace output of 90,000 Btu/h, the user would divide this number by 1,000 and enter 90 on line B02.
3. *Leakage Factor*: Depending on answer to A04 the leakage factor will be either .06 or .15.
4. *Air-Handling Unit Airflow (AHUAirflow) Determination Method*: User will select from the following options:
 - a. **Cooling System Method**: For systems with cooling, this selection must be made, and the nominal air handler airflow shall be 400 CFM per nominal ton of condensing unit cooling capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices).
 - b. **Heating System Method**: For heating only systems the nominal air handler airflow shall be 21.7 CFM per kBtu/hr of rated heating output capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices)..
5. *Calculated Target Allowable Duct Leakage Rate (cfm)*: This value will be automatically populated depending on values in B04.
6. *Actual Duct Leakage Rate from Leakage Test Measurement (cfm)*: User will input this value from actual measurements from leakage test.
7. *Air Handling Unit Manufacturer Name*: Enter the name of the certified low leakage air handler unit; the unit must be listed by the California Energy Commission as a low leakage air handler.
8. *Air Handling Unit Model Number*: Enter the air handling unit; the unit must be listed by the California Energy Commission as a low leakage air handler unit.
9. *Compliance Statement*: If Actual Duct Leakage Rate from leakage test (B06) is less than or equal to Calculated Target Allowable Duct Leakage Rate (B05), "System passes leakage test" will automatically populate. If not, "System fails leakage test" will automatically populate

C. Additional Requirements for Compliance

1. The duct leakage test must be performed on the system while in its normal operating condition. Temporary taping of the supply registers, return grilles, outside air damper, outside air intake and economizers is allowed for the duct leakage test on non-residential buildings. Parts of the duct system may not be isolated for the test.
2. For new systems and systems passing by the smoke test, all registers must be sealed to the air barrier when mounted in the air barrier. Note: T-bar ceiling is not an acceptable air barrier in newly constructed buildings. In existing buildings a T-bar ceiling

might define the conditioned boundary (insulation sits on T-bar ceiling), but it would not be effective to seal the register to the T-bar ceiling (location A in the diagram below). In this situation it is recommended but not required that the conditioned boundary be modified so that the insulation is aligned with an appropriate air barrier. When using the smoke test to pass an existing system with registers mounted in a T-bar ceiling, the register should be sealed to the register boot (location B in the diagram below).



3. Cloth back rubber adhesive duct tape (old style duct tape) does not meet the UL181 requirements for any new connections and may not be used as the primary method of sealing a duct connection. It may be used in conjunction with UL181 rated mastic, draw bands, mesh, etc. On existing systems, it is recommended that old duct tape be covered with mastic to prevent further degradation. It is recommended that it not be used at all on new connections.
4. All connection points between the supply and return plenums shall be completely sealed using approved materials. For newly installed equipment and systems passing by the smoke test, this is mandatory. On existing systems where the air handler and/or plenums have not been disconnected as part of the project these points do not need to be resealed as long as the system passes the 15% leakage rate, however it is recommended that they be resealed with approved materials to prevent further degradation.
5. To qualify for the low leakage air handling unit credit, the installed air handling unit's make and model number must have been listed with the Commission. This list can be found on the Commission's website.
6. User to select one of the following:
 - a. Pass – select this when all of the additional requirements listed above have been met.
 - b. Fail – select this when one or more of the additional requirements listed above cannot be met. Use Row 6 to explain reason for non-compliance. Non-compliance must be corrected prior to passing.
 - c. All n/a – select this when **all** of the additional requirements listed above do not apply. This is not a common situation.
7. When "Fail" is selected in Row 5, use this row to explain why. Be as detailed as possible.

D. Determination of HERS Verification Compliance

1. When all requirements of Section B and Section C comply, "System Passes Leakage Test" will display here, otherwise "System Does not Comply" will display here and corrections will need to be made.

DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

A. System Information

01	HVAC System Identification or Name	
02	HVAC System Location or Area Served	
03	Verified Low Leakage Air-handling Unit Credit from NRCC-PRF-01-E	
04	Duct System Compliance Category	

B. Duct Leakage Diagnostic Test - MCH-04d - Altered Duct System

01	Condenser Nominal Cooling Capacity (ton)	
02	Heating Capacity (kBtu/h)	
03	Leakage Factor	
04	Air-Handling Unit Airflow (AHU Airflow) Determination Method	
05	Calculated Target Allowable Duct Leakage Rate (cfm25)	
06	Actual duct leakage rate from leakage test measurement (cfm25)	
07	Compliance Statement:	

C. Additional Requirements for Compliance

01	System was tested in its normal operation condition.
02	Cloth backed rubber adhesive duct tape may not be used as the primary air sealing method for duct connections.
03	All connection points between the air handler and the supply and return plenums are completely sealed.
04	Verification Status:
05	Correction Notes:

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

D. Determination of HERS Verification Compliance

All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.

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DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 2 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Verification documentation is accurate and complete.	
Name:	Signature:
Company:	Date:
Address:	CEA / HERS Certification Identification (If applicable):
City/State/Zip:	Phone:
RESPONSIBLE PERSON'S DECLARATION STATEMENT	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> The information provided on this Certificate of Verification is true and correct. I am the certified HERS Rater who performed the verification identified and reported on this Certificate of Verification (responsible rater). The installed features, materials, components, manufactured devices, or system performance diagnostic results that require HERS verification identified on this Certificate of Verification comply with the applicable requirements in Reference Nonresidential Appendices NA1 and NA2, and the requirements specified on the Certificate of Compliance for the building approved by the enforcement agency. The information reported on applicable sections of the Certificate(s) of Installation (NRCI), signed and submitted by the person(s) responsible for the construction or installation conforms to the requirements specified on the Certificate(s) of Compliance (NRCC) approved by the enforcement agency. I will ensure that a registered copy of this Certificate of Verification shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Verification is required to be included with the documentation the builder provides to the building owner at occupancy. 	
BUILDER OR INSTALLER INFORMATION AS SHOWN ON THE CERTIFICATE OF INSTALLATION	
Company Name (Installing Subcontractor or General Contractor or Builder/Owner):	
Responsible Builder/Installer Name:	CSLB License:
HERS PROVIDER DATA REGISTRY INFORMATION	
Sample Group Number (if applicable):	Dwelling Test Status in Sample Group (if applicable)
HERS RATER INFORMATION	
HERS Rater Company Name:	
Responsible Rater's Name:	Responsible Rater's Signature:
Responsible Rater's Certification Number w/ this HERS Provider	Date Signed:

Registration Number:

Registration Date/Time:

HERS Provider:

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance

May 2015

User Instructions NRCV-MCH-04d

A. System Information

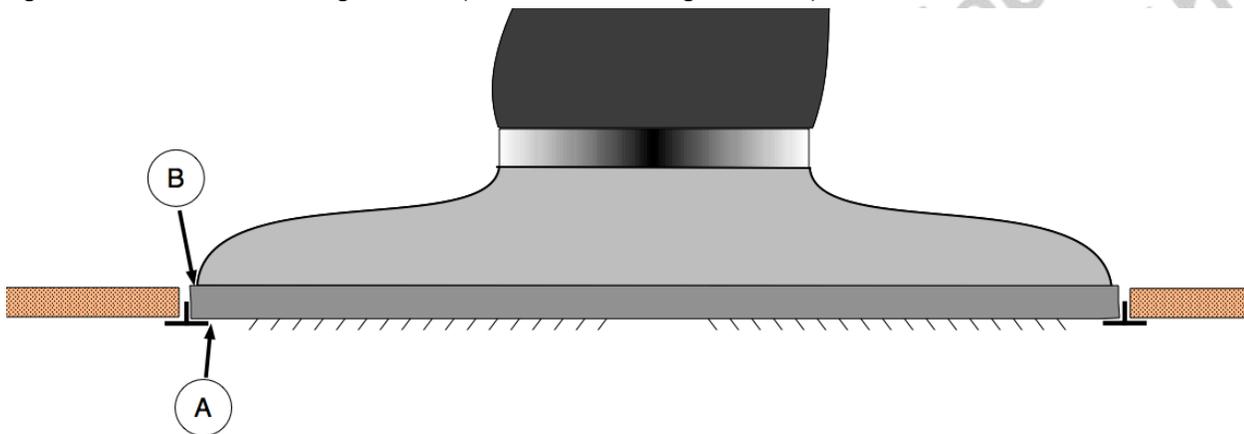
1. *HVAC System Identification or Name*: Provide an identification name or tag name that uniquely identifies the duct system. If there is a mechanical plan for the system, the tag name may be given on the plans.
2. *HVAC System Location or Area Served*: Provide a brief description of the area served by the duct system (e.g. upstairs; downstairs) to help distinguish one system from another in buildings with multiple systems.
3. *Verified Low Leakage Air-handling Unit (VLLAHU) Credit*: Indicate whether or not VLLAHU is required per PRF-01. For prescriptive alterations (change outs), choose "no".
4. *Duct System Compliance Category*: Choose from Completely New, Complete Replacement, or Alteration.
 - a. New: For new buildings with a new HVAC system or replacement of at least 75 percent of the duct system and up to 25 percent consisting of reused parts from the existing duct system (i.e. registers, grilles, boots, air handler, coil, plenums, duct material).
 - b. Alteration: For HVAC change outs or when the air handler, condensing unit of a split system, or cooling coil or any amount of duct is added to an existing system but does not constitute a new duct system.
 - c. Alteration using Smoke Test: For alterations that are unable to pass the leakage test and a smoke test is used to confirm that all accessible leaks have been sealed.

B. Duct Leakage Diagnostic Test - MCH-04

1. *Condenser Nominal Cooling Capacity (ton)*: Enter the condenser nominal cooling capacity, refer to the manufacturer documentation. Example: if manufacture lists air conditioner total nominal output of 60,000 Btu/h, the user would divide this number by 12,000 and enter 5. Tonnage may also be determined by the model number. 018 = 1.5 tons, 024 = 2 tons, 030 = 3 tons, etc.)
2. *Heating Capacity (kBtu/h)*: Enter the system heating capacity (output) in thousands Btu/h, refer to the manufacturer documentation. Example if manufacture lists furnace output of 90,000 Btu/h, the user would divide this number by 1,000 and enter 90.
3. *Leakage Factor*: Based on answers to questions A03 and A04 the leakage factor will be set at 0.15 (15% leakage).
4. *Air-Handling Unit Airflow (AHUAirflow) Determination Method*: User will select from the following options:
 - a. Cooling System Method: For systems with cooling, this selection must be made. The nominal air handler airflow shall be 400 CFM per nominal ton of condensing unit cooling capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices).
 - b. Heating System Method: For heating only systems this selection must be made. The nominal air handler airflow shall be 21.7 CFM per kBtu/hr of rated heating output capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices)..
5. *Calculated Target Allowable Duct Leakage Rate (cfm)*: This value will be automatically calculated. For systems with cooling, the target allowable duct leakage rate will be the leakage factor multiplied by the nominal air handler airflow of 400 CFM per nominal ton of condensing unit cooling capacity. For heating only systems, the target allowable duct leakage rate will be the leakage factor multiplied by the nominal air handler airflow of 21.7 CFM per kBtu/hr of rated heating output capacity.
6. *Actual Duct Leakage Rate from Leakage Test Measurement (cfm)*: User will input this value from actual measurements from leakage test.
7. *Compliance Statement*: If Actual Duct Leakage Rate from leakage test is less than or equal to Calculated Target Allowable Duct Leakage Rate, "System passes leakage test" will automatically populate. If not, "System fails leakage test" will automatically populate.

C. Additional Requirements for Compliance

1. This must be a true statement (or not applicable) for the system to comply. The duct leakage test must be performed on the system while in its normal operating condition. Temporary taping of the supply registers, return grilles, outside air damper, outside air intake and economizers is allowed for the duct leakage test on non-residential buildings. Parts of the duct system may not be isolated for the test.
2. This must be a true statement (or not applicable) for the system to comply. For new systems and systems passing by the smoke test, all registers must be sealed to the air barrier when mounted in the air barrier. Note: T-bar ceiling is not an acceptable air barrier in newly constructed buildings. In existing buildings a T-bar ceiling might define the conditioned boundary (insulation sits on T-bar ceiling), but it would not be effective to seal the register to the T-bar ceiling (location A in the diagram below). In this situation it is recommended but not required that the conditioned boundary be modified so that the insulation is aligned with an appropriate air barrier. When using the smoke test to pass an existing system with registers mounted in a T-bar ceiling, the register should be sealed to the register boot (location B in the diagram below).



3. This must be a true statement (or not applicable) for the system to comply. Cloth back rubber adhesive duct tape (old style duct tape) does not meet the UL181 requirements for any new connections and may not be used as the primary method of sealing a duct connection. It may be used in conjunction with UL181 rated mastic, draw bands, mesh, etc. On existing systems, it is recommended that old duct tape be covered with mastic to prevent further degradation. It is recommended that it not be used at all on new connections.
4. User to select one of the following:
 - a. Pass – select this when all of the additional requirements listed above have been met.
 - b. Fail – select this when one or more of the additional requirements listed above cannot be met. Use Row 6 to explain reason for non-compliance. Non-compliance must be corrected prior to passing.
 - c. All n/a – select this when **all** of the additional requirements listed above do not apply. This is not a common situation. Selecting this option may subject the project to additional scrutiny.
5. When “Fail” is selected in Row 5, use this row to explain why. Be as detailed as possible.

D. Determination of HERS Verification Compliance

1. When all requirements of Section B and Section C comply, “System Passes Leakage Test” will display here, otherwise “System Does not Comply” will display here and corrections will need to be made.

DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF INSTALLATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City	Zip Code

A. System Information

01	HVAC System Identification or Name	
02	HVAC System Location or Area Served	
03	Verified Low Leakage Air-handling Unit Credit from NRCC-PRF-01-E	
04	Duct System Compliance Category	

B. Duct Leakage Diagnostic Test - MCH-04e – Altered Duct System using Smoke Test

01	Condenser Nominal Cooling Capacity (ton)	
02	Heating Capacity (kBtu/h)	
03	Leakage Factor	
04	Air-Handling Unit Airflow (AHU Airflow) Determination Method	
05	Calculated Target Allowable Duct Leakage Rate (cfm25)	
06	Actual duct leakage rate from leakage test measurement (cfm25)	
07	Compliance Statement:	

C. Additional Requirements for Compliance

01	If method of compliance is by use of smoke testing, then no visible smoke shall exit the accessible portions of the duct system. Note – Accessible is defined as having access thereto, but which first may require removal or opening of access panels, doors, or moving similar obstructions. If access to the ducts requires an object to be demolished or deconstructed then sealing of those ducts is not required
02	If method of compliance is by use of smoke testing, smoke is only emanating from air-handling unit (AHU) cabinet and non-accessible portions of the duct system
03	System was tested in its normal operation condition.
04	All supply and return register boots sealed to the surrounding material.
05	Cloth backed rubber adhesive duct tape may not be used as the primary air sealing method for duct connections.
06	All connection points between the air handler and the supply and return plenums are completely sealed.
07	Verification Status:
08	Correction Notes:

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

D. Determination of HERS Verification Compliance

All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.

01	
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DUCT LEAKAGE DIAGNOSTIC TEST

CEC-NRCV-MCH-04-H (Revised 05/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF INSTALLATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 2 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City	Zip Code

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT		
1. I certify that this Certificate of Installation documentation is accurate and complete.		
Documentation Author Name:	Documentation Author Signature:	
Documentation Author Company Name:	Date Signed:	
Address:	CEA/HERS Certification Identification (If applicable):	
City/State/Zip:	Phone:	
RESPONSIBLE PERSON'S DECLARATION STATEMENT		
I certify the following under penalty of perjury, under the laws of the State of California:		
<ol style="list-style-type: none"> The information provided on this Certificate of Installation is true and correct. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the scope of construction or installation, in the applicable classification, for the scope of work specified on this Certificate of Installation (responsible builder/installer), otherwise I am an authorized representative of the responsible builder/installer. The constructed or installed features, materials, components or manufactured devices (the installation) identified on this Certificate of Installation conforms to all applicable codes and regulations, and the installation conforms to the requirements given on the plans and specifications approved by the enforcement agency. I understand that a HERS rater will check the installation to verify compliance, and that if such checking identifies defects; I am required to take corrective action at my expense. I understand that Energy Commission and HERS Provider representatives will also perform quality assurance checking of installations, including those approved as part of a sample group but not checked by a HERS rater, and if those installations fail to meet the requirements of such quality assurance checking, the required corrective action and additional checking/testing of other installations in that HERS sample group will be performed at my expense. I reviewed a copy of the Certificate of Compliance approved by the enforcement agency that identifies the specific requirements for the scope of construction or installation identified on this Certificate of Installation, and I have ensured that the requirements that apply to the construction or installation have been met. I will ensure that a registered copy of this Certificate of Installation shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Installation is required to be included with the documentation the builder provides to the building owner at occupancy. 		
Responsible Builder/Installer Name:	Responsible Builder/Installer Signature:	
Company Name: (Installing Subcontractor or General Contractor or Builder/Owner)	Position With Company (Title):	
Address:	CSLB License:	
City/State/Zip:	Phone	Date Signed:
Third Party Quality Control Program (TPQCP) Status:	Name of TPQCP (if applicable):	

Registration Number:

Registration Date/Time:

HERS Provider:

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance

May 2015

A. System Information

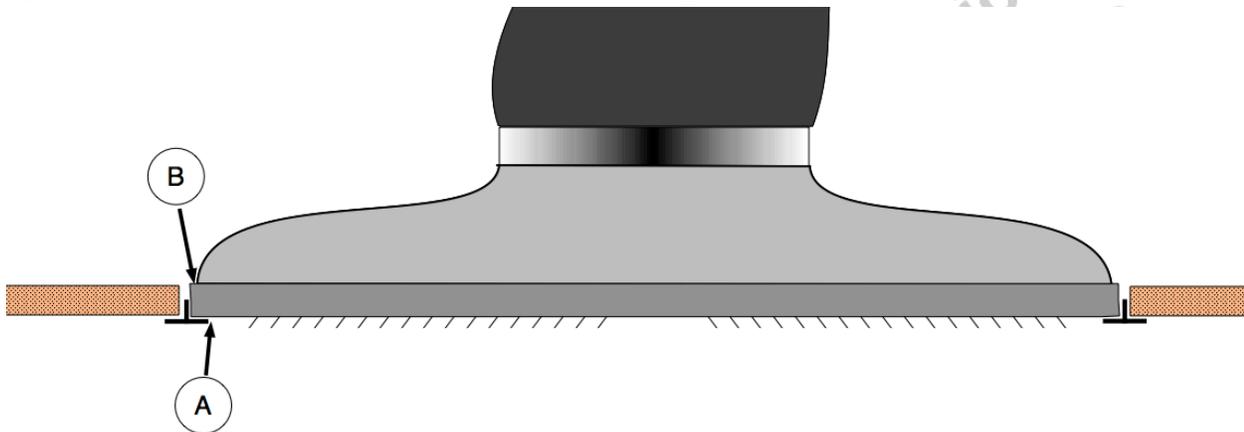
1. *HVAC System Identification or Name*: Provide an identification name or tag name that uniquely identifies the duct system. If there is a mechanical plan for the system, the tag name may be given on the plans.
2. *HVAC System Location or Area Served*: Provide a brief description of the area served by the duct system (e.g. upstairs; downstairs) to help distinguish one system from another in buildings with multiple systems.
3. *Verified Low Leakage Air-handling Unit (VLLAHU) Credit*: Indicate whether or not VLLAHU is required per PRF-01. For prescriptive alterations (change outs), choose "no".
4. *Duct System Compliance Category*: Choose from Completely New, Complete Replacement, or Alteration.
 - a. **New**: For new buildings with a new HVAC system or replacement of at least 75 percent of the duct system and up to 25 percent consisting of reused parts from the existing duct system (i.e. registers, grilles, boots, air handler, coil, plenums, duct material).
 - b. **Alteration**: For HVAC change outs or when the air handler, condensing unit of a split system, or cooling coil or any amount of duct is added to an existing system but does not constitute a new duct system.
 - c. **Alteration using Smoke Test**: For alterations that are unable to pass the leakage test and a smoke test is used to confirm that all accessible leaks have been sealed.

B. Duct Leakage Diagnostic Test - MCH-04e

1. *Condenser Nominal Cooling Capacity (ton)*: Enter the condenser nominal cooling capacity, refer to the manufacturer documentation. Example: if manufacture lists air conditioner total nominal output of 60,000 Btu/h, the user would divide this number by 12,000 and enter 5. Tonnage may also be determined by the model number. 018 = 1.5 tons, 024 = 2 tons, 030 = 3 tons, etc.)
2. *Heating Capacity (kBtu/h)*: Enter the system heating capacity (output) in thousands Btu/h, refer to the manufacturer documentation. Example if manufacture lists furnace output of 90,000 Btu/h, the user would divide this number by 1,000 and enter 90.
3. *Leakage Factor*: Based on answers to questions A03 and A04 the leakage factor will be set at 0.06 (6% leakage).
4. *Air-Handling Unit Airflow (AHU Airflow) Determination Method*: User will select from the following options:
 - a. **Cooling System Method**: For systems with cooling, this selection must be made. The nominal air handler airflow shall be 400 CFM per nominal ton of condensing unit cooling capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices).
 - b. **Heating System Method**: For heating only systems this selection must be made. The nominal air handler airflow shall be 21.7 CFM per kBtu/hr of rated heating output capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices).
5. *Calculated Target Allowable Duct Leakage Rate (cfm)*: This value will be automatically calculated. For systems with cooling, the target allowable duct leakage rate will be the leakage factor multiplied by the nominal air handler airflow of 400 CFM per nominal ton of condensing unit cooling capacity. For heating only systems, the target allowable duct leakage rate will be the leakage factor multiplied by the nominal air handler airflow of 21.7 CFM per kBtu/hr of rated heating output capacity.
6. *Actual Duct Leakage Rate from Leakage Test Measurement (cfm)*: User will input this value from actual measurements from leakage test.
7. *Compliance Statement*: If Actual Duct Leakage Rate from leakage test is less than or equal to Calculated Target Allowable Duct Leakage Rate, "System passes leakage test" will automatically populate. If not, select from "System Fails Smoke Test" or "System Passes Smoke Test".

C. Additional Requirements for Compliance

1. This must be a true statement for the system to comply.
2. This must be a true statement for the system to comply.
3. This must be a true statement (or not applicable) for the system to comply. The duct leakage test must be performed on the system while in its normal operating condition. Temporary taping of the supply registers, return grilles, outside air damper, outside air intake and economizers is allowed for the duct leakage test on non-residential buildings. Parts of the duct system may not be isolated for the test.
4. This must be a true statement (or not applicable) for the system to comply. For new systems and systems passing by the smoke test, all registers must be sealed to the air barrier when mounted in the air barrier. Note: T-bar ceiling is not an acceptable air barrier in newly constructed buildings. In existing buildings a T-bar ceiling might define the conditioned boundary (insulation sits on T-bar ceiling), but it would not be effective to seal the register to the T-bar ceiling (location A in the diagram below). In this situation it is recommended but not required that the conditioned boundary be modified so that the insulation is aligned with an appropriate air barrier. When using the smoke test to pass an existing system with registers mounted in a T-bar ceiling, the register should be sealed to the register boot (location B in the diagram below).



5. This must be a true statement (or not applicable) for the system to comply. Cloth back rubber adhesive duct tape (old style duct tape) does not meet the UL181 requirements for any new connections and may not be used as the primary method of sealing a duct connection. It may be used in conjunction with UL181 rated mastic, draw bands, mesh, etc. On existing systems, it is recommended that old duct tape be covered with mastic to prevent further degradation. It is recommended that it not be used at all on new connections.
6. This must be a true statement (or not applicable) for the system to comply. All connection points between the supply and return plenums shall be completely sealed using approved materials. For newly installed equipment and systems passing by the smoke test, this is mandatory. On existing systems where the air handler and/or plenums have not been disconnected as part of the project these points do not need to be resealed as long as the system passes the 15% leakage rate, however it is recommended that they be resealed with approved materials to prevent further degradation.
7. User to select one of the following:
 - a. Pass – select this when all of the additional requirements listed above have been met.
 - b. Fail – select this when one or more of the additional requirements listed above cannot be met. Use Row 6 to explain reason for non-compliance. Non-compliance must be corrected prior to passing.
 - c. All n/a – select this when **all** of the additional requirements listed above do not apply. This is not a common situation. Selecting this option may subject the project to additional scrutiny.
8. When “Fail” is selected in Row 5, use this row to explain why. Be as detailed as possible.

D. Determination of HERS Verification Compliance

1. When all requirements of Section B and Section C comply, “System Passes Leakage Test” will display here, otherwise “System Does not Comply” will display here and corrections will need to be made.



CERTIFICATE OF VERIFICATION		NRCV-PLB-21-H
HERS Verified High Rise Residential/Hotel/Motel Central Hot Water System Distribution		(Page 1 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City	Zip Code

A. Design HERS Verified Central Water Heating Systems Information													
01	02	03	04	05	06	07	08	09	10	11	12	13	14
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in system	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value	Central DHW System Distribution Type	Dwelling Unit DHW System Distribution Type

B. Installed HERS Verified Central Water Heating Systems Information													
01	02	03	04	05	06	07	08	09	10	11	12	13	14
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in system	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value	Central DHW System Distribution Type	Dwelling Unit DHW System Distribution Type
15	Compliance Statement:												

C. Installed Water Heater Manufacturer Information		
01	02	03
Water Heating System ID or Name	Manufacturer	Model Number



CERTIFICATE OF VERIFICATION		NRCV-PLB-21-H
HERS Verified High Rise Residential/Hotel/Motel Central Hot Water System Distribution		(Page 2 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

D. HERS Verification Requirements for All Central Domestic Hot Water Recirculation Systems	
01	All sections of the recirculation loop, and the first five feet of all branches off the loop are insulated, to the thicknesses required by Table 120.3A, except for the following: (RA4.4.1) <ul style="list-style-type: none"> • Piping installed in interior or exterior walls that is surrounded on all sides by at least 1inch of insulation. • Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top • Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members. • Insulation is not required on the cold water line when it is used as the return
02	Hot water pipes that are buried below grade are installed in a water proof and non-crushable casing or sleeve that allows for installation, removal, and replacement of the enclosed pipe and insulation. (RA4.4.1)
03	Insulation outside conditioned space is protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. (RA4.4.1)
04	Pipe insulation fits tightly to the pipe. (RA4.4.1)
05	On insulated sections of pipe, no piping is visible due to insulation voids, and all elbows and tees are fully insulated.. (RA4.4.1)
06	The recirculation pump is mounted on a vertical section of the return line, OR an automatic air release valve is installed on a riser at least 12 inches in length, on the inlet side of the recirculation pump, no more than 4 feet from the pump. (Section 110.3(c)5A).
07	A check valve is located between the recirculation pump and the water heater. (Section 110.3(c)5B).
08	A hose bibb is installed between the pump and the water heating equipment with an isolation valve between the hose bibb and the water heating equipment. (Section 110.3(c)5C).
09	Isolation valves are installed on both sides of the pump. One of the isolation valves may be the same isolation valve as in item 12 above. (Section 110.3(c)5D).
10	The cold water supply piping and the recirculation loop piping is not connected to the hot water storage tank drain port. (Section 110.3(c)5E).
11	A check valve is installed on the cold water supply line between the hot water system and the next closest tee on the cold water supply. (Section 110.3(c)5F).
12	The hot water distribution system piping from the water heater(s) to the fixtures and appliances takes the most direct path. (RA 4.4.7.1)
13	Installation and operation instructions that provide details of the operation of the pump and controls are available at the jobsite for inspection. (RA 4.4.7.1)
14	More than one circulation loop may be installed. Each loop shall have its own pump and controls. (RA4.4.8, RA 4.4.9, RA 4.4.10)
15	Verification Status:
16	Correction Notes:
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.	

Registration Number:

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance

Registration Date/Time:

HERS Provider:

May 2015



CERTIFICATE OF VERIFICATION		NRCV-PLB-21-H
HERS Verified High Rise Residential/Hotel/Motel Central Hot Water System Distribution		(Page 3 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

E. Multiple Dwelling Units – Recirculation Temperature Modulation Control Requirements

Systems that utilize this distribution type shall comply with these requirements

01	Controls have been installed that reduce the hot water supply temperature when hot water demand is determined to be low by the control system. The control system may use a fixed control schedule or dynamic control schedules based measurements of hot water demand. (RA4.4.11).	
02	Daily hot water supply temperature reduction (which is defined as the sum of temperature reduction by the control in each hour within a 24-hour period) shall be more than 50 degrees Fahrenheit. (RA4.4.11)	
03	Verification Status:	
04	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		

F. Multiple Dwelling Units – Recirculation Continuous Monitoring Systems Requirements

Systems that utilize this distribution type shall comply with these requirements

01	The water heating system must have a means of communicating with the remote monitoring facility. (RA4.4.12)	
02	The monitoring system must record no less frequently than hourly measurement of key system operation parameters, including hot water supply and return temperatures, and status of gas valve relays. (RA4.4.12)	
03	A current contract must be available that demonstrate the system will be monitored. (RA4.4.12)	
04	Verification Status:	
05	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		



CERTIFICATE OF VERIFICATION		NRCV-PLB-21-H
HERS Verified High Rise Residential/Hotel/Motel Central Hot Water System Distribution		(Page 4 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

G. Multiple Dwelling Units – Demand Recirculation Requirements	
Systems that utilize this distribution type shall comply with these requirements	
01	The system operates “on-demand”, meaning that the pump begins to operate shortly before or immediately after hot water draw begins, and stops when the return water temperature reaches a certain threshold value. (RA4.4.13)
02	After the pump has been activated, the controls shall allow the pump to operate until the water temperature at the thermo-sensor rises to one of the following values: (RA4.4.13) <ul style="list-style-type: none"> • Not more than 10 degrees Fahrenheit (5.6 degrees Celsius) above the initial temperature of the water in the pipe • Not more than 102 degrees Fahrenheit (38.9 degrees Celsius).
03	The controls shall limit pump operation to a maximum of 10 minutes following any activation. This is provided in the event that the normal means of shutting off the pump have failed. (RA4.4.13)
04	Pump and control placement shall meet one of the following criteria: (RA4.4.13) <ul style="list-style-type: none"> • When a dedicated return line has been installed the pump, controls and thermo-sensor are installed at the end of the supply portion of the recirculation loop; or • The pump and controls are installed on the dedicated return line near the water heater and the thermo-sensor is installed in an accessible location as close to the end of the supply portion of the recirculation loop as possible, or • When the cold water line is used as the return, the pump, demand controls and thermosensor shall be installed in an accessible location at the end of supply portion of the hot water distribution line (typically under a sink).
05	Insulation is not required on the cold water line when it is used as the return. (RA4.4.13)
06	Manual or sensor controls shall be installed and, if powered, each control has standby power of 1 Watt or less. Controls may be located in individual units or on the loop. Controls may be activated by wired or wireless mechanisms, including buttons, motion sensors, door switches and flow switches. (RA4.4.13)
07	Verification Status:
08	Correction Notes:
The responsible person’s signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.	



CERTIFICATE OF VERIFICATION		NRCV-PLB-21-H
HERS Verified High Rise Residential/Hotel/Motel Central Hot Water System Distribution		(Page 5 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

H. Multiple Dwelling Units – Non-demand control Recirculation Systems Requirements

Systems that utilize this distribution type shall comply with these requirements

01	The active control shall be either: timer, temperature, or time and temperature. Timers shall be set to less than 24 hours. The temperature sensor shall be connected to the piping and to the controls for the pump.	
02	Verification Status:	
03	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		

I. HERS Verified Multiple Recirculation Loops for DHW Systems Serving Multiple Dwelling Unit Requirements

All distribution systems listed on this form shall comply with these requirements

01	All buildings with 8 or more dwelling units have a minimum of 2 recirculation loops.	
02	Each loop roughly serves the same number of dwellings.	
03	Verification Status:	
04	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		

J. Determination of HERS Verification Compliance

All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.

01	
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CERTIFICATE OF VERIFICATION		NRCV-PLB-21-H
HERS Verified High Rise Residential/Hotel/Motel Central Hot Water System Distribution		(Page 6 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Verification documentation is accurate and complete.	
Name:	Signature:
Company:	Date:
Address:	CEA / HERS Certification Identification (If applicable):
City/State/Zip:	Phone:
RESPONSIBLE PERSON'S DECLARATION STATEMENT	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> The information provided on this Certificate of Verification is true and correct. I am the certified HERS Rater who performed the verification identified and reported on this Certificate of Verification (responsible rater). The installed features, materials, components, manufactured devices, or system performance diagnostic results that require HERS verification identified on this Certificate of Verification comply with the applicable requirements in Reference Nonresidential Appendices NA1 and NA2, and the requirements specified on the Certificate of Compliance for the building approved by the enforcement agency. The information reported on applicable sections of the Certificate(s) of Installation (NRCI), signed and submitted by the person(s) responsible for the construction or installation conforms to the requirements specified on the Certificate(s) of Compliance (NRCC) approved by the enforcement agency. I will ensure that a registered copy of this Certificate of Verification shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Verification is required to be included with the documentation the builder provides to the building owner at occupancy. 	
BUILDER OR INSTALLER INFORMATION AS SHOWN ON THE CERTIFICATE OF INSTALLATION	
Company Name (Installing Subcontractor or General Contractor or Builder/Owner):	
Responsible Builder/Installer Name:	CSLB License:
HERS PROVIDER DATA REGISTRY INFORMATION	
Sample Group Number (if applicable):	Dwelling Test Status in Sample Group (if applicable)
HERS RATER INFORMATION	
HERS Rater Company Name:	
Responsible Rater's Name:	Responsible Rater's Signature:
Responsible Rater's Certification Number w/ this HERS Provider	Date Signed:

Registration Number:

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance

Registration Date/Time:

HERS Provider:

May 2015

Instructions to NRCV-PLB-21-H**A. Design Central Water Heating Systems Information**

This table reports the water heating system features that were specified on the NRCC-PRF-01 compliance document for this project.

- 01 Water Heating System ID or Name – User input
- 02 Water Heating System Type – User input. The different kinds of water heating system type are DHW or Combined Hydronic
- 03 Water Heater Type – User input. The different kinds of water heaters are Large Storage, Small Storage, Heat Pump, Boiler, Large Instantaneous, Small Instantaneous or Indirect
- 04 # of Water Heaters in system – User input.
- 05 Water Heater Storage Volume (gal) – User input. Value may be N/A if water heater type is instantaneous with zero storage.
- 06 Fuel Type – User input. The different kinds of fuel types are natural gas, propane, oil, or electricity.
- 07 Rated Input Type – User input. For natural gas, propane and oil fuel type the input type is Btu/Hr. For electric the input type is kW
- 08 Rated Input Value – User input. Numerical value of the rated input. Must be equal to or less than value indicated on the NRCC-PRF-01
- 09 Heating Efficiency Type – User input. Different efficiency types are Energy Factor, AFUE, and Thermal Efficiency
- 10 Heating Efficiency Value – User input. Numerical value of the Heating Efficiency. Must be equal to or higher efficiency than value indicated on the NRCC-PRF-01
- 11 Standby Loss – User input. Value may be N/A if NRCC-PRF-01 value is N/A.
- 12 Exterior Insul. R-Value – User input. Value may be N/A if NRCC-PRF-01 value is N/A.
- 13 Central DHW System Distribution Type - User input from list
 - * Recirculation Temperature Modulation Control with HERS-Verified Multiple Loops
 - * Recirculation Continuous Monitoring Systems with HERS-Verified Multiple Loops
 - * Demand Recirculation with HERS-Verified Multiple Loops
 - * Non-demand control Recirculation Systems with HERS-Verified Multiple Loops
- 14 Dwelling Unit DHW System Distribution Type - User input from list.
 - *Standard Distribution System
 - *Pipe Insulation
 - *HERS-Verified Pipe Insulation

B. Installed Central Water Heating Systems Information

This table reports the water heating system information that is being installed. Require one line for each central system.

- 01 Water Heating System ID or Name – Reference information from Table A
- 02 Water Heating System Type – Reference information from Table A
- 03 Water Heater Type – Reference Information from Table A
- 04 # of Water Heaters in system – Reference information from Table A
- 05 Water Heater Storage Volume (gal) – User input. Value may be N/A if water heater type is instantaneous with zero storage..
- 06 Fuel Type – Reference information from Table A
- 07 Rated Input Type – Reference information from Table A
- 08 Rated Input Value – User input. Numerical value of the rated input. Must be equal to or less than value indicated on the NRCC-PRF-01
- 09 Heating Efficiency Type – Reference information from Table A
- 10 Heating Efficiency Value – User input. Numerical value of the Heating Efficiency. Must be equal to or higher efficiency than value indicated on the NRCC-PRF-01
- 11 Standby Loss – User input. Must be equal to or less than value indicated on the NRCC-PRF-01. Value may be N/A if NRCC-PRF-01 value is N/A.

12 Exterior Insul. R-Value – User input. Must be equal to or higher than value indicated on the NRCC-PRF-01. Value may be N/A if NRCC-PRF-01 value is N/A.

13 Central DHW System Distribution Type - Reference information from Table A

14 Dwelling Unit DHW System Distribution Type - Reference information from Table A

C. Installed Water Heater Manufacturer Information

This table reports the manufacturer information of the installed water heater(s). Require one line for each installed water heater

01 Water Heating System ID or Name – Reference information from NRCC-PRF-01.

02 Manufacturer – User input. Enter the name of the water heater manufacturer.

03 Model Number – User input. Enter the model number of the water heater.

D. HERS Verification Requirements for All Central Domestic Hot Water Recirculation Systems

This table lists the requirements for all central recirculation systems. HERS rater must ensure all the requirements on this table are met.

E Multiple Dwelling Units – Recirculation Temperature Modulation Control Requirements

This table only applies to systems indicated in A13 and B13 as **Recirculation Temperature Modulation Control**. In addition the mandatory requirements in Table D, the HERS rater must ensure the requirements on this table are met.

F. Multiple Dwelling Units – Recirculation Continuous Monitoring Systems Requirements

This table only applies to systems indicated in A13 and B13 as **Recirculation Continuous Monitoring Systems**. In addition the mandatory requirements in Table D, the HERS rater must ensure the requirements on this table are met.

G. Multiple Dwelling Units – Demand Recirculation Requirements

This table only applies to systems indicated in A13 and B13 as **Demand Recirculation**. In addition the mandatory requirements in Table D, the HERS rater must ensure the requirements on this table are met.

H. Multiple Dwelling Units – Non-Demand Control Recirculation Systems Requirements

This table only applies to systems indicated in A13 and B13 as **Non-Demand Control Recirculation Systems**. In addition the mandatory requirements in Table D, the HERS rater must ensure the requirements on this table are met.

I. HERS Verified Multiple Recirculation Loops for DHW Systems Serving Multiple Dwelling Units Requirements

This table applies to all systems identified on this form. This measure requires on site HERS verification that at least two central recirculation loops are included in the system design. This credit is available to buildings with 8 or more units. The recirculation loops must be relatively equal in length and supply approximately the same number of dwelling units.

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Dwelling Address:	City	Zip Code

A. General Information

This table reports the dwelling unit name that were specified on the NRCC-PRF-01 compliance document for this project.

01	Dwelling Unit Name

B. Design HERS Verified Dwelling Unit Water Heating Systems Information

This table reports the water heating system features that were specified on the NRCC-PRF-01 compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11	12	13	14
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in system	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value	Central DHW System Distribution Type	Dwelling Unit DHW System Distribution Type

C. Installed HERS Verified Dwelling Unit Water Heating Systems Information

01	02	03	04	05	06	07	08	09	10	11	12	13	14
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in system	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value	Central DHW System Distribution Type	Dwelling Unit DHW System Distribution Type
15	Compliance Statement:												

D. Installed Water Heater Manufacturer Information

01	02	03
Water Heating System ID or Name	Manufacturer	Model Number

Registration Number:

Registration Date/Time:

HERS Provider:



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E. Mandatory Measures for all Domestic Hot Water Distribution Systems	
01	<p>The following pipes are insulated, to the thicknesses required by Table 120.3A, except for those sections of pipe that are subject to one of the exceptions below: (RA4.4.1)</p> <ul style="list-style-type: none"> • The first 5 feet (1.5 meters) of hot and cold water pipes from the storage tank. • All piping with a nominal diameter of 3/4 inch (19 millimeter) or larger. • All piping associated with a domestic hot water recirculation system regardless of the pipe diameter, except when cold water return is used in a demand system. • Piping from the heating source to storage tank or between tanks. • Piping buried below grade. • All hot water pipes from the heating source to the kitchen fixtures. <p>The following sections of pipe do not have to be insulated: (RA4.4.1)</p> <ul style="list-style-type: none"> • Piping installed in interior or exterior walls that is surrounded on all sides by at least 1 inch of insulation. • Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top • Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members.
02	Piping buried below grade must be installed in a water proof and non-crushable casing or sleeve that allows for installation, removal, and replacement of the enclosed pipe and insulation. (Section 150.0(j))
03	All elbows and tees shall be fully insulated. (RA4.4.1)
04	Where insulation is required, no piping shall be visible due to insulation voids, and all insulation shall fit tightly to the pipe. (RA4.4.1)
05	Verification Status:
06	Correction Notes:
<p>The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.</p>	



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F. HERS-Verified Pipe Insulation Credit Requirements

Systems that utilize this distribution type shall comply with these requirements

01	All hot water piping shall comply with the insulation requirements in Table 120.3-A. (RA 4.4.14)	
02	Verification Status:	
03	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		

G. HERS-Verified Parallel Piping Requirements

Systems that utilize this distribution type shall comply with these requirements

01	Each central manifold has 5 feet or less of pipe between manifold and water heater. (RA 4.4.15)	
02	For manifolds that include valves, the manifold must be readily accessible in accordance with the plumbing code. (RA 4.4.4)	
03	Hot water distribution system piping from the manifold to the fixtures and appliances must take the most direct path. For example, piping from a second story manifold cannot supply the first floor. (RA 4.4.4)	
04	The hot water distribution piping must be separated by at least two inches from any other hot water supply piping, and at least six inches from any cold water supply piping. Alternatively, the hot water supply piping must be insulated to the thicknesses shown in TABLE 120.3-A. (RA 4.4.4)	
05	Verification Status:	
06	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		



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H. HERS-Verified Compact Hot Water Distribution System Requirements

Systems that utilize this distribution type shall comply with these requirements

01	Total Conditioned floor area (square feet)	
02	Maximum allowed pipe run length from the water heater to the furthest point of use For the floor area served (feet)	
03	The pipe run length from each water heater to the furthest fitting served by that water heater must be no greater than the maximum pipe run length above.	
04	Verification Status:	
05	Correction Notes:	

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

I. HERS-Verified Point of Use Requirements

Systems that utilize this distribution type shall comply with these requirements

01	<p>All hot water supply pipe run lengths are equal to or less than the maximum values shown below, based on the pipe diameter. If a combination of piping is used in a single run then one half the allowed length of each size is the maximum installed length.</p> <p>The maximum allowed length of piping for the longest run terminating in:</p> <p>3/8 inch - For only one pipe size - max length allowed is 15 feet For combination pipe sizes the max allowed length of 3/8 inch piping is 7.5 feet, of 1/2 inch piping is 5 feet, and 3/4 inch piping is 2.5 feet.</p> <p>1/2 inch - For only one pipe size - max length allowed is 10 feet For combination pipe sizes the allowed length of 1/2 inch piping is 5 feet, and 3/4 inch piping is 2.5 feet.</p> <p>3/4 inch - For only one pipe size = 5 feet</p>	
02	Verification Status:	
03	Correction Notes:	

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.



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Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

J. HERS-Verified Demand Recirculation Manual Control Requirements	
Systems that utilize this distribution type shall comply with these requirements	
01	The system operates “on-demand”, meaning that the pump begins to operate shortly before or immediately after hot water draw begins, and stops when the return water temperature reaches a certain threshold value. (RA4.4.13)
02	After the pump has been activated, the controls shall allow the pump to operate until the water temperature at the thermo-sensor rises to one of the following values: (RA4.4.13) <ul style="list-style-type: none"> • Not more than 10 degrees Fahrenheit (5.6 degrees Celsius) above the initial temperature of the water in the pipe • Not more than 102 degrees Fahrenheit (38.9 degrees Celsius).
03	The controls shall limit pump operation to a maximum of 10 minutes following any activation. This is provided in the event that the normal means of shutting off the pump have failed. (RA4.4.13)
04	Pump and control placement shall meet one of the following criteria: (RA4.4.13) <ul style="list-style-type: none"> • When a dedicated return line has been installed the pump, controls and thermo-sensor are installed at the end of the supply portion of the recirculation loop; or • The pump and controls are installed on the dedicated return line near the water heater and the thermo-sensor is installed in an accessible location as close to the end of the supply portion of the recirculation loop as possible, or • When the cold water line is used as the return, the pump, demand controls and thermosensor shall be installed in an accessible location at the end of supply portion of the hot water distribution line (typically under a sink).
05	Insulation is not required on the cold water line when it is used as the return. (RA4.4.13)
06	Each control shall have standby power of 1 Watt or less. Controls may be located in individual units or on the loop. Controls may be activated by wired or wireless mechanisms, including buttons, motion sensors, door switches and flow switches. (RA4.4.13)
07	If more than one loop installed each loop shall have its own pump and controls
08	Automatic Air release valve is installed on the inlet side of the recirculation pump per Section 110.3(c)5A.
09	A check valve is located between the recirculation pump and the water heater per Section 110.3(c)5B.
10	Hose bibb is installed between the pump and the water heating equipment with an isolation valve between the hose bibb and the water heating equipment per Section 110.3(c)5C.
11	Isolation valves are installed on both sides of the pump. One of the isolation valves may be the same isolation valve as in item 10 above per Section 110.3(c)5D.
12	The cold water supply piping and the recirculation loop piping is not connected to the hot water storage tank drain port per Section 110.3(c)5E.

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Dwelling Address:	City	Zip Code

13	A check valve is installed on the cold water supply line between the hot water system and the next closest tee on the cold water supply per Section 110.3(c)5F.	
14	Verification Status:	
15	Correction Notes:	
<p>The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.</p>		

For information and data collection only. Not valid until registered with a HERS provider



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Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

K. HERS-Verified Demand Recirculation Sensor Control Requirements	
Systems that utilize this distribution type shall comply with these requirements	
01	The system operates "on-demand", meaning that the pump begins to operate shortly before or immediately after hot water draw begins, and stops when the return water temperature reaches a certain threshold value. (RA4.4.13)
02	After the pump has been activated, the controls shall allow the pump to operate until the water temperature at the thermo-sensor rises to one of the following values: (RA4.4.13) <ul style="list-style-type: none"> • Not more than 10 degrees Fahrenheit (5.6 degrees Celsius) above the initial temperature of the water in the pipe • Not more than 102 degrees Fahrenheit (38.9 degrees Celsius).
03	The controls shall limit pump operation to a maximum of 10 minutes following any activation. This is provided in the event that the normal means of shutting off the pump have failed. (RA4.4.13)
04	Pump and control placement shall meet one of the following criteria: (RA4.4.13) <ul style="list-style-type: none"> • When a dedicated return line has been installed the pump, controls and thermo-sensor are installed at the end of the supply portion of the recirculation loop; or • The pump and controls are installed on the dedicated return line near the water heater and the thermo-sensor is installed in an accessible location as close to the end of the supply portion of the recirculation loop as possible, or • When the cold water line is used as the return, the pump, demand controls and thermosensor shall be installed in an accessible location at the end of supply portion of the hot water distribution line (typically under a sink).
05	Insulation is not required on the cold water line when it is used as the return. (RA4.4.13)
06	Each control shall have standby power of 1 Watt or less. Controls may be located in individual units or on the loop. Controls may be activated by wired or wireless mechanisms, including buttons, motion sensors, door switches and flow switches. (RA4.4.13)
07	If more than one loop installed each loop shall have its own pump and controls
08	Automatic Air release valve is installed on the inlet side of the recirculation pump per Section 110.3(c)5A.
09	A check valve is located between the recirculation pump and the water heater per Section 110.3(c)5B.
10	Hose bibb is installed between the pump and the water heating equipment with an isolation valve between the hose bibb and the water heating equipment per Section 110.3(c)5C.
11	Isolation valves are installed on both sides of the pump. One of the isolation valves may be the same isolation valve as in item 8 above per Section 110.3(c)5D.
12	The cold water supply piping and the recirculation loop piping is not connected to the hot water storage tank drain port per Section 110.3(c)5E.

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Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

13	A check valve is installed on the cold water supply line between the hot water system and the next closest tee on the cold water supply per Section 110.3(c)5F.	
14	Verification Status:	
15	Correction Notes:	
<p>The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.</p>		

L. Determination of HERS Verification Compliance	
All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.	
01	

For information and data collection only. Not valid until registered with a HERS provider

HERS VERIFIED SINGLE DWELLING UNIT HOT WATER SYSTEM DISTRIBUTION

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Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Verification documentation is accurate and complete.	
Name:	Signature:
Company:	Date:
Address:	CEA / HERS Certification Identification (if applicable):
City/State/Zip:	Phone:
RESPONSIBLE PERSON'S DECLARATION STATEMENT	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> The information provided on this Certificate of Verification is true and correct. I am the certified HERS Rater who performed the verification identified and reported on this Certificate of Verification (responsible rater). The installed features, materials, components, manufactured devices, or system performance diagnostic results that require HERS verification identified on this Certificate of Verification comply with the applicable requirements in Reference Nonresidential Appendices NA1 and NA2, and the requirements specified on the Certificate of Compliance for the building approved by the enforcement agency. The information reported on applicable sections of the Certificate(s) of Installation (NRCI), signed and submitted by the person(s) responsible for the construction or installation conforms to the requirements specified on the Certificate(s) of Compliance (NRCC) approved by the enforcement agency. I will ensure that a registered copy of this Certificate of Verification shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Verification is required to be included with the documentation the builder provides to the building owner at occupancy. 	
BUILDER OR INSTALLER INFORMATION AS SHOWN ON THE CERTIFICATE OF INSTALLATION	
Company Name (Installing Subcontractor or General Contractor or Builder/Owner):	
Responsible Builder/Installer Name:	CSLB License:
HERS PROVIDER DATA REGISTRY INFORMATION	
Sample Group Number (if applicable):	Dwelling Test Status in Sample Group (if applicable)
HERS RATER INFORMATION	
HERS Rater Company Name:	
Responsible Rater's Name:	Responsible Rater's Signature:
Responsible Rater's Certification Number w/ this HERS Provider	Date Signed:

Registration Number:

Registration Date/Time:

HERS Provider:

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance

May 2015

Instructions to NRCV-PLB-22-H**A. Dwelling Unit Name**

01 This identifies the dwelling unit on this form and is reference from the NRCC-PRF-01. One form is required for each dwelling unit in the building.

B. Design Central Water Heating Systems Information

This table reports the water heating system features that were specified on the registered NRCC-PRF-01 compliance document for this project.

01 Water Heating System ID or Name – User input

02 Water Heating System Type – User input. The different kinds of water heating system type are DHW or Combined Hydronic

03 Water Heater Type – User input. The different kinds of water heaters are Large Storage, Small Storage, Heat Pump, Boiler, Large Instantaneous, Small Instantaneous or Indirect

04 # of Water Heaters in system – User input.

05 Water Heater Storage Volume (gal) – User input. Value may be N/A if water heater type is instantaneous with zero storage.

06 Fuel Type – User input. The different kinds of fuel types are natural gas, propane, oil, or electricity.

07 Rated Input Type – User input. For natural gas, propane and oil fuel type the input type is Btu/Hr. For electric the input type is kW

08 Rated Input Value – User input. Numerical value of the rated input. Must be equal to or less than value indicated on the NRCC-PRF-01

09 Heating Efficiency Type – User input. Different efficiency types are Energy Factor, AFUE, and Thermal Efficiency

10 Heating Efficiency Value – User input. Numerical value of the Heating Efficiency. Must be equal to or higher efficiency than value indicated on the NRCC-PRF-01

11 Standby Loss – User input. Value may be N/A if NRCC-PRF-01 value is N/A.

12 Exterior Insul. R-Value – User input. Value may be N/A if NRCC-PRF-01 value is N/A.

13 Central DHW System Distribution Type - User input from list

*N/A

* Recirculation Temperature Modulation Control

* Recirculation Continuous Monitoring Systems

* Demand Recirculation

* Non-demand control Recirculation Systems

* Recirculation Temperature Modulation Control with HERS-Verified Multiple Loops

* Recirculation Continuous Monitoring Systems with HERS-Verified Multiple Loops

* Demand Recirculation with HERS-Verified Multiple Loops

* Non-demand control Recirculation Systems with HERS-Verified Multiple Loops

14 Dwelling Unit DHW System Distribution Type - User input from list. For Single Dwelling systems pick from

* HERS-Verified Pipe Insulation Credit

* HERS-Verified Parallel Piping

* HERS-Verified Compact Hot Water Distribution System

* HERS-Verified Point of Use

* HERS-Verified Demand Recirculation Manual Control

* HERS-Verified Demand Recirculation Sensor Control for Central Systems,

*HERS-Verified Pipe Insulation

C. Installed Central Water Heating Systems Information

This table reports the water heating system information that is being installed. Require one line for each system.

- 01 Water Heating System ID or Name – Reference information from Table A
- 02 Water Heating System Type – Reference information from Table A
- 03 Water Heater Type – Information from Table A 04 # of Water Heaters in system – Reference information from Table A
- 05 Water Heater Storage Volume (gal) – User input. Value may be N/A if water heater type is instantaneous with zero storage..
- 06 Fuel Type – Reference information from Table A
- 07 Rated Input Type – Reference information from Table A
- 08 Rated Input Value – User input. Numerical value of the rated input. Must be equal to or less than value indicated on the NRCC-PRF-01
- 09 Heating Efficiency Type – Reference information from Table A
- 10 Heating Efficiency Value – User input. Numerical value of the Heating Efficiency. Must be equal to or higher efficiency than value indicated on the NRCC-PRF-01
- 11 Standby Loss – User input. Must be equal to or less than value indicated on the NRCC-PRF-01. Value may be N/A if NRCC-PRF-01 value is N/A.
- 12 Exterior Insul. R-Value – User input. Must be equal to or higher than value indicated on the NRCC-PRF-01. Value may be N/A if NRCC-PRF-01 value is N/A.
- 13 Central DHW System Distribution Type - Reference information from Table A
- 14 Dwelling Unit DHW System Distribution Type - Reference information from Table A

D. Installed Water Heater Manufacturer Information

This table reports the manufacturer information of the installed water heater(s). Require one line for each installed water heater

- 01 Water Heating System ID or Name – Reference information from NRCC-PRF-01.
- 02 Manufacturer – User input. Enter the name of the water heater manufacturer.
- 03 Model Number – User input. Enter the model number of the water heater.

E. MANDATORY MEASURES FOR ALL DOMESTIC HOT WATER DISTRIBUTION SYSTEMS

This table lists the requirements for all central recirculation systems. HERS rater must ensure all the requirements on this table are met.

F. HERS-Verified Pipe Insulation Credit Requirements

This table only applies to systems indicated in B14 and C14 as **HERS-Verified Pipe Insulation Credit**. In addition the mandatory requirements in Table E, the HERS rater must ensure the requirements on this table are met.

G. HERS-Verified Parallel Piping Requirements

This table only applies to systems indicated in B14 and C14 as **HERS-Verified Parallel Piping**. In addition the mandatory requirements in Table E, the HERS rater must ensure the requirements on this table are met.

H. HERS-Verified Compact Hot Water Distribution System Requirements

This table only applies to systems indicated in B14 and C14 as **HERS-Verified Compact Hot Water Distribution System**. In addition the mandatory requirements in Table E, the HERS rater must ensure the distance between the water heater to furthest point of water use does not exceed the maximum indicated in Table H1 below. Calculated the Floor Area Served by dividing the conditioned floor area by the number of installed water heaters (Floor Area Served= CFA/# of WH). In addition all hot water lines shall be insulated.

Floor Area Served (ft ²)	Maximum Measured Water Heater To Use Point Distance (ft)
< 1000	28
1001 – 1600	43
1601 – 2200	53
2201 – 2800	62
>2800	68

I. HERS-Verified Point of Use Requirements

This table only applies to systems indicated in B14 and C14 as **HERS-Verified Point of Use**. In addition to the mandatory requirements in Table E, the HERS rater must ensure the distance between the water heater to furthest point of water use does not exceed the maximum indicated in Table H1 below. If a combination of piping is used in a single run then one half the allowed length of each size is the maximum installed length. In addition all hot water lines shall be insulated.

Size Nominal, Inch	Maximum Measured Water Heater To Use Point Distance Length of Pipe (feet)
3/8"	15
1/2"	10
3/4"	5

J. HERS-Verified Demand Recirculation Manual Control Requirements

This table only applies to systems indicated in B14 and C14 as **HERS-Verified Demand Recirculation Manual Control**. In addition to the mandatory requirements in Table E, the HERS rater must ensure the requirements on this table are met.

K. HERS-Verified Demand Recirculation Sensor Control Requirements

This table only applies to systems indicated in B14 and C14 as **HERS-Verified Demand Recirculation Sensor Control**. In addition to the mandatory requirements in Table E, the HERS rater must ensure the requirements on this table are met.