Guidelines for Home Energy Professionals: 2023 Standard Work Specifications (SWS) Redline Report

Guidelines for Home Energy Professionals Project

National Renewable Energy Laboratory (NREL)

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Introduction

The SWS define the minimum requirements to ensure that the work performed during home energy upgrades is effective, durable, and safe. The SWS can be used as an industry guide for workers, training instructors, homeowners, and program administrators involved in the home performance industry. In order for the SWS to remain a reliable and accurate industry resource, the SWS is maintained every five years. The table below explains the five-year maintenance cycle, which allows for comments to be accepted and adjudicated by the SWS committees.

		Tear 5
FY2021 FY2022 FY Public comments received on the 2020 update Public comments received on the 2020 update Co adj put comments received on the 2020 update Q4: Comment deadline for 2023 redline input En	2023FY2024mmittees udicate blic mments on e 2020 datePublic comments received on the 2023 redlined Q3: Draft 23 redline oducedQ4: Deadlin for commer on the 2023 redline	FY2025 Committees adjudicate public comments for the 2023 redline End Q3: Draft 2025 update produced End Q4: 2025 update

*The U.S. Federal Government's Fiscal Year (FY) runs from October 1st to September 30th every year and is divided into four quarters:

- Q1 Fiscal Year First Quarter runs from October 1st to December 31st
- $\ensuremath{\mathsf{Q2}}\xspace$ Fiscal Year Second Quarter runs from January 1st to March 31st
- $\ensuremath{\mathsf{Q3}}\xspace$ Fiscal Year Third Quarter runs from April 1st to June 30th
- Q4 Fiscal Year Fourth Quarter runs from July 1st to September 30th

During years one and two (FY 2021 and FY 2022) of the current five-year maintenance cycle of SWS, public comments on the most recent SWS were collected. In the beginning of year three (FY 2023), NREL coordinated the review of submitted comments on the SWS with the SWS maintenance committees which resulted in redline changes.

This document highlights the redline changes that have been accepted by the SWS committee, and communicates the forthcoming changes to the SWS, providing stakeholders with an opportunity to respond to such redline changes. This is the only redline that will be produced during the five-year cycle.

Looking ahead into year four (FY 2024), public comments on the redlined SWS will be collected. In the fifth and final year (FY 2025), the SWS committees will review and adjudicate public comments received for the redline in year four. A revised version of the SWS will be produced and published by

the end of year five. This cycle will repeat starting the following year.

2023 Maintenance Update – Standard Work Specifications (SWS) Redline to address comments received between August 2020 and October 2022

SWS redlined changes are based on methodology which confirmed the relevance and applicability of existing content while removing duplicative details across housing types. Any specifications that dictate building analysis practices, safety practices, or measure selection were removed as these items do not align with the intent of the SWS. Most occupant education specifications were removed along with specifications that would be difficult to verify at a final inspection site. Updates to the SWS also prioritized removing specifications that simply referenced outside standards but provided no actual installation details. If a referenced standard met the intent of the SWS, language from that standard was added instead of requiring the user to look elsewhere, which often involved an additional cost. The updates described above reduced the volume of specifications by 50% without losing relevant information, while improving the organizational structure and ease of use. A total of 56 comments have been adjudicated through the Committee review process of comments received from August 2020 through October 2022.

This 2023 SWS Maintenance document tracks all comments to the SWS while allowing stakeholders a method to view comments, changes, and the rationale behind them. Stakeholders are encouraged to provide feedback on the proposed changes directly in the online SWS tool. The redline version is open for public comment through September 30, 2024.

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2.0202.2	Vented Subspaces - Ground Cover
Торіс	Moisture
Subtopic	Ground Vapor Retarders
Desired Outcome	Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

Title	Specification(s)	Objective(s)	Housing Type(s)
2.0202.2c Coverage	Cover all exposed soil	Create a continuous	Single Family Site-Built
		ground vapor retarder	Housing, Manufactured
	Extend ground vapor	layer that does not	Housing, Multifamily
	retarder a minimum of	compromise wooden	Housing
	6" up all foundation	foundation materials	
	walls and piers, but		
	<mark>do</mark> Do not install in		
	contact with non-treated		
	structural wood		

2.0202.2	Vented Subspaces - Ground Cover
Торіс	Moisture
Subtopic	Ground Vapor Retarders
Desired Outcome	Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

Title	Specification(s)	Objective (s)	Housing Type(s)
2.0202.2g <mark>Air Scaling</mark>	Seal all penetrations in	Ensure ground vapor	Single Family Site-Built
	the ground vapor	retarder is air tight	Housing, Manufactured
	retarder with a		Housing, Multifamily
	compatible scalant		Housing

2.0202.3	Pier and Skirting Foundations - Ground Cover
Торіс	Moisture
Subtopic	Ground Vapor Retarders
Desired Outcome	Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

Title	Specification(s)	Objective(s)	Housing Type(s)
2.0202.3b Coverage	Cover all exposed soil	Create a continuous	Single Family Site-Built
		ground vapor retarder	Housing, Manufactured
	Extend ground vapor	layer that does not	Housing
	retarder a minimum of	compromise wooden	
	6" up all foundation	foundation materials	
	walls and piers, but		
	<mark>do</mark> Do not install in		
	contact with non-treated		
	structural wood		

3.0102.1	Sealing Non-Insulation Contact (IC) Recessed Light
Торіс	General Pressure Boundary
Subtopic	Specific Air Sealing
Desired Outcome	Airtight, durable, and fire safe enclosure that remains in place and prevents air
	movement @ 50 Pascals of pressure

Title	Specification(s)	Objective (s)	Housing Type(s)
3.0102.1c Clearance	Maintain a minimum	Prevent overheating of	Single Family Site-Built
	clearance of 3 inches	fixture	Housing, Manufactured
	between enclosure and		Housing, Multifamily
	all portions of fixture		Housing
	(e.g. wiring, box, and		
	ballast)		
	Enclosure must be at		
	least as tall as the		
	surrounding insulation		
	Note: Installing an LED		
	bulb in a non-IC rated		
	fixture does not change		
	the rating of the fixture		
	or the need for an		
	airtight enclosure.		

3.0201.1	Window Air Sealing
Торіс	Shell Components
Subtopic	Windows
Desired Outcome	Weathertight window repairs

Title	Specification(s)	Objective (s)	Housing Type(s)
3.0201.1i Safety	Verify safe operation	Safe egressoperation	Single Family Site-Built
	and size of egress	maintained	Housing, Manufactured
	windows as required by		Housing, Multifamily
	local codes		Housing

4.0102.1	SPF Roof Insulation - Unvented Roof Deck
Торіс	Attics
Subtopic	Interior Roof Insulation
Desired Outcome	Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50
	Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0102.1c Material	Select insulation	Select fire safe	Single Family Site-Built
selection	materials that do not	insulation	Housing, Manufactured
	exceed a perm rating of		Housing, Multifamily
	2 and have a flame		Housing
	spread and smoke		
	development index of		
	75/450 or less when		
	tested in accordance		
	with ASTM E84 or UL		
	723		

4.0104.2	Knee Wall - Batt Insulation
Торіс	Attics
Subtopic	Attic Knee Walls
Desired Outcome	Continuous, contiguous, safe, and compliant thermal boundary that prevents air
	movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0104.2a Pre-work	Verify that installation	Prepare for safe,	Single Family Site-Built
qualifications	area is free of:	effective, and airtight	Housing, Manufactured
		installation of <mark>dense-</mark>	Housing, Multifamily
	active water leaks, fuel	<mark>packed</mark> knee wall batt	Housing
	leaks (i.e., gas, oil,	insulation	
	propane), and pest		
	intrusions		
	energized knob and tube		
	wiring		
	uncovered electrical		
	junctions		
	improperly terminated		
	devices (ventilation fans,		
	dryers, plumbing stacks,		
	condensate lines,		
	combustion appliance		
	flues/chimneys, etc.)		
	unshielded high-		

Title	Specification(s)	Objective (s)	Housing Type(s)
	temperature devices		
	(non-IC rated recessed		
	lights, chimneys, flues,		
	vents, etc.) unless they		
	are zero clearance		
	devices		
	insulation escape		
	openings		
	Verify that installation		
	area is:		
	intact, able to support		
	insulation weight, and		
	air sealed (including		
	blockers under		
	kneewalls in alignment		
	with the interior side of		
	the kneewall)		

4.0104.2	Knee Wall - Batt Insulation
Торіс	Attics
Subtopic	Attic Knee Walls
Desired Outcome	Continuous, contiguous, safe, and compliant thermal boundary that prevents air
	movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0104.2e Install	Install an airtight vapor	Airtight, vapor	Single Family Site-Built
backing	permeable backing	permeable, and durable	Housing, Manufactured
	material in full contact	insulation <mark>cavity</mark>	Housing, Multifamily
	with the existing cavity	protection	Housing
	insulation		
	Secure backing material		
	using mechanical		
	fasteners that penetrate		
	the sub framing a		
	minimum of 1"		
	Installation must have a		
	minimum of a 30-year		
	service life		

4.0202.6	SPFInjection Foam Insulation Installation in Closed Cavities
Торіс	Walls
Subtopic	Enclosed Walls
Desired Outcome	Continuous, contiguous, and safe thermal boundary

4.0401.3	Rigid Insulation
Торіс	Conditioned Subspaces
Subtopic	Rim/Band Joist
Desired Outcome	Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50
	Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0401.3d BattInsulation	Install rigid insulation to	Continuous and	Single Family Site-Built
installation	prescribed R-value in	contiguous thermal	Housing, Multifamily
	every joist bay in full	boundary	Housing
	contact with the		
	rim/band joist air barrier		
	and all sides of the		
	cavity without gaps,		
	voids, or misalignments		

4.0402.1	Closed Crawlspace - Non-Foam Insulation
Торіс	Conditioned Subspaces
Subtopic	Walls
Desired Outcome	Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that
	prevents air movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0402.1b Material	Select insulation that:	Select fire safe and	Single Family Site-Built
selection		moisture	Housing, Multifamily
	has a flame	resistant hydrophobic	Housing
	spread/smoke	materials	
	development index of		
	25/450 or less when		
	tested in accordance		
	with ASTM E 84 or UL		
	723		
	is, or include a facing		
	that is, a class II vapor		
	retarder		
	is <mark>non-</mark> not		
	water absorbent		

4.0402.1	Closed Crawlspace - Non-Foam Insulation
Торіс	Conditioned Subspaces
Subtopic	Walls
Desired Outcome	Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that
	prevents air movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0402.1e Installation	Install insulation to	Contiguous and	Single Family Site-Built
	prescribed R-value in	continuous thermal	Housing, Multifamily
	full contact with the	barrier	Housing
	foundation wall <mark>from</mark>		
	<mark>ceiling to floor</mark> with		
	vapor retarder facing the		
	conditioned space		

4.0402.2	Closed Crawlspace - Rigid Foam Insulation
Торіс	Conditioned Subspaces
Subtopic	Walls
Desired Outcome	Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that
	prevents air movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0402.2f Installation	Install insulation to	Contiguous and	Single Family Site-Built
	prescribed R-value in a	continuous thermal	Housing, Multifamily
	continuous layer in full	barrier	Housing
	contact with the		
	foundation wall <mark>from</mark>		
	ceiling to floor		
	If installing multiple		
	layers, offset seams by a		
	minimum of 12" and		
	seal the seams and joints		
	of each layer before		
	installing the next layer		

4.0402.3	Closed Crawlspace - SPF Insulation
Торіс	Conditioned Subspaces
Subtopic	Walls
Desired Outcome	Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that
	prevents air movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0402.3f Installation	Install insulation to	Continuous thermal	Single Family Site-Built
	prescribed R-value in a	barrier which prevents	Housing, Multifamily
	continuous layer in full	air and moisture vapor	Housing
	contact with the	movement	
	foundation wall <mark>from</mark>		
	ceiling to floor using a		
	pass thickness maximum		
	in accordance with		
	manufacturer		
	specifications		
	Install SPF to a		
	thickness of at least a		
	class II vapor retarder		

4.0402.4	Basements - Without Groundwater Leakage
Торіс	Conditioned Subspaces
Subtopic	Walls
Desired Outcome	Continuous, contiguous, moisture resistant, and safe thermal boundary that prevents
	air movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0402.4e Installation	Install insulation to	Contiguous and	Single Family Site-Built
	prescribed R-value in	continuous thermal	Housing, Multifamily
	full contact with the	barrier	Housing
	entire perimeter		
	<mark>of-</mark> foundation wall <mark>-from</mark>		
	ceiling to floor		
	If insulation has a vapor		
	retarder on only one side		
	install it facing the		
	conditioned space		

4.0402.5	Basements - With Groundwater Leakage
Торіс	Conditioned Subspaces
Subtopic	Walls
Desired Outcome	Continuous, contiguous, moisture resistant, and safe thermal boundary that prevents
	air movement @ 50 Pascals

Title	Specification(s)	Objective (s)	Housing Type(s)
4.0402.5d Installation	Install insulation to	Contiguous and	Single Family Site-Built
	prescribed R-value in a	continuous thermal	Housing, Multifamily
	continuous boundary	barrier	Housing
	around the <mark>entire-</mark>		
	perimeter of foundation		
	wall -from top of band		
	<mark>joist to floor,</mark> in contact		
	with any waterproof		
	membrane that exists at		
	the foundation wall		

5.0106.3	Duct Sealing - Proprietary Spray Application
Торіс	Forced Air
Subtopic	Duct Sealing
Desired Outcome	Ducts safely sealed to prevent air leakage

Title	Specification(s)	Objective(s)	Housing Type(s)
5.0106.3a Material	Select sealant that is UL	Select safe and effective	Single Family Site-Built
selection	<mark>181-</mark> approved	sealant	Housing, Manufactured
			Housing, Multifamily
			Housing

6.0201.1	Surface Mounted
Торіс	Local Ventilation
Subtopic	Exhaust Systems
Desired Outcome	Efficient, safe, quiet, and effective removal of air contaminants from area

Title	Specification(s)	Objective (s)	Housing Type(s)
6.0201.1a Fan selection	Select a fan that:	Select efficient and quiet	Single Family Site-Built
		equipment	Housing, Manufactured
	-producesrated as no		Housing, Multifamily
	more than 2.0 sones at		Housing
	maximum speed		
	has an efficacy of 4		
	cfm/watt or more		
	moves at least 50 cfm		
	after installation,		
	ducting, and termination		
	is complete		

6.0201.1	Surface Mounted
Торіс	Local Ventilation
Subtopic	Exhaust Systems
Desired Outcome	Efficient, safe, quiet, and effective removal of air contaminants from area

Title	Specification(s)	Objective (s)	Housing Type(s)
6.0201.1c Damper	If the fan does not	Prevent unwanted air	Single Family Site-Built
	contain an integrated	movement while not	Housing, Manufactured
	damper, install a damper	restricting desired air	Housing, Multifamily
	that:	flow	Housing
	opens in the direction of		
	the desired flow		
	closes when the system		
	is off		
	fan housing connections		
	shall not interfere with		
	damper operation		

6.0202.1	Clothes Dryer
Торіс	Local Ventilation
Subtopic	Appliance Exhaust
Desired Outcome	Dryer vented to outdoors safely and effectively

Title	Specification(s)	Objective (s)	Housing Type(s)
6.0202.1a Duct selection	Select The transition	Smooth airflow that does	Single Family Site-Built
	ducts (flexible or rigid)	not collect lint	Housing, Manufactured
	used to connect the dryer		Housing, Multifamily
	transition ducting		Housing
	materials that are to the		
	primary exhaust duct		
	system shall be UL		
	2158A approved and		
	less than 8 feet in total		
	length with no joints.		
	Select primary dryer		
	ducting material that is		
	28 gauge metal with a		
	smooth interior		

6.0202.1	Clothes Dryer
Торіс	Local Ventilation
Subtopic	Appliance Exhaust
Desired Outcome	Dryer vented to outdoors safely and effectively

Title	Specification(s)	Objective (s)	Housing Type(s)
6.0202.1b Venting	Vent all clothes dryers to	Dryer ducted to outdoors	Single Family Site-Built
installation	the outdoors, which does	durably and effectively	Housing, Manufactured
	not include		Housing, Multifamily
	unconditioned spaces		Housing
	such as attics and crawl		
	spaces that are ventilated		
	with the outdoors		
	Choose the shortest		
	practical installation		
	path		
	Install a dryer <mark>booster</mark>		
	<mark>fan</mark> exhaust duct power		
	ventilator that is listed		
	and labeled to UL 705		
	for dryer ducts		
	exceeding 35' in		
	equivalent length		
	Install ducts according to		
	SWS detail for		
	"Ventilation Ducts"		

7.0103.3	Ballast Replacement
Торіс	Plug Load
Subtopic	Lighting
Desired Outcome	Improved lighting efficacy without performance loss

Title	Specification(s)	Objective (s)	Housing Type(s)
7.0103.3c Disposal	Permanently remove	Old equipment is	Single Family Site-Built
	equipment from job site	permanently removed	Housing, Manufactured
	and recycle or dispose of	from service, protect the	Housing, Multifamily
	removed equipment and	environment, and	Housing
	<mark>refrigerant</mark> ballast in	comply with regulation	
	accordance with local		
	and federal law (e.g.,		
	EPA Section 608Part		
	761 in Title 40 of <mark>Clean</mark>		
	Air Actthe Code of		
	<mark>1990</mark> Federal		
	Regulations)		
	Permanently		
	decommission old		
	equipment		

7.0301.2	Tank Insulation
Торіс	Water Heating
Subtopic	Thermal Loss Reduction
Desired Outcome	Safely reduce standby loss from storage tanks

Title	Specification(s)	Objective (s)	Housing Type(s)
7.0301.2d Clearance	Maintain a minimum	Prevent a fire hazard	Single Family Site-Built
	clearance of 6" or the		Housing, Manufactured
	distance specified by the		Housing, Multifamily
	manufacturer between		Housing
	combustible tank		
	insulation and fuel-fired		
	water heater draft hood		
	and/or single wall metal		
	vent materials		
	Do not wrap the top of		
	fuel-fired water heaters		
	or cover combustion air		
	intakes		

7.0302.1	Electric Storage Tank Water Heater
Торіс	Water Heating
Subtopic	Water Heater Installation
Desired Outcome	Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible
	water heater

Title	Specification(s)	Objective (s)	Housing Type(s)
7.0302.1f TandP valve	Install a Temperature	Direct scalding water	Single Family Site-Built
and piping	and Pressure (TandP)	away from occupants	Housing, Manufactured
	relief valve per the IRC		Housing, Multifamily
	and manufacturer		Housing
	specifications		
	Pipe the valve to		
	within 6" of or less from		
	the floor or drain pan or		
	to the outdoors and must		
	terminate in an		
	observable location		
	Select piping material		
	based on IRC		
	requirements		

7.0302.2	Fuel-Fired Storage Tank Water Heater		
Торіс	Water Heating		
Subtopic	Water Heater Installation		
Desired Outcome	Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible		
	water heater		

Title	Specification(s)	Objective (s)	Housing Type(s)
7.0302.2b Equipment	Select a system that:	Select <mark>efficient</mark> safe,	Single Family Site-Built
selection		durable, and properly	Housing, Manufactured
	is ENERGY STAR	sized water heater	Housing, Multifamily
	certified,		Housing
	equivalent,rated 0.70		
	UEF or better		
	includes a low nitrogen		
	oxide burner		
	fits in the installation		
	space with required		
	clearances		
	provides sufficient hot		
	water for the home and		
	occupants		
	For Manufactured		
	Housing only:		
	Select a system that:		

Title	Specification(s)	Objective (s)	Housing Type(s)
	is listed and labeled for		
	installation in		
	Manufactured Homes		
	drafts all its combustion		
	air from outside the		
	dwelling		
	fits in the installation		
	space with required		
	clearances		
	provides sufficient hot		
	water for the home and		
	occupants		

7.0302.3	Heat Pump Storage Tank Water Heater
Торіс	Water Heating
Subtopic	Water Heater Installation
Desired Outcome	Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible
	water heater

Title	Specification(s)	Objective (s)	Housing Type(s)
7.0302.3c Location	Install appliance where	Select indoor, safe, and	Single Family Site-Built
	it:	accessible location with	Housing, Manufactured
		sufficient air volume	Housing, Multifamily
	is in conditioned space a		Housing
	location above the		
	minimum temperature		
	specified by the		
	equipment manufacturer		
	is accessible for service		
	has sufficient volume of		
	air per manufacturer		
	specifications		
	will not affect indoor		
	thermostat readings or		
	blow directly on		
	occupants		