"Minimum Spray Application Rates of Original Undiluted and Diluted Emulsions"

2010 and 2015 Standard Specification Sec 39 Tack Coat Minimum Residual Rates

Residual Rate is amount of bituminous material left on sprayed surface after water and emulsifying/stabilizing agents evaporate.

	Type A, RHMA-G				OGFC		
Sec 39 Required Tack Residual Rates (gal/sy) **HMA Over:**	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	CRS1/CRS2, RS1/RS2 and QS1/CQS1	Asphalt Binder and PMRS2/ PMCRS2 and PMRS2h/ PMCRS2h		CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	CRS1/CRS2, RS1/RS2 and QS1/CQS1	Asphalt Binder and PMRS2/ PMCRS2 and PMRS2h/ PMCRS2h
New HMA (Between Layers)	**0.02**	**0.03**	**0.02**		**0.03**	**0.04**	**0.03**
Concrete pavement and existing asphalt concrete surfacing	**0.03**	**0.04**	**0.03**		**0.05**	**0.06**	**0.04**
Planed Pavement	**0.05**	**0.06**	**0.04**		**0.06**	**0.07**	**0.05**

"Minimum Spray Application Rates of Original Undiluted and Diluted Emulsions"

necessary to achieve Sec 39 "Tack Coat Minimum Residual Rates" in the above table.

Note: Only Slow Setting (SS) or Quick Setting (QS) emulsions are dilutable. Refer to Caltrans "Tack Coat Guidelines" for additional information.

For Engineers Estimating purposes, determine total gallons of "undiluted emulsion" required, add 10% , then divide by by 240 gal/ ton emulsion, or use guidance in Tack Coat Guidelines.

(*) Use caution when the tack coat application rate is above 0.15 gal/sy because of the possibility for tack coat pudding and tack coat runoff.

(**) Spray nozzles limit minimum application rate to 0.05 gal/sy. **Spray application rates closer to 0.10 gal / sy are recommended as they promote more even coverage.**

As spray rates are "minimum", they are rounded up to the nearest 0.01 gal/sy. Calc'd rates are based on volume at 60F, any theoretical adjustment for higher temp is deemed negligible.

$$\text{Min Spray Application Rate } \left(\frac{gal}{sy}\right) = \frac{\text{SS Sec 39 Min Residual Rate } \left(\frac{gal}{sy}\right)}{(\text{SS Sec 94 \% Min Residue by distillation}/100)x(\%\ \text{original emulsion}/100)}; \quad \text{rounded up to nearest } 0.01\ \frac{gal}{sy}$$

Undiluted Emulsion

100.00% Original Emulsion, 0% Added Water, Undiluted Application Rates (gal/sy)

	Type A, RHMA-G							OGFC						
HMA Over:	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h
Sec 94 Residue by distillation, %	57%	55%	57%	60%	63%	65%	65%	57%	55%	57%	60%	63%	65%	65%
New HMA (Between Layers)	**0.04	0.06	0.06	0.05	0.05	0.05	0.04	0.06	0.08	0.08	0.07	0.07	0.07	0.05
Concrete pavement and existing asphalt concrete surfacing	0.06	0.08	0.08	0.07	0.07	0.07	0.05	0.09	0.11	0.11	0.10	0.10	0.10	0.07
Planed Pavement	0.09	0.11	0.11	0.10	0.10	0.10	0.07	0.11	0.13	0.13	0.12	0.12	0.11	0.08

** calculated value of 0.04 gal/sy. Spray nozzles limit minimum application rate is 0.05gal/sy

Diluted 90/10 (1:9) (Added Water : Orig Emulsion)

90.00% Original Emulsion, 10% Added Water (90/10), Diluted Application Rates (gal/sy)

	Type A, RHMA-G							OGFC						
HMA Over:	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h
Sec 94 Residue by distillation, %	57%	55%	57%	60%	63%	65%	65%	57%	55%	57%	60%	63%	65%	65%
New HMA (Between Layers)	**0.04	--	0.06	--	--	--	--	0.06	--	0.08	--	--	--	--
Concrete pavement and existing asphalt concrete surfacing	0.06	--	0.08	--	--	--	--	0.10	--	0.12	--	--	--	--
Planed Pavement	0.10	--	0.12	--	--	--	--	0.12	--	0.14	--	--	--	--

-- Non Dilutable

** calculated value of 0.04 gal/sy. Spray nozzles limit minimum application rate is 0.05gal/sy

Diluted 80/20 (1:4) (Added Water : Orig Emulsion)

80.00% Original Emulsion, 20% Added Water (80/20), Diluted Application Rates (gal/sy)

	Type A, RHMA-G							OGFC						
HMA Over:	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h
Sec 94 Residue by distillation, %	57%	55%	57%	60%	63%	65%	65%	57%	55%	57%	60%	63%	65%	65%
New HMA (Between Layers)	0.05	--	0.07	--	--	--	--	0.07	--	0.09	--	--	--	--
Concrete pavement and existing asphalt concrete surfacing	0.07	--	0.09	--	--	--	--	0.11	--	0.14	--	--	--	--
Planed Pavement	0.11	--	0.14	--	--	--	--	0.14	--	*0.16	--	--	--	--

-- Non Dilutable

* Use caution when applications rates are above 0.15 gal/sy because of potential tack coat puddling and runoff

Diluted 70/30 (1 : 2.33) (Added Water : Orig Emulsion)

70.00% Original Emulsion, 30% Added Water (70/30), Diluted Application Rates (gal/sy)

	Type A, RHMA-G							OGFC						
HMA Over:	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h
Sec 94 Residue by distillation, %	57%	55%	57%	60%	63%	65%	65%	57%	55%	57%	60%	63%	65%	65%
New HMA (Between Layers)	0.06	--	0.08	--	--	--	--	0.08	--	0.11	--	--	--	--
Concrete pavement and existing asphalt concrete surfacing	0.08	--	0.11	--	--	--	--	0.13	--	*0.16	--	--	--	--
Planed Pavement	0.13	--	*0.16	--	--	--	--	*0.16	--	*0.18	--	--	--	--

* Use caution when applications rates are above 0.15 gal/sy because of potential tack coat puddling and runoff

Diluted 60/40 (1 : 1.5) or (2:3) (Added Water : Orig Emulsion)

60.00% Original Emulsion, 40% Added Water (60/40), Diluted Application Rates (gal/sy)

	Type A, RHMA-G							OGFC						
HMA Over:	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h
Sec 94 Residue by distillation, %	57%	55%	57%	60%	63%	65%	65%	57%	55%	57%	60%	63%	65%	65%
New HMA (Between Layers)	0.06	--	0.09	--	--	--	--	0.09	--	0.12	--	--	--	--
Concrete pavement and existing asphalt concrete surfacing	0.09	--	0.12	--	--	--	--	*0.15	--	*0.18	--	--	--	--
Planed Pavement	*0.15	--	*0.18	--	--	--	--	*0.18	--	*0.21	--	--	--	--

* Use caution when applications rates are above 0.15 gal/sy because of potential tack coat puddling and runoff

Diluted 50/50 (1 : 1) (Added Water : Orig Emulsion)

50.00% Original Emulsion, 50% Added Water (50/50), Diluted Application Rates (gal/sy)

	Type A, RHMA-G							OGFC						
HMA Over:	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h	RS1	QS1 or CQS1	CRS1	RS2	CRS2	PMRS2, PMCRS2, PMRS2h or PMCRS2h
Sec 94 Residue by distillation, %	57%	55%	57%	60%	63%	65%	65%	57%	55%	57%	60%	63%	65%	65%
New HMA (Between Layers)	0.08	--	0.11	--	--	--	--	0.11	--	0.15	--	--	--	--
Concrete pavement and existing asphalt concrete surfacing	0.11	--	*0.15	--	--	--	--	*0.18	--	*0.22	--	--	--	--
Planed Pavement	*0.18	--	*0.22	--	--	--	--	*0.22	--	*0.25	--	--	--	--

* Use caution when applications rates are above 0.15 gal/sy because of potential tack coat puddling and runoff.

To ensure that minimum tack coat spray rates are achieved, you and the contractor must know the dilution rates and the minimum residual rate required by Section 39. Section 39 requires the contractor to notify the Engineer in writing of dilution rates (if any) and include the information with a Certificate of Compliance (COC) for the original undiluted emulsion.

When diluting an emulsion, the Std Spec Sec 39 further requires the contractor to submit the final dilution expressed as weight ratio of added water to asphaltic emulsion, e.g. (parts added water) : (parts original emulsion), including the original weights of the undiluted emulsion, the weight of the added water, and percent bitumnous material in the orignal emulsion.

Emulsion suppliers commonly refer to the dilution rates in expressed as a fraction, and in reverse order. For example an 80/20 where the diluted emulsion is 80 parts original emulsion and 20 parts added water (for 100 total parts). Converting an "80/20" to the ratio required by SS Sec 39 is performed as follows; $(1: \frac{80}{20})$ = (1:4) or (0.25:1).

Likewise, converting a "60/40" is converted as follows; $(1 : \frac{60}{40})$ =(1:1.5) or (2:3).

Include the dilution rate with TL-101 that you include with the sample. If not diluted, state so.

If there is insufficient time for the tack coat to break when sprayed at the required minimum rates, consider using a Quick Setting(QS) and Rapid Setting(RS) grades that are formulated with reduced setting times.

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To address any concerns regarding this sheet contact pete.spector@dot.ca.gov, 916-227-7306, HQ's Construction