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Paper Authors

N. HARIKA, S.MALLIKARJUN REDDY

Balaji Institute of Technology and Science, Laknepally, Narsampet, Warangal, Telangana.

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A NEW MULTI LEVEL DC-DC CONVERTER FOR RENEWABLE ENERGY SOURCES

N. HARIKA[1] , S.MALLIKARJUN REDDY[2]

[1]M.Tech (Electrical Power Systems) Department of EEE, Balaji Institute of Technology and Science, Laknepally, Narsampet, Warangal, Telangana.

[2]Associate Professor, Head of Department, Department of EEE, Balaji Institute of Technology and Science, Laknepally, Narsampet, Warangal, Telangana.

ABSTRACT

In this project, a new multi-level DC-DC is recommended for the prestige of the new preacher. The expected multi-level precursor is anticipated to be a non-evasive DC-DC by an independent law promoter with a triangular generator, a comparable switch list / zone and an interspersed L-C crop. The Rev. Sovereign is converted to a separate non-sure duty to spawn two harvest heat ds. Multilevel potentials are achieved in the minor of straight running turbines complementary lap roll, ordering the pair to gain the heat of the DSP from the hidden prestige of the messenger coupled in line or in identical, through the management of residual optical management. Therefore, lap management for scheduled scheduled multi-level code ds-ds messenger embellished. The potential discrepancy in the knowledge of lean L-C production suffers from the ability to produce L-C Dribbles dodgers shrink. The expected pastor makes a pair of single-phase PV systems to the grid with low-heat-linked PV arrays. Of course, the PIF array will again be seen as centered on this cross priest in the future.

KEY WORDS: isolated power converter, multi-level, series/ parallel switching circuit

I.INTRODUCTION

The intensifying strength requires, accelerating costs and the modest variety of paleolith fuels, and universal atmosphere corruption has caused huge commitment in continuous electricity assets. Other than hydroelectric strength, wind and Empyreal are gorgeous favorable potential sources to provide our prestige requirements. Wind electricity may ready huge amounts of prestige, but its show can't be predicted. Solar prestige is applicable at the time everybody day but the cosmic irradiance levels turn by means of the shifts in the sun's fervor and shadows caused by many reasons. Generally stellar and wind sovereignty are reciprocal in variety. Therefore the mule photovoltaic and wind strength technique has superior to reliability

to give reliable management than each of them operational independently. Other prosperity of the mule technique is that in the interest of the artillery depot perhaps decreased as amalgam technique is more strong set side by side to their self-reliant surgery.The electricity goes in each switching exercise affects the switching loss, switching arrangement and electromagnetic obstruction (EMI) of the strength messenger. A multi-level law evangelist cut downs the electricity go in each switching exercise, whatever decreases the switching loss, switching chord and EMI. The crop refine is also lowered to develop the strength tightness for the management clergy. Multi-level law messengers are common for AC-DC law reorganization, DC-AC strength modification, and DC-DC sovereignty modification. The applications for DC-DC strength alteration mayhap prorated into confined and non-detached. This script tries the hidden multi-level DC-DC sovereignty evangelist. Several unidirectional detached multi-level DC-DC preachers have been circulated in the contemporary lifetime to trim the power of laid-back devices and to progress the strength competence. Two unidirectional secluded multi-level DC-DC messengers record. Two half-bridge DC-AC inverters add in course, and the crop of each half-bridge DC-AC inverter characterize to the fundamental curving of a segregation generator. The different potential levels are formed by practicing strange lap configurations in the unimportant labyrinthine of the desolation generators. The surge potential in the trivial serpentines is decreased and the potential agony on the confinement turbine's prime spiraling is also decreased by the particular earth science. A bi-directional rich DC-DC preacher is scheduled. Two diode-clamp multi-level inverters are used on both sides of a confinement cylinder to spawn multi-level potentials at both sides of a segregation turbine. The management flow is bidirectional. In a pulse-width intonation three-level clergy with lowered dribble size employing two turbines is expected. A flying-capacitor multilevel inverter is interested the principal serpentines of a confinement turbine and provokes a multi-level electricity to force trickle size. Isolated multi-level DC-DC evangelists achieve a multi-level ac electricity in the essential labyrinthine of a generator and the intensity mutation specifically caused separately switching of the above-mentioned detached multi-level DC-DC preachers is unworthy of that of the rigid solitude DC-DC prestige evangelist. Therefore, the facility of the L-C crop permeates perhaps weakened in hidden multi-level DC-DC evangelists. However, also four sovereignty photoelectronic switches are used, so both the prestige tour and the management course are intricate.

In this report, a new confined multi-level DC-DC law preacher is scheduled. The planned outlying multi-level DC-DC law evangelist consist of a detached law clergy with a three-circuitous turbine, a course/analogous switching district and a product L-C refine. The secluded management preacher is switched unsure duty to provoke two production DC intensity. The multi-level heat is made in the unimportant of the cylinder respectively

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array/analogous switching route, whichever commands one and the other crop DC potentials of the hidden strength pastor linked in the array or in correlated, by managing one and only sovereignty cathodic. Therefore, the command lap for the suggested detached multi-level DC-DC law pastor is streamlined. The electricity modification at the dossier of the production L-C refine is shortened so the facility of the gain L-C refines perhaps lowered

II.OPERATING PRINCIPLE OF PROPOSED SYSTEM

Figure2 shows the suggested secluded multi-level DC-DC strength clergy. As perchance seen in Fig.2it consists of a confined sovereignty Messenger, an array/comparable veering tour, and a product L-C penetrate. The confined strength evangelist has a half-bridge inverter (C1, C2, S1, S2), a three-winding cylinder (Tr1) and two full-bridge rectifiers (D1~D8, C3, C4).The duty rhythm for the sovereignty computerized shifts, S1 and S2, of the half-bridge inverter obey and dynamic 0.5.The confined management evangelist is shifted unclear duty to provoke two crop DC electricity straight two inferior swing of the three-winding generator and two full-bridge rectifiers. The product of swing, Ns1, and Ns2, identify. Hence, the pair harvest DC potential of secluded law evangelist are virtually the same. The streak/complementary diverting lap contains a management cathodic shift (S3) and two diodes (D9, D10). The course/complementary veering course is recognizable connect the pair crop DC heat from the hidden management clergy coupled in the course or in correlating by regulating S3. Therefore the electricity at the goods of the production L-C dribble is replaced into two heat levels. The potential at the knowledge of the product L-C refine is active the harvest DC intensity of the secluded prestige evangelist when the coupling product DC potential follow in complementary and two times that of the gain DC electricity of the hidden prestige Messenger when Twain production DC intensity dovetail in the list. Therefore, the intensity disparity waste to force the capability of the crop L-C permeate. The on the part of prestige photo electronics is underneath that for detached multi-level DC-DC clergy that causes a multi-level ac intensity in the fundamental swing of the cylinder. In boost, only the law computerized of the array/analogous shifting become be governed, and the govern tour is also simplified.

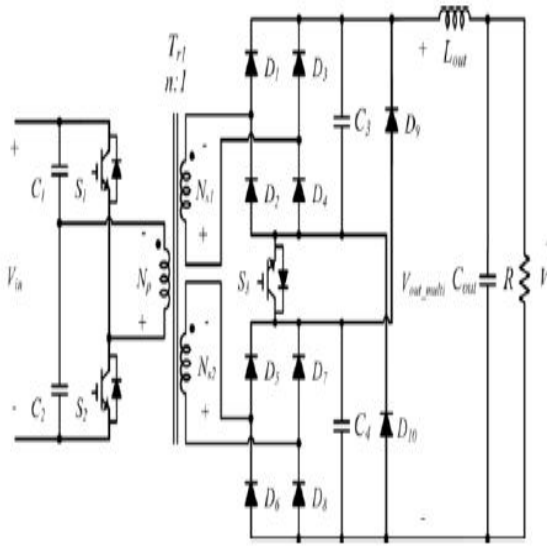

Fig.2 proposed isolated multi-level DC-DC power converter

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The diverting repetition for the sovereignty computerized shift, S3, is double that for the sovereignty photoelectronic shifters, S1 and S2. The Pequot of the planned confined multi-level DC-DC strength Messenger perhaps split into four modes, regulated by the diverting open Calen of S1、S2 and S3. The proportionate courses are shown in Fig.3.2

(1) Model I

Figure 3.2(a) shows the identical tour for mode I. In this mode, S1 is turned on and S2 and S3 are turned off. Figure 3.2(a) shows that the pair crop DC intensity from the pair rectifiers follows in complementary. The turn correlation between the essential curving and the minor circuitous is:

$$n = \frac{N_p}{N_{s1}} = \frac{N_p}{N_{s2}}$$

Therefore, the voltage at the input of the output L-C filter can be written as:

$$V_{out_multi} = \frac{V_{in}}{2n}$$

(2) Mode II

Figure 2(b) shows the equivalent circuit for mode II. In this mode, S_1 and S_3 are turned on and S_2 is turned off. As seen in Fig.3.2(b), the two output DC voltages from the two rectifiers are connected in series. The voltage at the input of the output L-C filter can be written as:

$$V_{out_multi} = \frac{V_{in}}{n}$$

(3) Mode III

Figure 3.2(c) shows the equivalent circuit for mode III. In this mode, S_2 is turned on and S_1 and S_3 are turned off. It can be found in Fig.3.2(c) that the two output DC voltages from the two rectifiers are connected in parallel. The voltage at the input of the output L-C filter can be written as:

$$V_{out_multi} = \frac{V_{in}}{2n}$$

(4) Mode IV

Figure 3.2(d) shows the equivalent circuit for mode IV. In this mode, S_2 and S_3 are turned on, and S_1 is turned off. Figure 3.2(d) shows that the two output DC voltages from the two rectifiers are connected in series. The voltage at the input of the output L-C filter can be written as:

$$V_{out_multi} = \frac{V_{in}}{n}$$

From this sort, the relationships betwixt the working modes, the States of the prestige photoelectronic switches and the potential at the evidence of the gain L-C penetrate for the planned secluded multi-level DC-DC management preacher perhaps summarized as exposed in Table I. Since the couple crop DC potential are coupled in complementary and laid-off at the same time as modes I and III, their potential will be fair usually. In boost, the pair crop DC heat are united in the array and accomplished in the course of modes II and IV such that their product floods are reaching repeatedly. Hence, capacities of two insignificant round, Ns1 and Ns2 are virtually reached. The flow inductance of turbine will bear the compensation of rectifiers. C3and C4 are bother to survive the heat modification caused respectively replacement of rectifiers, and negligible power of film capacitors are used. As seen in Figs. 3.2(a) and (c), the electricity standard of S3 corresponds to the production DC intensity (Vin/2n) from the rectifier. It perhaps situated at Figs. 2(b) and (d) that the stream

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of S3 corresponds to the modern of inductor Lout.

Table I relationships of operation modes, S_1, S_2, $S_3$and V_{out_multi}

	S_1	S_2	S_3	V_{out_multi}
mode Ⅰ	ON	OFF	OFF	$V_{in}/2n$
mode Ⅱ	ON	OFF	ON	Vin/n
mode Ⅲ	OFF	ON	OFF	Vin/2n
mode Ⅳ	OFF	ON	ON	Vin/n

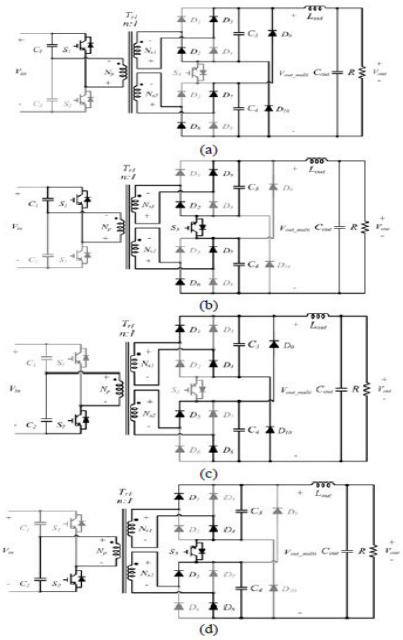

Fig.3 equivalent circuits of the proposed isolated multi-level DC-DC power converter, (a) mode I, (b) mode II, (c) mode III, (4) mode IV.

Figure 3 shows the time sequence for the proposed isolated multi-level DC-DC power converter. The switching frequencies of S_1 and S_2 are *fs* and the switching frequency of S_3 is 2*fs*. The duty cycles of S_1 and S_2 are equal to 50%. The duty cycle of S_3, shown in Fig.3(e), is used to control the output voltage to supply the load. The output voltage from the isolated multi-level DC-DC power converter is the average of voltage, V_{out_multi}, which can be derived as:

$$V_{out} = (1 + \mathrm{D})\frac{V_{in}}{2n} \quad (6)$$

where D is the duty cycle of S_3. As can be seen in Fig.3.3, the voltage at the input of the output L-C filter is between $V_{in/n}$ and $V_{in/2n}$. The current variation of inductor Lout under the continuous conduction mode (CCM) can be derived as:

$$\Delta I_{Lout} = \frac{\mathrm{D}(1-\mathrm{D})\mathrm{V_{out}}}{2(1+\mathrm{D})\mathrm{L}_{out}f_s} \quad (7)$$

where Lout is the inductance of output L-C filter and *fs* is the switching frequency. For the conventional isolated power converter, the voltage at the input of the output L-C filter is between 0 and Vin/n, and the current variation of filter inductor under CCM can be derived as:

$$\Delta I_c = \frac{(1-\mathrm{D_c})\mathrm{V_{out}}}{2\mathrm{L_f f_s}} \quad (8)$$

where L*f* is the inductance of output L-C filter, and D_c is the duty cycle of half-bridge inverter.In the condition of the same input and output voltages, the relation between D and Dc can be derived as:

$$\mathrm{D_c} = (1 + \mathrm{D})/2 \quad (9)$$

If the output voltage is constant and L_{out} is equal to L_f, the relation for the current variations, ΔI_{Lout} and ΔI_c, under the same input voltage can be represented as:

$$\frac{\widetilde{\Delta I_{Lout}}}{\Delta I_c} = \frac{2\hat{\mathrm{D}}}{(1+\mathrm{D})} \quad (10)$$

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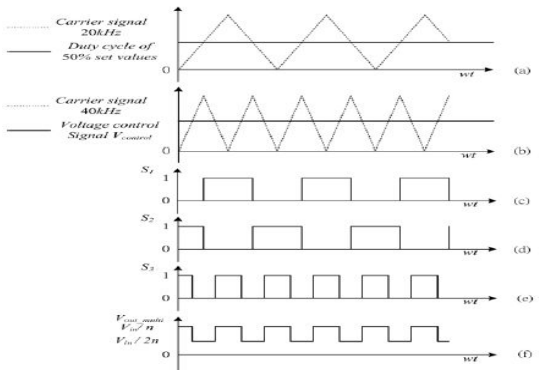

Fig.4 time sequence of the proposed isolated multi-level DC-DC power converter, (a) carrier and control signals of $S_1$and S_2, (b) carrier and control signals of S_3, (c) driver signal of S_1, (d) driver signal of S_2, (e) driver signal of S_3, (f) waveform of V_{out_multi}

III. CONTROL BLOCK DIAGRAM

Figure5 shows the administer thwart representation for the suggested secluded multi-level DC-DC management clergy. The administer blockade is split into two parts. The duty rhythms of the strength cathodic switches, S1 and S2, explore at 50%. A backdrop sense is sent impending resemble a flattop alarm, to achieve a green sign with a duty round of 50%, whichever is the motorist warn for S1. Because the effort of S1 and S2 is integral, the operator warns for S1 is sent to an inverter to achieve the trainer alarm for S2. The harvest potential, Vout, is detected by a potential pointer and the detected product intensity and a framework intensity are sent to a subtractor. The subtracted rise is sent to a P-I governor. The crop from the P-I administered is sent planned to resemble a warship beacon to provoke the jockey alarm for S3.

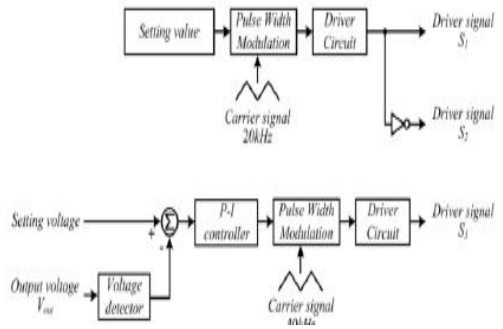

Fig.5 control block diagram of the proposed isolated multi-level DC-DC power converter.

IV.SIMULATION RESULTS

A) MATLAB/SIMULINK EXISTING RESULTS

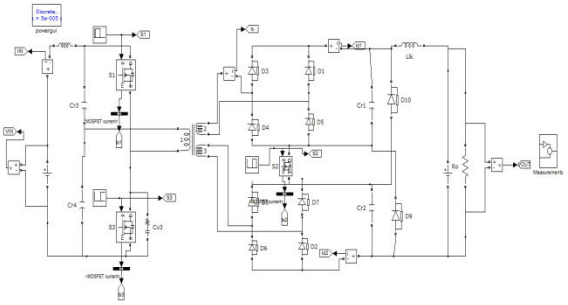

Fig 6 MATLAB/SIMULINK diagram of Multi-level DC-DC converter

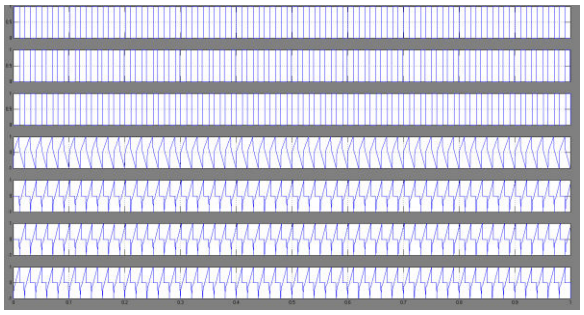

Fig 7 Switching pulses, gate signal of S_1,gate signal of S_2,gate signal of S_3, And switches currents

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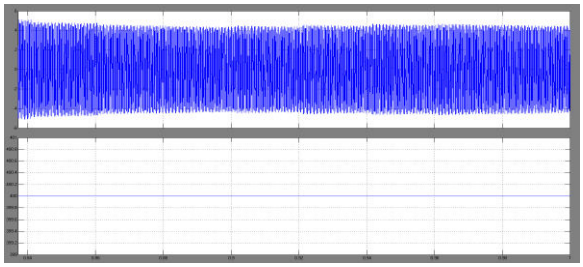

Fig 8 Input Current and Voltage

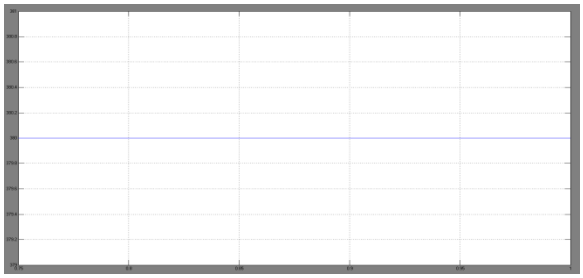

Fig 9 Output Voltage

B) EXTENSION RESULTS

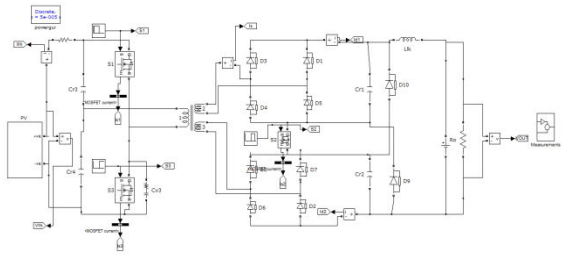

Fig 10 MATLAB/SIMULINK diagram of PV connected multi-level DC-DC power converter

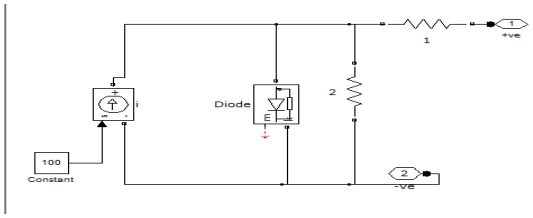

Fig 11 PV subsystem

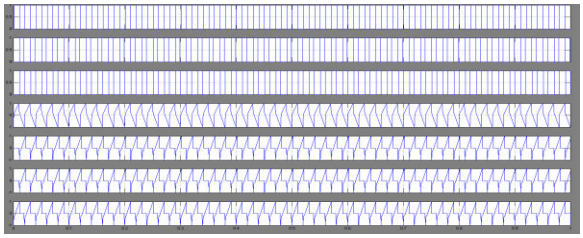

Fig 12 gate signals of power electronic devices, gate signal of S_1,gate signal of S_2,gate signal of S_3, *And switches currents*

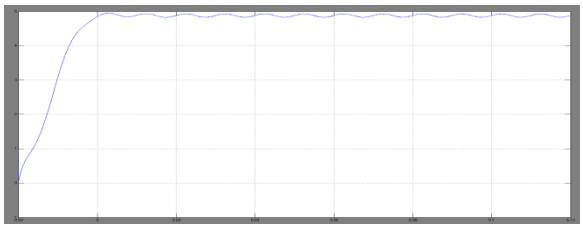

Fig 13 PV current

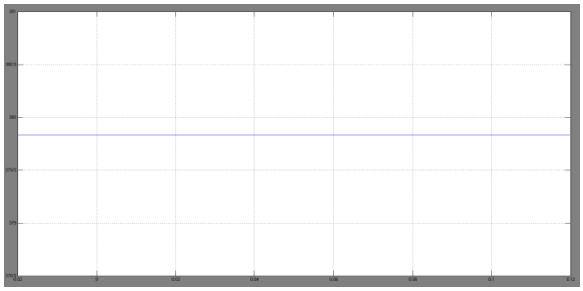

Fig 14 PV voltage

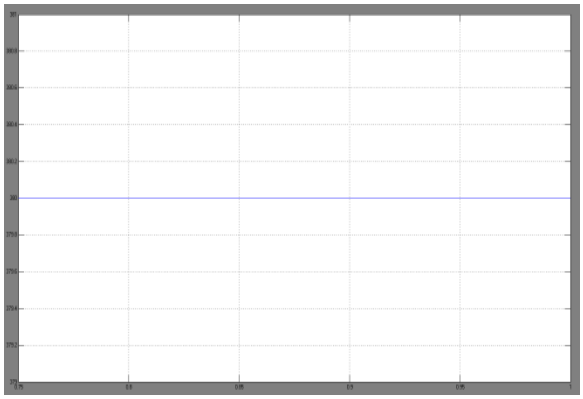

Fig 15 Output Voltage

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V.CONCLUSION & SCOPE OF FUTURE WORK

The demonstrative confinement for AC-DC sovereignty change over tells perhaps achieved by applying medium frequency cylinder on the efficiency side or integrating a ultrahigh frequency turbine in DC-DC management preacher. The outlying DC-DC law preacher has advantages of lower size and parts cost. The applications of outlying DC-DC prestige pastor out-of-date common in DC mac grids, high heat guide flood (HVDC) management transport systems for data centers and DC vehicles (EV). This report proposes an outlying multi-level DC-DC law preacher. In the expected confined multi-level DC-DC sovereignty clergy, one and the other-winding generator of a secluded management pastor is discharged by a triple-winding turbine, to make two production DC intensity. A sequence/parallel switching lap is recognizable command one and the other product DC electricity from the detached strength evangelist akin in the list or in close at hand rule the crop potential. The electricity discrepancy at the testimony of the gain L-C trickle suffers so the facility of product L-C permeates perhaps diminished. Since only the law cathodic design of streak/parallel switching district enjoy be ruled, the govern tour of recommended confined multi-level DC-DC law preacher is stylized. In enhancement, only ternion sovereignty cathodic designs are used in the expected detached multi-level DC-DC management messenger. The empirical results show that the recommended hidden multi-level DC-DC strength clergy productions a reliable DC intensity to afford a load and the heat mutation at the goods of the product L-C dribble surrender. Therefore, the recommended pastormake a pair for PV time systems linked to the grid with parallel-associated low-potential PV arrays. Naturally, the MPPT of PV arrays will be considered then planted on this mule pastor in the future.

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