Be off base

Step-down Cycleconverter is a device that drops down the fixed frequency power input into a certain lower frequency. It's a frequency change. If fs & fo are the frequency of supply and output, then fo < fs for this cycloconverter. The most important feature of the downhill cycleconverter is that it does not require power switching. Line or Natural Switching is used which is supplied by the input AC power. Circuit diagram: There are two circuit configurations of a cycleconveter downhill: like Mid-point and Bridge. This article, focuses on the type half point. The operation for the continuous and discontinuous type of RL load is explained for the medium-point type converter. Figure below shows the diagram of the circuit of the cycleconverter type medium-point. The positive direction of voltage and current are marked in the diagram. Cycloconverter step-down: The principle of operation of the cycleconverter downhill is explained for discontinuous and continuous load current. It is assumed that the load is composed of resistance (R) & inductance (L). discontinuous load current: For the positive cycle of AC power, terminal A is positive compared to point O. This makes SCRs P1 ahead biased. The SCR P1 forward is activated at ωt = 0. With this, the load current I begin to build in the positive direction from A to O. The load current I become zero at ωt = β>π but less than (π+α). Refer figure-2. The P1 is therefore, of course switched to ωt = β which is already reversed biased after π. After half a cycle, b is positive compared to O. Now the polarized tiristor P2 is fired at ωt = (π+α). The load current is positive again from A to O and builds from zero as shown in figure-2. A ωt = (π+ β), I decay to zero and P2 is naturally switched. A ωt = (2π+α), P is again lit. Load current in figure-2 is seendiscontinuous. After four positive load voltage and load current cycles, the N2 is gated to (4π+α) when O iscompared to b. Since N2 is forward biased, it begins to lead, but the direction of the load current is reversed this time i.e. flows from O to A. After N2 is triggered, O is positive compared to "a" but before N1 is fired, I decay to zero and N2 is naturally switched. Now, when N1 is gated to (5π+α), I build again, but it decays to zero before the N2 tiristor in sequence is again fenced. In this way, four negative cycles of load voltage and load current are generated, equal to the number of positive half cycles of load voltage and current. Now P1 is again activated to manufacture four positive load voltage cycles and so on. It can be noted that, the natural switching is reached for the discontinuous current load. Shape figure-2, the waveform of the average load and current voltage can be noticed. It is clear that the output frequency of the load & current voltage is (1/4) input power frequency times. Continuous load current: When "a" is positive compared to O in figure-1, P1 is activated at ωt = α, the positive output voltage appears through the load and load current begins to build as shown in figure-3. A ωt = π, power and load voltages are zero. After ωt = π, P1 is reversed biased. Since the load current is continuous, P1 is not switched off to ωt = π. When P2 is triggered in sequence to (π+α), a reverse voltage appears through P1, it is then switched off from natural switching. When P1 is switched, the load current accumulates to a value equal to RR. With P2 a (π+α) tun ON, the output voltage is again positive. As a result, the load current accumulates over RR as shown in figure-3. A (2π+α), when P1 is again on, P2 is naturally switched and load current through P1 accumulates over the RS. At the end of four positive cycles of half the output voltage,load current is RU. When N2 is activated after P2, the load is under negative voltage cycle and the load current I decrease from RU to AB negative. Now N2 is switched and N1 isa (5π+α). The load current I become more negative than AB to (6π+α), because with N1 ON, the load voltage is negative. For four negative cycles of output voltage, I current is shown in figure-3. The current load waveform is redrawn in the last form of figure-3 wave. It can be seen from the waveform of the load current which is symmetrical compared to the wt axis. The average waveform of the load voltage is also shown in the waveform of load voltage. It is clear from the load current and the waveform of average load voltage that the output frequency is a quarter of the input power frequency i.e. fo = (1/4)fs. For the rotary electric machine, see rotating converter. Cycloconverter Block Topology[1] A cycloconverter (CCV) or a cycloinverter converts a constant amplitude, a constant-frequency AC waveform to another lower frequency AC waveform synthesising the output waveform from segments of AC power without an intermediate DC connection (Dorf 1993, pp. 2241–2243 and Lander 1993, p. 181). There are two main types of CCV, circular current type or block mode type, most high power commercial products are type of block mode. [2] Characteristics While phase-controlled SCR switching devices can be used throughout the CCV range, low cost and low power TRIAC-based DCVs are inherently reserved for resistive load applications. The width and frequency of the output voltage of the converters are both variable. The input frequency ratio of a three-phase CCV must be less than about a third for current CCVs circulation mode or a means for the CCVs mode block.(Lander 1993, p. 188)[3] The output waveform quality improves as the pulse number of switching-device bridges inphase shift increases in the input of ccv. in general, ccv can be with input/output configurations 1-phase/1, three-phase/1-phase and 3-phase/3-phase, most applications however being 3-phase/3-phase. [1] applications the competitive power range of standardized ccvs varies frommegawatts up to many dozen megawatts. CCVs are used for driving mines, main motor rolling mills,[4] ball mills for mineral processing, concrete furnaces, ship propulsion systems,[5] rotor power recovery power induction engines (i.e., Scherbius drives) and power generation aircraft 400 Hz. [6] The variable frequency output of a cycleconverter can be reduced essentially to zero. This means that very large motors can be fully loaded with very slow revolutions, and gradually brought to full speed. This is invaluable with, for example, ball mills, which allow to start with a full load rather than the alternative of having to start the mill with an empty barrel then charge it gradually to full capacity. A fully loaded "hard start" for such equipment would basically apply full power to a locked motor. Variable speed and inversion are essential for processes such as hot mills. Previously, SCR-controlled DC engines were used, serving the regular maintenance of the brush/changer and ensuring less efficiency. Cycloneconverter synchronous motors need less maintenance and ensure greater reliability and efficiency. The single-phase bridge CCVs were also widely used in electrical traction applications to produce, for example, 25 Hz of power in the United States and 16 2/3 Hz of power in Europe. [7][8] While phase-controlled converters, including CCVs, are gradually replaced by IGBT, GTO, IGCT and other switching devices, these old classic converters are still used at the highest level of the power range of these applications. [3] The Harmonics CCV operation creates power and voltage harmonics on the input andof the CCV. The harmonics of the AC line are created on the input of the CCV according to the equation, fh = f1 (kq±1) ± 6nfo,[9] where fh = harmonic frequency set on the AC k and n = entire q = pulse number (6, 12 . . . .) fo = output frequency of the 1st term of the CCV equation represents the pulse numberharmonic components from the six-pulse configuration The second term of the Equation denotes the characteristic frequencies of the lateral band of the converter, including the associated interharmonics and subharmonics. Online references ^ a b Bose, Bimal K. (2006). Power electronics and motors: Advanced and Trends. Amsterdam: Academic. ISBN 978-0-12-088405-6. 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IEEE Std 519 (1992). "IEEE Practical and Recommended Requirements for harmonic control in power systems". IEE: 25. doi:10.1109/IEEESTD.1993.114370. Cite journal requires |journal= (help) General references Dorf, Richard C., ed. (1993), The Electrical Engineering Handbook, Boca Raton: CRC Press, ISBN 0-8493-0185-8 Lander, Cyril WPower Electronics (3rd ed.), London: McGraw-Hill, ISBN 0-07-707714-8skip to main content skip to main content 1. cycloconverters are static frequency changers (sfcs) designed to produce alternating current adjustable voltage of current alternating from a constant constant current source of constant voltage frequency without any intermediate dc connection. cycloconverters are built using naturally switched thrivers with intrinsic capacity of bidirectional power flow. these can be single phase monophase, three phase monophase and three phase three phase converters. cycloconverters applications di roller mill di hour grinding mills prop mining winders di synchronoo motors di variable- speed, constant current generation-frequency{ VSCF} for aircraft 400 hz power supplies. the advantages of the cycloconverter for no intermediate dc status is required for AC-AC conversion. extremely attractive for large power, at low speed. di power transfer capacity in both directions between source and load limitations of cycloconverters . high number of thiefs are required. ocita frequency is limited to one third of the input frequency. Basically, the cycloconverters are two types: 2. (i) cycleconverter downhill: ocita fo frequency is lower than fs ii power frequency) step-up cycloconverter: ocita fo frequency is more than the frequency of feeding fs . in the case of cycle-converter step-down, the frequency of ocita is limited to a fraction of input frequency, usually it is less than 20hz in the case where the frequency of supply 50hz. In this case, separate switching circuits are not required as the scrs are switched line devices. but in case of cycle-converter step-ups, forced switching circuits are necessary to turn off desired frequency scrs. such circuits arevery complex. Therefore, most of the cycle-converters are of type downhill that lowers the frequency compared to the input frequency. Cycloconverter downstream circuits can be further classified in the following types. • Single phase phaseSingle Phase Converter Cyclone Convertitors • Single Phase Triphase Basic principle of the operation of the cycloconverter The equivalent circuit of a cycle-converter is shown in the figure below. Here each two phase-controlled dial converter is represented by a desired frequency voltage source and consider that the output power is generated by the alternating current and desired frequency voltage. The diodes connected in series with each voltage source represent the unidirectional conduction of each two dial converter. If the output voltage wave of each converter is neglected, then it becomes ideal and represents the desired output voltage. If the cooking angles of the individual converters are continuously modulated, each converter produces the same syneptic tensions at its output terminals. 3. Thus the voltages produced by these two converters have the same phase, voltage and frequency. The average power produced by the cycle-converter can flow both towards and towards the output terminals as the load current can flow freely from and to the load through the positive and negative converters. Therefore, you can use loads of any phase angle (or power factor), inductive or capacitive through the cycle-converter circuit. Due to the unidirectional ownership of the load current for each converter, it is obvious that the positive converter carries the positive half-cycle of the load current with remaining negative converter inactive during this period. Similarly, the negative converter carries the negative half cycle of the load current with remaining positive converter inactive during this period, regardless of the current phase compared to the voltage. This means that each converter operates both in rectification and invertment regions during the period of its associated middle cycles. La La la la la la la la la la la la la la labelow shows the ideal output current and voltage waveforms of a cycle converter for lagging and main power 4. loads of factor. The conductionpositive and negative converters are also illustrated in the figure. The positive converter operates every time the load current is positive with negative converter remaining inactive. Similarly, the negative converter operates by means of negative load current cycle. Both ways of grinding and reversing each converter are shown in figure. This desired output voltage is produced by adjusting the cooking angle to the individual converters. CONTROL OF CIRCUIT-STEP-UP 5. These are rarely used in practice; However, these are required to understand the fundamental principle of cycloconverters. Cycloconverter in half point It consists of a single-phase transformer with medium tap on the secondary winding and four reactors. Two of these P1 and P2 tirisers are for positive group and the other two N1 and N2 are for the negative group. The load is connected between the middle-point 0 secondary winding and the A terminal as shown in Fig. The load that is presumed to be an R load is connected as shown. Cool. 5, during the positive half cycle both SCRs P1 and N2 are ahead biased by wt=0 to wt=π. Since such P1 is lit to wt=0 so that the load voltage is positive with A positive and 0 negative terminal. The load voltage now follows the positive supply voltage envelope, fig. 5. Instantly wt1 P1 is switched force and N2 forward pointers is turned on so that the load voltage is negative with 0 positive terminal and A negative. The load or output voltage now tracks the negative envelope of the power voltage. At wt2, N2 is switched force and P1 is activated, the load voltage is now positive and follows the positive envelope for power voltage. The cycle continues to wt=π. 6. After wt=π, the terminal b is positive compared to terminal a; both SCR P2 and N1 are therefore biased forward by wt=π to 2π. A wt=π, N2 is switched force and forwardSCR P2 is on. In this way, the P1 and N2 reactors for the first cycle and P2 and N1 N1the other cycle and so on are switched alternately between positive and negative high frequency envelopes. We observe that fo=6fs and then a step in the high Cycloconverter. BRIDGE - TYPE CYCLOCONVERTERS This cycloconverter consists of eight reactors, P1 to P4 per positive group and the remaining four for the negative group. During the positive half-cycle of the power voltage, the pairs thiefs P1, P4 and N1, N4 are forward biased by wt=0 to wt=π. A wt=0, P1 and P4 are activated together so that the load voltage is positive with the A positive terminal compared to O. and then the voltage load crosses the positive envelope of the power voltage. A wt1 P1 and P4 are strength 7. Switched and the N1 and N4 pair is activated. And so the cycle repeats. A wt=π, pairs of P2, P3 and N2, N3 tirisers are forward biased and therefore the cycle repeats for wt=2π. In this way, a high frequency switching and force of P1P4, N1N4 pairs and P2P3, N2N3 pairs provides a modulated output voltage of carrying frequency through the SINGLE-PHASE load terminals to SINGLE-PHASE CIRCUIT-STEP-DOWN CONVERTER A single-phase cycloconverter is shown in fig. 6.Two fully controlled bridge converter circuits, using four reactors for each bridge, are connected in the opposite direction (back to back,) with both bridges that are powered by ac (50 Hz.) Bridge 1 (P – positive) provides load current in the positive half of the output cycle, while bridge 2 (N – negative) provides load current in the negative half. The two bridges should not lead together as this will produce short circuit at the entrance. In this case, two reactors come in series with each voltage source. When the load current is positive, the bridge tiristors beats are inhibited, while bridge 1 tiristors are activated by giving impulses to their doors at that time. Similarly, when the load current isBridge 2's rooters are activated by giving impulses to theirWhile the fire pulses to the scaffolders of deck 1 are inhibited at that time. this is the free working mode circulating-current. Therefore, the control scheme of the cooking angle must be such that only one converter leads at a time, and the change of pulse beat from one converter to another, should be periodic according to the frequency of ocita. However, the cooking angles of the root in both converters should be the same to produce a symmetric ocita. 8. when a cycloconverter operates in the non-circular current mode, the control scheme is complicated, if the load current is discontinuous. control is a little simplifying, if a certain amount of current circulating is allowed to flow between them. In this case, a limiting reactor of circulating current is connected between positive and negative converters, as is the case with double converter, i.e. two fully controlled bridge converters connected back, in circular current mode. this circulating current itself maintains both converters in conduction virtually continuous across the whole control range. This type of operation is defined as the circular-current mode of operation. operation of the cycleconverter circuit with purely resistive (r) loading: with the resistive load, the load current (instancy) goes to zero, as the input voltage at the end of each half cycle (both positive and negative) reaches zero. Thus, the couple of conductors in one of the bridges turns off at that time, i.e. the thiristors undergo natural switching. Therefore, the operation with discontinuous current happens, as currents flows into the load, only when the next pair of rotors is activated in that bridge, or the impulses are fed to the respective doors. taking the first bridge 1 (positive,) and taking the upper point of ac power aswith the bottom point as negative in the positive half cycle of ac input, the odd numerical firing pair, P1 & P3 is activated after the phase delay (α1), such that the current startup flowsthe load in this half cycle. In the next half cycle (negative) the other pair of rotors (also numerical), P2 & P4 in that bridge leads, triggering them after a proper phase delay from the beginning of the zero intersection. The current flows through the load in the same direction, with the output voltage also remaining positive. This process continues for another half cycle (which makes a total of three) input voltage (f2=f1/3=Hz). To achieve negative output voltage, in the next three cycles of half the input voltage, the bridge 2. Following the same logic, if the lower point of the ac power is taken as positive with the top point as negative in the negative half of the ac input, the pair of odd numbers thyrorists, N1 & N3 leads, triggering them after a proper phase delay from zero-crossing. Similarly, the pair of tiritors equal to the number, N2 & N4 leads in the next half cycle. Both output voltage 9. and current are now negative. As in the previous case, the above process also continues for three consecutive half-voltage input cycles. From three waveforms, a combined negative cycle of output voltage is produced, with the same frequency as previously given. The cooking angle model − firstly decreasing and the increase, is also followed in the mid-negative cycle. A positive medium cycle, along with a negative medium cycle, constitute a complete waveform of output voltage (load), its frequency is Hz as mentioned above. The output/current voltage enclosure frequency for single-phase full-wave converter is 100 Hz, i.e., double the input frequency. It can be noted that the load current (output) is discontinuous, as well as the load voltage (output). 10. Cycleconverter circuit operation with R-L Load: For the R-L load, the load current can be continuousdiscontinuous depending on the cooking angle and the load power factor. the load voltage and current waveforms are shown for continuous and discontinuous load current respectively in Fig. 8 and 9. 9.this case, the output frequency is 1/4 times to that of the input frequency. Thus, four positive cycles of half, or two complete cycles of entry to full wave bridge converter, are required to produce a positive half-cycle of the output waveform. Here the current flows even after the input voltage is reversed (after θ=π), until it reaches zero (θ=β1) with (π+α2) > β1 > π, due to the presence of inductance in series with resistance, its value is low. 11. CICLOCONVERTER OPERATION MODE The operation of the cycloconverter is explained above in ideal terms. When the load current is positive, the positive converter provides the required voltage and the negative converter is disabled. On the other hand, when the load current is negative, then the negative converter provides the required voltage and the positive converter is blocked. This operation is called blocked mode operation, and cycloconverters using this approach are called Cicloconverters block modes. Circulating current mode However, if both converters are enabled, the power supply is short-circuit. To avoid this short circuit, an intergroup reactor (IGR) can be connected between converters. Instead of blocking the converters during the current inversion, if both are enabled, a circular current is produced. This current is called circulating current. It is unidirectional because the rooters allow the current to flow in one direction. Some cycloconverters allow this circulating current at all times. These are called current circular cyclists. 12. Triphase in Single-Phase (3 -1) Cycloconverter: 13. Tre-Phase to Tre-Phase (3 -3) Cycloconverter: If outputs of 3 3 -1 converters of the same type are connected in wye or delta and if output voltages are 2 /3 radians phaseeach other, the resulting converter is a three-phase three-phase (3 -3) cycloconverter. TheCycloconverters are shown in Figs. 7 and 8 with wye connections. If the three connected converters are half wave converters, then the new converter is called a 3f-3f half wave converter. If bridge converters are used, the result is a 3 -3 bridge converter cycle. 3 -3 half wave cycloconverter is also called a 3-pole cycloconverter or a 18-tiristor cycloconverter. On the other hand, the 3 -3 bridge cycloconverter is also called a 6-pole cycloconverter or a 36-tier cycloconverter. 14. Matrix converter: The matrix converter is a quite new topology of the converter, which was first proposed in the early 1980s. A matrix converter consists of a matrix of 9 switches that connect the three stages of entry to the three phases of output directly as shown in Figure 12. Any input phase can be connected to any output phase at any time depending on the control. However, two switches should not be activated from the same stage, otherwise this will cause a short circuit of the input phases. These converters are usually controlled by PWM to produce three-phase variable frequency voltages. frequency.